39/85

IN THE PRIVY COUNCIL NO. 28 of 1985

ON APPEAL
FROM THE COURT OF THE SUPREME COURT OF WESTERN AUSTRALIA

B E T W E E N :

HAMERSLEY IRON PTY LIMITED	Appellant (Respondent) (Plaintiff)
- and -	
1. THE NATIONAL MUTUAL LIFE ASSOCIATION OF AUSTRALASIA LIMITED, 2. LANGLEY GEORGE HANCOCK, 3. ERNEST ARCHIBALD MAYNARD WRIGHT, 4. HANCOCK PROSPECTING PTY LTD, 5. WRIGHT PROSPECTING PTY LTD AND 6. L.S.P. PTY LTD	Respondents (Appellants) (Defendants)

RECORD OF PROCEEDINGS

PART I
VOLUME III

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SOLICITORS FOR THE RESPONDENTS (APPELLANTS) (DEFENDANTS)

IN THE PRIVY COUNCIL NO.

ON APPEAL

FROM THE FULL COURT OF THE SUPREME COURT OF WESTERN AUSTRALIA

B E T W E E N :

HAMERSLEY IRON PTY LIMITED	Appellant (Respondent) (Plaintiff)
- and -	
LANGLEY GEORGE HANCOCK, ERNEST ARCHIBALD MAYNARD WRIGHT, HANCOCK PROSPECTING PTY LTD, WRIGHT PROSPECTING PTY LTD AND L.S.P. PTY LTD AND THE NATIONAL MUTUAL LIFE ASSOCIATION OF AUSTRALASIA LIMITED	Respondents (Appellants) (Defendants)

RECORD OF PROCEEDINGS
INDEX OF REFERENCE

PART I
VOLUME III

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B E T W E E N :

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- and -

LANGLEY GEORGE HANCOCK, ERNEST ARCHIBALD MAYNARD WRIGHT, HANCOCK PROSPECTING PTY LTD, WRIGHT PROSPECTING PTY LTD AND L.S.P. PTY LTD AND THE NATIONAL MUTUAL LIFE ASSOCIATION OF AUSTRALASIA LIMITED — Respondents (Appellants) (Defendants)

RECORD OF PROCEEDINGS
INDEX OF REFERENCE

PART II

EXHIBITS

Description of Document		Date	Page
Exhibit "1 CRL1"	Copy Royalty Agreement between Defendants and Plaintiff	12th December 1962	1161
Exhibit "1 CRL2"	Copy Deed of Authority	12th November 1967	1162 -1168
Exhibit "1 CRL3"	Copy Notice of Assignment from Fifth Defendant to Plaintiff	25th October 1979	1169 -1171
Exhibit "1 CRL4"	Copy plan Isometric Arrangment of Tom Price Concentrator Plant	16th July 1980	1172
Exhibit "1 CRL5"	Copy letter C R Fieldhouse to Plaintiff's Solicitor	5th August 1983	1173
Exhibit "1 CRL6"	Copy letter Plaintiff's Solicitor to C R Fieldhouse	11th September 1981	1174
Exhibit "1 CRL7"	Copy text of letter Plaintiff's Solicitor to C R Fieldhouse	Undated	1175
Exhibit "2"	Affidavit of Colin Roy Langridge	24th May 1983	1176 - 1178
Exhibit "2 CRL8"	Copy Agreement between A.V. Barrett - Leonard and others and Rio Tinto Southern Pty Ltd	4th May 1962	1179 - 1192
Exhibit "3"	Paper presented by Messrs Uys & Bradford entitled "The Beneficiation of Iron Ore by Heavy Medium Separation"	1981	1193 - 1216
Exhibit "4"	Three photographs of Tom Price concentrator control room mimic panel	1983	1217
Exhibit "5"	Three photographs of Tom Price concentrator plant lookout display panel	1983	1218 - 1219
Exhibit "6"	Annual Reports of Hamersley Holdings Limited for the years 1976, 1978, 1981 and 1982		1220 - 1328

Description of Document		Date	Page
Exhibit "24"	Reprint from Volume 66 No. 47 Skillings Mining Review entitled "Hamersley's Low Grade Iron Ore Concentration Project"	1977	1631 - 1635
Exhibit "25"	Affidavit of John Roberts	1st June 1983	1636 - 1637
Exhibit "26"	South Australian Broken Hill Proprietary Company Steel Works Indenture Act, 1958	1958	1638 - 1663
Exhibit "27"	Two pamphlets entitled "Iron Ore" published by the Geological Survey of Western Australia, 1966 (copy) and 1983	1966, 1983	1664 - 1705
Exhibit "28"	Copy pages 7-01, 7-06, 7-36 and 7-37 of Taggart's "Handbook of Mineral Dressing"	1976	1706 - 1709
Exhibit "29"	Affidavit of Niles Earl Grosvenor	27th October 1982	1710 - 1719
Exhibit "29NEG1"	Copy letter from Plaintiff's Solicitor to C.R. Fieldhouse	21st October 1982	1720
Exhibit "29NEG2"	Drawing P-004-5041 General Arrangement Section B, of Tom Price Concentrator Washing and Screening Plant	7th December 1976	1721
Exhibit "29NEG3"	Drawing P-004-5033 General Arrangement of Tom Price Concentrator Washing and Screening Plant Wet Feeder	18th May 1977	1722
Exhibit "29NEG4"	Copy booklet "Vibrating Screen - Theory and Selection" published by Allis-Chalmers		1723 - 1748
Exhibit "30"	Copies pages 108, 115, 119-120, 127-132 and 149 of a compilation of extracts from the American Engineering and Mining Journal	1930's - 1950's	1749 - 1760
Exhibit "31"	Page 270 of the United Nations' Publication, "Economic Aspects of Iron Ore Preparation"	1966	1761

	Description of Document		Date	Page
	Exhibit "32"	Hamersley Iron "Resources Technology Operations" Booklet, page 16, Plant Layout, Mt Tom Price	January 1981	1762
	Exhibit "33"	Affidavit of Peter Forbes Booth (with exception of paragraph 4)	27th October 1982	1763 - 1770
	Exhibit "34"	Affidavit of Peter Forbes Booth	30th June 1983	1771 - 1773
	Exhibit "34PFB1"	Copy Conceptual Drawings of Wet Feeder Designs		1774 - 1775
	Exhibit "34PFB2"	Copy Conceptual Drawings of Feed Chutes at Tom Price and Mt. Newman		1776
	Exhibit "35"	Affidavit of Geoffrey Samuel Baker	17th October 1983	1777 - 1779
	Exhibit "36"	Affidavit of Christian Frederick Beukema	22nd June 1983	1780 - 1789
	Exhibit "36CFB1"	Copy United Nations Survey of World Iron Ore Resources, 1955	1955	1790 - 1798
	Exhibit "37"	Copy State of Minnesota Iron Ore Mining Lease	1941	1799 - 1808
VOL IV	Exhibit "38"	Copy article entitled "State of Iron Ore Mining Industry" by Christian F. Beukema	February 1961	1809 - 1812
	Exhibit "39"	Affidavit of Neville Oliver Boughton (excluding paragraphs 6, 7 & 8, the last sentence of paragraph 9 and paragraphs 12 to 15 inclusive)	20th October 1983	1813 - 1820
	Exhibit "39NOB1"	Copy article entitled "Iron ore Concentration Plant of Hamersley Iron Pty Ltd, Mt Tom Price W.A." by Colin R. Langridge.		1821 - 1823

Description of Document		Date	Page
Exhibit "39NOB2"	Copy article entitled "Developments in Iron Ore Mining and Treatment in Australia, 1960-1978" by R.T. Madigan		1824 - 1826
Exhibit "39NOB3"	Copy letter Plaintiff to Hancock & Wright and attached statements	14th June 1979	1827 - 1831
Exhibit "39NOB4"	Copy letter Plaintiff to Hancock & Wright and attached statements	5th May 1981	1832 - 1837
Exhibit "39NOB9"	Copy letter Plaintiff's Solicitor to Messrs Keall Brinsden & Co.	30th August 1983	1838
Exhibit "39NOB10"	Copy letter Keall Brinsden & Co to Plaintiff's Solicitor	16th September 1983	1839 - 1840
Exhibit "39NOB11"	Letter Plaintiff's Solicitor to Keall Brinsden & Co	23rd September 1983	1841
Exhibit "39NOB12"	Copy letter Keall Brinsden & Co to Plaintiff's Solicitor	6th October 1983	1842 - 1843
Exhibit "40"	Photograph of Tom Price Concentrator Mimic Panel, with enlargement	1983	1844
Exhibit "41A"	Photograph of material on small screens	1983	1845
Exhibit "41B"	Second print of exhibit "41A"	1983	1846
Exhibit "42"	Two photographs of material coming from primary wet screens	1983	1847
Exhibit "43"	Flow Chart of Concentrator Medium Drum Plant	30th July 1976	1848
Exhibit "44"	Chart of Isometric Arrangement of Tom Price Concentrator Plant	23rd June 1977	1849
Exhibit "45"	Affidavit of Ernest Archibald Maynard Wright	20th October 1983	1850 - 1852

DOCUMENTS NOT TRANSMITTED TO THE PRIVY COUNCIL

Description of Document	Date	Page
IN THE SUPREME COURT		
Affidavit of Neil Alexander Florence together with exhibit "A" thereto	20th December 1982	
Summons for Directions and order thereon	22nd April 1983 2nd June 1983	
Affidavit of Nicholas Paul Hasluck	30th May 1983	
Exhibits "8DFT2-11" to the affidavit of Douglas Frederick Tompsitt sworn 24th May 1983 were not documents but were samples of iron ore feed		
Exhibits "NOB5-8" to the Affidavit of Neville Oliver Boughton sworn 20th October 1983		
IN THE FULL COURT OF THE SUPREME COURT		
Notice of Motion in Appeal No 60 of 1984 for leave to Appeal to the Full Court	13th February 1984	

EARL CONRAD HERKENHOFF, sworn:

EXAMINED BY MR HULME QC:

MR HULME: Is your full name Earl Conrad Herkenhoff?---That is correct.

You live at 151 Warfield Drive, Moraja, California in the US? ---Correct.

You are a mining and metallurgical engineer?---That is correct.

Have you sworn an affidavit in these proceedings?---I have.

(Could Mr Herkenhoff please be given a copy of his affidavit - - -)

10

MR HULME (Continuing):(- - - of his affidavit?) Would you just look through it, Mr Herkenhoff, and identify your signature to yourself?---Yes, that is correct.

I tender the affidavit, your Honour.

EXHIBIT EXHIBIT 23 .... Affidavit of E.C. Herkenhoff dated 29th August 1983 with exhibits.

MR HULME: Mr Herkenhoff, you set out your qualifications in para.1, that of a Bachelor of Science in Mining Engineering, Master of Science in Metallurgical Engineering 1936 and 1937 and you are, you say, the author of approximately 15 papers on mineral dressing and you hold a number of United States patents in mineral beneficiation. From 1948 to 1955 you were on the iron ranges of Minnesota and Michigan in various capacities including responsibility for the design and construction performance of three major iron ore washing and beneficiation plants. From 1956 to 1963 you were concerned with the development of beneficiation procedures of iron ore deposits on the coast of Peru at the Marcona mines; from 1963 to 1967 in Northern Peru with phosphate rock and the various processes there set out and from 1967 to 1969 general manager for Pickands Mather International in Sydney and technical adviser to the managing director of Savage River Mines in Tasmania, that being an iron ore mine?---That is correct.

From 1969 to 1971 senior mineral engineer to the executive vice president of Kaiser Aluminum in Oakland, California and then further activity in California. You returned to consulting work on phosphate rock in Lakeland, Florida and Lima, Peru and in 1982 consultant to Manéra Peru on base metal projects and to Eyéro Peru for cobalt recovery. You set out in para.2 the various affidavits you have looked at and you inspected Tom Price concentration plant on 26th August 1983. In para. 3 you say there are two broad reasons for beneficiating iron ores; firstly, to increase the iron content and improve the physical structure by crushing oversize and removing excessive fines and secondly, to remove or reduce undesirables such as alumina, phosphate, silica and others, to provide companies with an iron ore feed that will meet and maintain the specifications of blast furnaces. Could you expand a little to his Honour on what you say in that paragraph?---There are a number of iron ores that may have an iron ore content high enough to be classified as saleable but they may contain some undesirable elements such as titanium which is a very common one and sometimes a contaminant is nickel - - -

WITNESS (Continuing): - - - is nickel. Sometimes it may be sulphur and it can be, in some cases, alkalis such as salt. Those elements may be present in such small quantities that they really do not affect the iron content of the ore but they are very objectionable to the man who must use them because they would tend to contaminate the pig iron that is derived from the blast furnace. So sometimes you beneficiate an iron ore to remove impurities only and other times - in most of the cases - you beneficiate it to do double things. You want to raise the iron - -

MR HULME: Can I just stop you for a moment? If you will ignore me and answer to his Honour, this will be better?---I am sorry - so in most cases an iron ore is beneficiated for both purposes, both broad reasons such as set out here. Obviously, the buyer wants the highest iron content that he can get and he wants the ore to be free of any contaminants.

I would say that one of the elements which is objectionable to a buyer of iron ore is moisture. Obviously, he has to pay the freight bill to move the ore from the mine to his furnaces and then, after he gets it to the blast furnace, he has to evaporate that water with expensive coke, so drying has sometimes been called beneficiation.

On the Mesabi iron range in Minnesota there was once nothing more than a drying plant which consisted of a rotary kiln. Obviously, that is an expensive way to remove water but the ore could not be sold unless it had a certain minimum moisture content.

Is a distinction drawn in the iron ore industry according to the suitability of ore for selling in the form in which it is as it comes out of the mine?---Very definitely. If you can sell it as it is mined from the deposit, it is called very commonly - used everywhere I have ever been - "direct shipping ore" and it meets the terminology. You simply mine it, crush it and ship it.

When the mines in the Mesabi Range in America were first opened, what kind of ore were they shipping from them?---The first iron ores shipped were as high-grade as could be mined from the ground and they direct-shipping ores. They were mined and transported to the Lake Superior ports and then moved by ship to the blast furnaces in the mid-west. Those ores, because as mined you encounter large rocks and boulders or ore, required, because of the buyer's specification, that they be crushed at least to minus 4 inches, so the minimum handling after bringing the ore from the mine was to deposit it in a receiving pocket and with a feeder

regulate the rate at which the ore is fed over a dry screen and the oversize at the screen would be crushed and join the undersize.

Subsequently, some of the mines were required to re-screen the undersize to about, say, three-eighths of an inch or one-half inch, because the buyer wanted it to come to him in two forms, a coarse ore - which is suitable to add to the furnace - - -

259. 12.41

WITNESS (Continuing): - - - to the furnace, the blast furnace, and the fines which would be agglomerated by sintering.

MR HULME: In the terminology there, if you have ore which is crushed and is then dry screened and can then be sold what is the industry description of that ore?---That is direct shipping ore.

If the ore is such that crushed and dry screened it cannot be sold, but if it is further treated in some manner it can be sold, what description is given to that kind of ore?---That would be called low grade ore and of course any mining operation, if miner can segregate such low grade ore and ultimately blend it with the higher grade ore as he comes to it, that is what he would do with it; as long as the proportion of the lower grade ore was not excessive he could stockpile it and feed it in. When the proportion got very much higher he had only one recourse, he had to do something to the ore to make it saleable. If it meant raising the iron content he would have to see what he could do to remove the waste rock, and if there was some other impurity in there, like, we might say, excessive water, he might have to drain it or dry it in order to meet the specifications.

Does industry usage there apply any particular word to what may be called generally "processes" for the treatment of low grade ore to make it saleable?---Yes; that is where the term beneficiation was applied, principally to the iron ore industry. In the base metal industry in the States we normally refer to beneficiation as milling - you mill the ores, because you put them through a concentrator. In the case of iron ore the term is "beneficiation", even though it may include some crushing, screening, jigging, heavy media, grinding - the whole field is called beneficiation.

I would take you then to para.4 where you say you agree that the treatment of the ore which takes place prior to and on the screens in the washing and screening house in the concentrator at Tom Price includes a scrubbing function "but the process would more likely be referred to in the iron ore industry in North America both now and in 1962 as 'washing', because that term better describes the cleansing effect of the water". If you have water applied under jets for the purpose of knocking the fines off the lump, what do you call that process - what would you normally call that process? ---I normally call that "washing"; that is the application to the ore lumps, to the ore stream

You go on to say:

> "The water by itself significantly affects the purity of the hematite by removing.....(reads).....to later heavy media separation."

Just so that we know we are talking of the same thing, would you tell his Honour very briefly why it is essential to that later heavy media separation?---The heart of any heavy media separation process is the medium circuit and - - -

K24. 12.46

WITNESS (Continuing): - - - medium circuit and the cleanliness of the medium circuit is very important in controlling both the specific gravity and the viscosity. The viscosity is perhaps a more important point because with a heavy media medium which is a suspension generally of a magnetic solid in water, in order to attain the densities of specific gravities required to float out heavy gangue you sometimes have to operate at a gravity of 3.0, 3.1 or 2. The medium at that point has immeasurable viscosity and the most important thing is that when this viscosity reaches a certain point the settling rate of the finer ore particles that you are trying to win is not sufficient to overcome the fluid forces in the medium and the first effect that you see is, you start to lose fine ore on the waste side. There are only two ways to improve the purity of your medium and that is to pass it through the magnetic separating circuit which has a dual function; it must recover the magnetite or the ferro-silicon from the slurry and it must reject the waste particles. It is pretty obvious that if you do not remove all the slime you can ahead of the process you may overload your cleaning circuit. Of course, another important part of cleaning the medium is to control the density of the medium bath. The only way you can overcome the dilution effect of water brought in with the washed ore is to offset it by bringing in high density medium from your densifier. So, there are situations when, if you do not thoroughly dewater the washed ore coming to you, you will find that as you operate at a high feed rate the density of the medium starts to drop. Then you have only one choice; cut the feed rate or increase the amount of densified medium that comes back. Every operator faces these kinds of problems daily.

MR HULME: Mr Herkenhoff, you go on in para.4 to say:

> "Screening now connotes and in 1962 connoted, the process of sizing...(reads)....is included in the term screening is incorrect."

If you asked the question, Mr Herkenhoff, of someone at Hamersley, "What do you do with your feed before you put it into the drums" and you got the answer, "We screen it", would you regard that - - -

MR HULME (Continuing): - - - regard that as an accurate answer in relation to what is in fact done to it before it goes into the drums?---I would have said that they should say "We screen and wash it".

In para.5 you exhibit the chapter of Taggart at which we have already looked previously. (Could the witness please have the three exhibits to the affidavit?) Would you look at Taggart? You have told us that if you put a jet of water against lump ore for brushing fines off you call that washing?---Correct.

And industry usage calls it washing. I do not wish to make any assumptions as to what, quite, Taggart says but if Taggart describes that as scrubbing - a jet of water - does that cause you any concern?---No, it does not. Perhaps, your Honour, if it would help clarify the court's understanding of what scrubbing is from a mineral dresser's point of view, I would say that scrubbing should be regarded as a power process and you can apply power to scrubbing ore in several forms. The simplest is simply to raise it as high as possible with conveyer belts and then by gravity drop it onto impinging plates, so that the particles collide with each other. That requires mechanical work to lift the ore up.

A second, and very important, way of applying power is with high-pressure water. It takes quite a bit of power to bring water up to a pressure of 100 pounds psi, or that order.

A third method is to use a device called a "drum scrubber" which is a cylinder with plates inside - compartments. You introduce the ore with a minimum of dilution water so that you get a thick mixture akin to what you might have in a common concrete truck, that lifts the ore up and drops it repeatedly on its passage through this cylindrical drum. That applies mechanical energy from powering the drum.

The final way is to put the ore and water in, say, a cylindrical tank and stir it with a mechanical impeller of some kind. With coarse ore that is just not really practical but for finer ores, where you are scrubbing to remove slimes for a flotation process which follows, it is extremely important to scrub by that method and it is most commonly used.

I would conclude that the degree of scrubbing that is achieved in a beneficiation plant such as you see at Mt Tom Price is related to those factors. Obviously, there is not much power applied in the feed chute. It is simply too short a space. Ore is not lifted high enough - - -

Y11. 12.55

WITNESS (Continuing): - - - high enough, and therefore in my opinion there is a minimum of scrubbing done in that feed chute. There is always some, but it is a matter of degree.

MR HULME: Taggart seems to have a somewhat different definition of washing. Taggart seems to refer to washing more as the carrying away of the particles in suspension rather than the actual forceful separation of them. To the extent that there is such a difference, does that affect your view as to what industry usage is in the United States?---I don't think it has any real bearing on what goes on in the scrubbing/washing circuit. It is almost like the chicken and the egg question. You have to put the water on, I think, before you can scrub but obviously after you have scrubbed you have to wash it off. The section which Mr Taggart has in this handbook starts off with "Washing and Scrubbing" as it is captioned, but the first operation he describes is scrubbing, then he follows that with various scrubbers and then assumes, I suppose, that washing goes along with it as you have pointed out. I must say that for efficient scrubbing, as you will realise, as you wash off slimes you must ultimately remove them because to achieve the maximum scrubbing effect if slimes are present they begin to lubricate the ore mass and this is particularly true when you are preparing feeds for floatation - you scrub in multiple series; you scrub, de-slime, scrub, de-slime.

Is that a convenient spot, your Honour?

OLNEY J: Yes, thank you. We will adjourn until 2.15.

LUNCHEON ADJOURNMENT

JW5. 2.15

UPON RESUMPTION:

MR HULME: Mr Herkenhoff, I was just taking you to exhibit 23, ECH 2, which is an extract of the bulletin of the University of Minnesota, the mining directory issue of 1963. You set out all of table 8 to that publication. There are a number of entries as, for instance, the mine called Embarrass, the Pickands Mather mine. Pickands Mather is a company you have worked for?---That is correct.

It just says "crushing". Others, one finds, as for instance Coons-Pacific, "crushing, washing, jigging, high density" and going down to the bottom, North Uno from the Hanna Ore Mining Co. at Hibbing, just crushing and you say in your affidavit:

> "All the references to crushing and screening and to crushing, screening....(reads)..... prior to and on the screens."

If one looks simply at, let us say, Jessie it gives just washing. What processes would you take that to be saying are at Jessie?---The Minnesota mining directory was issued every year that I am aware of since 1940 when I first went to the range and every year it is revised according to reports received from the operating mining companies. These simply tell you what the beneficiation plants are and what they involve. I want to point out that for the larger mines, certainly the Hull-Rust, the Rouchleau and the Sherman which were owned and operated by our distinguished Mr Beukema's company, the Oliver Iron Mining Co., those large mines commenced with mining direct shipping ores and then, as they exhausted the direct shipping ores and encountered more and more the lean ores which are around the perimeter of the ore bodies, eventually they added to those crushing and screening plants, which also would include facilities to load the ore into cars, either a washing plant or a heavy media plant or spirals, Humphrey spirals, to recover the fines.

In respect of the Embarrass mine it says just simply crushing. The Embarrass mine was at the bottom of a huge lake and to mine the ore they had to pump, as I remember the last time I saw it, about 4000 gallons a minute out of the mine to keep it dewatered so that the ore was quite wet and sticky. The only treatment that basically was used there was to crush the ore to a size that would pass 4 inch.

If one looks at the mine Jessie where you get washing - do you see that, it is just the one word entry?---Yes.

What processes would that convey to you took place at Jessie?---The classification of the Masabi ores, in order of their high iron content - - -

WITNESS (Continuing): - - - high iron content, starting with direct-shipping ores - first of all, direct shipping; then the next grade of ore that was the most easily upgraded were called "wash" ores and those that were more refractory and would not yield a saleable concentrate by simple washing were called, early on "jig" ores. Later that word "jigging", which was a gravity process, was supplemented by "heavy media" because it was more efficient. Then later, with the development of Humphrey spirals and devices equivalent to the locally used Reichert cones, more and more of the fines were recovered.

In respect of the Jessie, to me this indicates that the only ore they have in their pit was a wash ore and it might be helpful to the court to know that the laboratory test to determine whether you have a wash ore or not is very simple. You would take a sample of the crude ore that came from the mine, crush it to about minus one inch, cut out a cample, put it on 100-mesh screen and simply wash it with water. The material that was plus 100 would be de-watered and dried and sampled. If it was above the grade of about 57 iron, which was merchantable at that time, it would be called a wash ore and the bulk of the waste would pass through the minus 100-mesh and would probably run somewhere around 30 to 35 per cent iron; never perfectly clean but very much lower in iron and very much higher in silica.

The principal contaminant on the Mesabi iron ranges was silica and in some cases alumina from clays and a local, impure band that was known as "paint lock" which was actually a very high-iron clay and very sticky. So washing, to me, indicates that all they had was a washing plant and obviously that meant crushing, washing on a screen, de-watering in a classifier and stocking the product in a pile where it would drain or running it into a railroad car, which is the common practice, and letting it drain there.

That, obviously, is a small mine. The giants on the iron range were Oliver Mining, Piccans Mather and Jones & Laughlin, M.A. Hanna.

MR HULME: I am just asking you on that particular one, if you see the word "washing" what processes would that convey to you took place at that mine?---The ore had to be mined, brought to the plant, dumped into an ore pocket and fed onto a screen, the oversize of which could have gone to further crushing if it were of value or if it happened to be, as it is in some cases, a taconite material, which is refractory, it might be discarded there. The screen undersize would have gone to a washing screen with water applied. The coarser fraction

would have been screened of - and by "coarser" I say about quarter inch. The minus quarter by zero would have flowed to a classifier, a mechanical classifier. The classifier sands would then combine with the lump ore and the overflow of the classifier would have been discarded in what was called a tailings pond. That is the minimum circuit you would have for a wash ore.

MR HULME: Would you go then to exhibit ECH3 which is a United Nations paper on economic aspects of iron ore preparation published by the United Nations in 1966? If one looks at - - -

MR HULME (Continuing): - - - looks at p.XIII, the definition of "Concentration" at the bottom of that page is as follows:

> "Covers all processes which will increase the iron content of the ore.....(reads).....and the waste material is eliminated as tailings."

If in American usage you have ore which can be screened into two streams, one of which is marketable and the other of which is - - I am sorry; if you have ore which, if screened into two sizes, can then be sold what is that ore in United States terminology?---Well, just by mere, simple screening that would be a direct shipping ore. From the standpoint of chemical - -

I am just asking you from the point of view of terminology that is direct shipping ore?---You are not throwing away the fines?

No?---You are just separating them?

Yes?---Then it is a direct shipping ore; you separate it into two size ranges only. Yes, that is shipping ore.

If one looks at p.18 you will see that crushing can be either a basic or a preparatory operation:

> "It is a basic operation when the crushed ore does not undergo concentration.....(reads)..... in the blast furnace and have to be agglomerated."

Do you see that passage?---I do.

Again in United States terminology what name would you give to that ore which is merely crushed and the fines will, before going into the blast furnace, have to be agglomerated?---It is still a direct shipping ore and the fines would take a penalty; they would have to be sold with some discount in value because they would have to be agglomerated. They are in excess of an acceptable proportion.

It then goes on, skipping the next paragraph:

> "Crushing is used as a preparatory operation in the case of compact ores requiring further treatment."

So there we have ores which cannot be shipped just after merely crushing and screening but require something

further. What kind of ore in United States terminology would that be described as?---I want to think a little bit - by the terminology "compact ores"; I am not familiar with a compact ore. I assume they mean lumpy ores. I would agree,after reading that,that that represents ore which must be concentrated or beneficiated; it would be unacceptable for sale as it stands - - -

L167. 2.30

WITNESS (Continuing): - - - it stands.

MR HULME: What name do you attach to that?---That would be low grade ore or refractory ore.

OLNEY J: Can I just interrupt for a moment? You use the alternative description "refractory ore" for low grade ore?---That would be an ore that does not respond to the normal beneficiation processes. There are some ores that would require such fine crushing to liberate the diluent material which is largely silica that you wind up with a structure that is practically all fines and again you would be under the problem of trying to find someone who would buy fines at a reasonable price and agglomerate them on a sintering machine.

MR HULME: Will you look at p.18? I am just wondering where this word "refractory" gets us. You have told his Honour that the ore in relation to which this publication would say crushing was a basic operation was the direct shipping ore?---That is correct.

Then the next paragraph says:

> "It is a preparatory operation in the case of compact ores requiring further treatment."

WITNESS: That is correct.

MR HULME: I am just asking you, in the industry terminology in the United States, what would you call an ore that required further treatment beyond crushing and screening before it can be sold?

OLNEY J: Further treatment after crushing before it can be sold.

MR HULME: What name is attached to the ores which will be saleable when something is done to them beyond - I will first put it my way - crushing and screening? ---Beneficiation ores is the general term - - -

WITNESS (Continuing): - - - the general term; it has to be treated in some way.

MR HULME: What is the general term attaching to the ores which require that?---Obviously it would be low grade ore.

Yes. With your direct shipping ores, no matter where they are screened, will they have to be screened between crushing and the blast furnace?---The answer is yes, and the size to which the ores must be crushed depends on the furnace practice. In the early years on the Mesabi iron range the size to which it was crushed was 4 inches and the blast furnace was burdened with 4 inch ore. The famous Prof. Joseph from the University of Minnesota did some very basic work and brought the industry's attention to the fact that if they crushed their ores finer, reducing the top size to the furnace feed to around 2 inch, they could expect far better performance from the furnace, and when that was accepted by the blast furnace people and they realised the benefits then they ordered iron mines to crush finer or alternatively installed crushers at their own steelworks to reduce the ore to that size.

Mr Herkenhoff, do you ever crush ore and put it into a blast furnace without screening it?---If ever it is done - and not to my knowledge do they do that - it would be bad practice.

Have you ever known it to be done?---Not to my direct knowledge, no.

We will go back to your affidavit. In para.6 you say:

> "The process referred to in Mr Grosvenor's and Mr Beukema's affidavits would not be called.....(reads).....as a reference to both aspects of a dual process."

Can you tell us what you would regard as the prime function of - - -

MR HULME (Continuing): - - - prime function of a sieve bend? Are you familiar with that piece of apparatus?---Yes, I am.

What would you regard as its prime function?---The prime function of sieve bends in plants that I am aware of is primarily to reduce the volume of slurry that passes onto the following screens; in other words, it could be described as a dewatering function but you really do not remove water; you remove slurry and there is still suspended particles in it.

You have used a phrase there, "the following screen". Is that how you have found them?---I must say I would never put a sieve bend screen in any plant that I design because as a screen I think they are a very poor piece of equipment. You must remember that the oversize from a sieve bend screen is usually very sloppy. The only way that the oversized material gets off the screen is to be pushed off. A second disability is that these slots in the wedge wire screen, when they blind and tend to peg-off, the slurry progresses further and further down the screen and eventually, if not attended properly, will start to discharge slurry and stop screening. They do not vibrate so there is no mechanical maintenance but, on the other hand, they do not perform very well. You would say, "Then who developed these?" The Dutch State Mines in the Netherlands developed the process for washing coal which used hydrocyclones and that is where the term, "Dutch State Mines cyclones" came from. As a part of the circuit to design and operate an efficient coal washery they came up with these screens called sieve bends as a short-cut method of getting the medium away from the coal, principally, on the float coal which was the overflow of the cyclone, as promptly as possible, getting it back into the circulating medium circuit. So ahead of the actual vibrating screen on which the coal and refuge particles were washed and dewatered, they attempt to get the medium away as fast as they could and, therefore, they put it over this screen which I submit is primarily a drainage panel.

In the Florida phosphate fields where there are a tremendous number of washers that receive the pulped up crude matrix material from the minesite, the mining there is by drag-line, casting in front of hydraulic monitors which slurry the crude ore, if you will, and then pump it to a washery, there are literally hundreds of square feet of screen which look like a sieve bend except there is no curvature. I submit that when you buy a sieve bend screen you are buying an expensive screen service which wears out. It costs money to fabricate this screen on the curve. You can get just exactly, in my book, the same effect by buying a wedge bar screen which has a plain surface, no curvature whatsoever, and you save money.

If we can just get this on the record - - -

MR HULME (Continuing): - - - the record, what would you regard as the function of the sieve bends which you have seen installed immediately before vibrating screens? ---The function is pretty evident to me. It is to reduce the volume of slurry that flows to the succeeding screen.

What would happen on the vibrating screen if all this water taken out of the sieve bend went onto the screen? ---In the case where the succeeding screen has a very fine deck on it - for example in Hamersley with the slot half a millimetre in width and 13 millimetres long, many of the apertures of which are plugged - there is what we would call a minimum of effective screening area. It is measured as a percentage of the area of the screen. If that percentage of open area is too low and you put too much feed on the screen, there simply are not enough apertures for the pulp to get through, the water and the fines, and the result is you begin flowing pulp over the ends of the screen and therefore you have lost your de-watering aspect and, secondly, the oversize becomes contaminated with undersize.

One of the serious things that plants have to face is that fine screen decks cost a lot of money and the attempts are to find a material which will withstand wear and yet will have a large, open area in the apertures. In the case of Mt Tom Price I do not know the exact figure but it looks to me like they are very low in open area - I would say perhaps less than 30 per cent of the screen surface.

Can we turn to the mechanical classifiers? Is that the name you use?---That is the type of machine I am most familiar with.

Would you describe a mechanical classifier as being a screen? ---Certainly not.

Perhaps you could give us briefly the reasons for why you would not describe a mechanical classifier as a screen?--- A mechanical classifier could not in any manner or way separate, for example, two-inch iron ore from one-inch iron ore or from half-inch iron ore, because all those sizes of particles will settle in the tank of the classifier and be raked out as the coarse product. About the coarsest size that will overflow a mechanical classifier, in the case of iron ore, is about 10 mesh. That is about 1.65 millimetres. The common usage of classifiers is to feed them minus quarter-inch by zero washing from the washing plant.

According to what kinds of forces does it do that?---It separates by hydraulic forces and you control the oversize, the fine discharge of the classifier, by measuring the specific gravity of the overflow pulp. Normally, that will be

around 30 per cent solids to make a reasonably fine separation. If you want to overflow minus 100-mesh particles, you must dilute the overflow to a point of about 1.1 specific gravity. There is no way that the classifier will operate to discharge quarter-inch overflow unless the pulp is so thick within the tank that you do not have good separation.

MR HULME: What would you regard as being the essential features of a screen?---A screen should have the ability to separate a wide size range of ore.

I asked the question badly: Forgetting sizes at which it operates, what do you regard as being a screen?---A screen is a piece of equipment which will separate ore into size ranges, starting from anywhere from - -

Separate them in what kind of manner?---Simply by dimensions of the particles.

In relation to what?---In relation to the size of the openings in the screen deck. Specific gravity has no bearing there. I might add another distinction of a mechanical classifier is that (and it is a very important function of it) as the heavy coarse solids are raked up the tank you can apply counterwash by putting wash water on the upper end before the material discharges into the classifier, and I know no way that you can do that kind of an operation on a screen.

I have no more questions, if your Honour pleases.

CROSS-EXAMINED BY MR SHER QC:

MR SHER: Mr Herkenhoff, I could not help but notice that your affidavit, like that of many of the others which you say you have read, reveals a history of many different forms of employment with many different employers. Is that typical in this industry?---No, I would say it is not.

I did not mean to criticise you by making that suggestion, and I hope you do not think I did; I was suggesting that it is not unusual in any event in the iron ore industry, and the iron ore processing industry, for people involved in it to move to many different places of employment? ---I think you must remember that all mineral deposits are exhaustible.

And they are probably not in very convenient places, many of them?---That is true, sir.

Life would be tough?---There are some places where the man can endure it but the wife cannot.

Yes. Again I would make myself clear beyond, I hope, any question; I am not criticising you in any way - but is your experience if not typical certainly not unusual?---I find that that is true with what I would call my peers.

Yes. That means, then, that one of the beneficial spin-offs of that sort of thing happening is that companies employing

people of your calibre and experience are constantly getting a flow of ideas and experiences?---That is true, and I must add that on the Mesabi iron ranges in Minnesota which literally were the workshops and laboratories for developing advanced iron ore processes there was very open communication between the various companies.

MR SHER: Right. The history to which you depose, of your activities, has taken you to many countries, including Australia?---Yes.

And that is not an uncommon experience in the iron ore processing industry - would you agree?---That is correct.

One of the companies for which you worked was Kaiser Engineers, an aluminium and chemical company; is that right? ---Right.

Is that the same Kaiser company which had association with CRA and the Hamersley project?---That is entirely right.

Yes, so you would say, based on your experience and in that company in particular, that CRA and Hamersley would have had access to the knowledge and experience of people from, effectively, around the world?---Let me correct that: The Kaiser company which was the participant in the Hamersley operation was Kaiser Steel.

I gather that, but it is an associated company, I take it?---Yes. The holding company was Kaiser Resources - -

We can lift the corporate veil, if we may - - -

MR SHER (Continuing): - - - if we may?---Anyway, it was the Kaiser family.

So in a sense the experience you have had, which is not unusual, means that in the iron ore industry the large companies in particular would have many people at top level who know what is going on in the industry around the world? ---I think that is probably true.

And what sort of terminology people use around the world?---We call it "iron mining" in general.

I did not ask you what the terminology was but in so far as words mean something to certain people within the iron ore industry, the knowledge ought to be, in effect, world-wide? ---That is true. There are, perhaps, some minor variations in terminology but generally I did not find any difficulty communicating with people in other places as to what machines were and processes.

There are two pieces of evidence already before the court which suggest that that common experience also carries with it this particular qualification, that the terminology used is not universally used. Do you agree with that? In other words that words do not mean the same thing to the same people within the iron ore industry?--- I have not found any major variations to that at all; no way.

Let us find out if you have found any variations. Have you found some variations?---Honestly, no.

That may have been your personal experience but I am putting to you that it is known, despite your experience, that terminology is not always used with a constant meaning in the iron ore industry, in the iron ore processing industry. Do you agree with that?---That is possible.

I am asking whether you agree?---I agree.

In particular, do you agree with this statement made by one of the witnesses whose affidavit you have read? This is Dr Lynch.

> "I agree with Mr Grosvenor and Mr Booth that the expression....(reads) ....that they are used universally or with a constant meaning."

Do you agree with that?---Yes.

To take you to one of your own exhibits, which I assume you will agree with, the document that emanated from the United Nations, the 1966 document exhibit ECH3, do you see p.13 to which Mr Hulme has already taken you?---Yes.

"Note on terminology and sources"?---Yes.

MR SHER: The very first thing that is said, I suggest, is a reflection of what I have been asking you.

> "In this relatively young industry, a world-wide terminology....(reads) ....a slightly different meaning from one country to another."

I take it you would agree with that?---When it says "slightly", yes, I agree with that statement as written.

Let me take you to a specific term and let us see where we get to. Do you see the definition of "concentration" that appears on that page?---I do.

That is a definition which excludes screening, does it not? It says:

> "It does not apply to such very simple processes as the screening out of fine materials from a run of mine ore."

That sort of screening is excluded from the definition of concentration?---Yes, I see it.

It is saying that, is it not - that that type of screening is excluded from the definition of concentration in this article?---In this article, that is right.

That is a little unusual, that use of the word "concentration", is it not - to exclude screening?---When you say that you have eliminated fine materials - - -

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WITNESS (Continuing): - - - fine materials, simply to screen that out of a run of mine ore means that it could be screened from direct shipping ore - -

MR SHER: Do not worry about the application of the words for the moment. Let us just talk about the words. This document which you, yourself,have exhibited to your affidavit, defines concentration on p.13?---Correct.

And in defining concentration it makes it clear that it does not include in concentration simple processes as the screening out of fine materials from a run of mine ore so it is saying, in this article, when we talk of concentration, we are not talking of screening out of fine materials from the run of mine ore. Doyou see that there?---I see that because it is separation by size only.

Do not worry about anything other than whether you see it for a moment. You see it there?---Yes. I can read.

So far we are together; let us see if we can stick together, Mr Herkenhoff. Firstly, to use the word concentration as not meaning the screening out of fine materials from run of mine ore is unusual, is it not, because normally screening would be included in the term concentration? ---Concentration means to me that you must increase the content of something and, obviously, screening does not do that, it separates - -

Are you saying then that the definition is a good one, one that you would normally find?---For concentration I would take the first sentence in that paragraph there as my understanding of concentration. I submit the term concentration to me implies you must concentrate something.

We are in furious agreement about that. I am not asking you about that. I am really directing your attention to the fact that the author of this document says, "When I talk of concentration I am not including screening out of fine materials from a run of mine ore"?---He is the author.

Right; it's a free world, he can do what he likes?---Right.

But that is not the way, in the industry, that people normally talk of concentration, is it? They usually include screening as part of concentration, do they not?---As long as the screening is associated with some other function that increases the iron content or the metal content of whatever you are treating.

So screening is,on occasions at least, included in concentration? ---Definitely.

MR SHER: And the author is saying that in this type of screening he is not including it in concentration? That is clear, is it not?---Yes.

Let us turn over the page to the term beneficiation. He defines beneficiation and he defines it as:

> "A general term which covers both concentration and agglomeration, taken separately or together as the case may be, for a given ore."

All right?---Yes.

So if we then take his definition of concentration to find out whether something is beneficiation within his meaning, we can eliminate from both concentration and beneficiation screening out of fine materials from a run of mine ore because that is not included in the definition concentration?---That is what he maintains.

That is what he is saying, is it not?---Yes. He says it.

Do you agree with that?---If I do not agree with his statement on the preceding page I would take exception to what he says there.

Do you or do you not agree with his statement on the preceding page?---I told you that that is his opinion and not mine.

So you are disagreeing with him, both on the use of the word concentration and on the limits he puts on the meaning of the word beneficiation?---It follows if I do not agree with what he says about concentration I do not agree with what he says about beneficiation.

Of course it follows; I am merely wanting to make sure it is clear to you and me and his Honour and everyone who wants to listen to us, what we are all talking about.

OLNEY J: Just in case his Honour might not know, what is it that you do not agree with on that previous page? ---Let us consider the statement. "It does not apply" and he is referring now to upgrading the ore - - "Concentration covers all processes which will increase the iron content" which to me is upgrading, "that is upgrade the ore and eliminate some of the desirable elements." I submit that if you screen a run of mine ore that is direct shipping ore - - -

WITNESS (Continuing): - - - shipping ore you do not concentrate it, you do not upgrade it, you simply size it. He does not say "run-of-mine low grade ore", he says "run of mine ore", and we are talking about iron ore.

MR SHER: I ask you these questions for two reasons - and let me make clear what the first one is: Does not that little exercise that we have just had demonstrate as between you and the author of this document that you use words in the industry differently?---That I do, yes.

Yes. Now, you are not saying, are you, that the author of this United Nations document is wrong, are you? You are merely saying that you disagree with him?---I disagree with his statement, not his definition but his statement.

Right. Whatever it is that you are disagreeing with, you certainly are disagreeing with the author of this document?---In that point, yes, sir.

And in relation to the way in which he defines terms which are commonly used in the iron ore industry?---That is correct.

That does not mean that you are right and he is wrong, or he is right and you are wrong; it just means that you differ?---We have a difference of opinion, correct.

Yes, because people in the iron ore industry, as Dr Lynch says, do not use words with constant meaning - and that is an example of it, is it not?---Correct.

The second reason for asking you these questions is this: Let us accept for a moment that this terminology is what people normally use, that is that the author is correct. I know you do not agree with that, but I want you to assume that for a minute; would you do that for me so I can ask you another question?---Sure.

If he has excluded screening-out of fine materials from concentration and therefore beneficiation he is there referring to dry screening, is he not?---Yes, I assume so; I know no difference. He does not specify and I assume it could be dry.

Could it be wet as well?---Not on direct shipping ore.

Right - so he has to be talking of dry screening?---If it is direct shipping ore, correct.

If we take his definition and we have a contract which says: "Exclude screening from a beneficiation process", he is asking you to assume that screening is part of it but not to take it into account - - I will start again as I think I have not put that too well. If we take his definition and assume that the screening referred to in a document such as a contract is screening as part

of a beneficiation process, then that screening must be wet screening, must it not?---That is right.

MR SHER: That is exactly what appears in this contract. Did you realise that? It refers to "a beneficiation process", part of which being crushing and screening, and excludes the screening artificially from that process. That could only be, on your understanding of the terminology in the iron ore industry (if this definition is correct), wet screening, could it not?---Yes.

In 1962 the process of beneficiation known within the iron ore industry included heavy media separation?---What was the question?

I am sorry, I have a bad habit of making a statement which I really am trying to put as a question, so I ask you to agree or disagree: Is it true that in 1962 heavy media separation was a known form of beneficiating iron ore?---Definitely.

It had been known for many years, had it not?---Since the early 1940s, late 1930s.

So that in 1962 amongst iron ore people, including you would imagine the Kaiser people, beneficiation of iron ore could include heavy media separation?---Obviously, yes.

And you would expect the Kaiser people at least to know about heavy media separation in 1962?---I was their consultant.

You knew, did you not?---Yes.

Therefore they knew?---That is correct.

And it was not a secret that you kept to yourself, was it? It was well known in the company, was it not?---They had designed some of their own plants for Kaiser Steel.

Right. If in 1962 you were making a contract - - -

MR SHER (Continuing): - - - a contract talking about beneficiation and looking indefinitely into the future, for many, many years - the life of the mine - you would have naturally assumed that beneficiation may include heavy media separation?---Correct.

Because that was one of the well-known means of beneficiation. Do you agree?---I agree.

And in the event that you ran into any low-grade ore, that would be a natural beneficiation process to consider using? ---Correct.

And the moment you start talking about screening as part of a heavy media separation process you are talking of wet screening, are you not?---The moment you start talking about beneficiating low-grade ore,in my book you are talking wet screening.

This bulletin from the University of Minnesota was normally compiled, I suggest to you, by somebody at the university ringing up the office of the company and asking them what sort of processes they were using and being told over the phone?---Either that or they filled out a form and submitted it.

Who filled it out and how accurately they described it and whether they actually knew what they were talking about would be debatable, would it not?---It would be debatable, I agree with you, with the exception of what I would call "prominent" mining companies that had a staff who really knew what they were doing, and I would include in that Oliver Mining Company, and Pickands,Mather and so forth.

They ought to know?---The smaller companies probably did not have that type of staff.

But whether the University of Minnesota had got some 21 year-old girl to ring up a company who got onto a 19 year-old clerk who had been there two weeks and answered the question, you would not know?---That is quite probable.

Can I take you to para.6 of your affidavit?---Yes.

I direct your attention to a matter which was drawn to your attention by Mr Hulme just before you finished your evidence in-chief. You see the sentence in the middle of the paragraph:

> "When the term 'wet' screening is used, it is a reference to both aspects of a dual process."

Do you see that sentence?---Yes, I do.

I want to ask you a bit about that. Do you mean by a "dual" process, a process which carries out two - - you use

different words to describe two sub-processes?---Correct.

MR SHER: One washing, one screening?---Correct.

So when you say that the words "wet screening" were used and that was a reference to both aspects of a dual process, you are saying that the process to which it referred had two aspects - a dual aspect, one washing and one screening?---Correct.

If somebody had come to you in 1962 or now and said "We are wet screening" you would assume that what they were doing was washing and screening?---That is correct.

Just say the person who came to you - - -

MR SHER (Continuing): - - - came to you did not use the word "wet", normally you would think, if they just said "screening", dry screening or just the screening part of wet screening?---I would have to know what kind of a mine he was talking about if he came to me.

Right; that is exactly what I thought you would say, Mr Herkenhoff, you really need to know the context, do you not?---Absolutely.

And if they came to you and said, "Of the Tom Price mine we are screening", you would not know that they were wet screening, firstly?---If you would ask me that I would say definitely it is dry screening because no-one in a right mind would put wet screening on a direct shipping ore.

But what about the non-direct shipping ore of which there is plenty at Tom Price?---If you do not have a beneficiation plant there is no need for wet screening.

That may be right but if somebody talking to you about the Tom Price plant said, "We are screening up there", they could mean wet screening, they could mean dry screening, because they are doing both?---At direct shipping mines you had what they called a screening plant and, of course, if you have a beneficiation plant you have a screening section which I submit is always wet in my book.

So if they said to you of the beneficiation plant or something which indicated that is what they were talking about, "Screening", you would not know it meant wet screening? ---Please, again, come with this question.

If, in the conversation, they said to you that they were screening and you understood from what they said they were talking about the beneficiation plant, you would not know that that meant wet screening?---That is correct.

And that would mean dual process?---Your washing and screening, correct?

Yes?---I do not know of any iron ore that is not beneficiated by washing it. I just do not know any.

That means then, does it not, that as far as you are concerned, as long as you have been in the industry, when you are talking about beneficiating ore including screening you are talking about washing and screening?---Correct.

OLNEY J: But the same would be the case with washing, washing only, would it not?---Washing? I do not know of any washing circuit that does not involve screening, your Honour.

MR SHER: So the words are really interchangeable?---They would not be interchangeable if you define the kind of ore that you are treating. I submit that you would not wet screen direct shipping ore.

But leaving aside direct shipping ore, the moment you start talking about ore other than direct shipping ore, ore that needs beneficiating, screening means washing and washing means screening?---It involves screening, yes.

But if they said washing you would know what they meant, would you not?---Let me submit that you can wash ore in a log washer without screening.

Of course you can but, if they said they were screening the ore you would know they were washing it on a screen?---I would.

As long as they are talking about ore that needs beneficiation? ---Correct.

Just while we are at it, I have some of these exhibits here. Mr Herkenhoff, you have been a contributor yourself to a publication called The Engineering and Mining Journal which is published in New York?---That is correct.

In 1950 did you contribute as a co-author with another gentleman an article entitled Cyclone Separator may be Solution for Final Problem?---I did.

Was that published in the journal in vol. 151, No.6, in New York, in 1950?---Correct.

Was your co-author Stephen E. Erickson?---A very good friend of mine, yes.

Knowledgeable?---Yes.

Highly reputable?---Yes.

And regarded as an authority in the iron ore processing industry? ---He was.

You have seen the exhibit to Mr Beukema's affidavit, CFB 1, which exhibits a survey of world iron ore resources, occurrence, appraisal and news published by the United Nations in 1955, have you not?---I have.

At p.111 where it commences, does the author of that document - - -

MR SHER (Continuing): - - - of that document, that is Mr Sullivan, refer to and quote Mr Erickson, your friend and collaborator in your own article?---I read that; I do not have it directly in front of me, but I have read it.

I think it would be best if you saw it; look at p.111, please. Do you see how he refers to "wash ores" at the bottom of the page?---Yes.

He refers to:

> Erickson grouped wash ores to include true wash ores and also a small tonnage of off-grade merchantable ore."

Is that correct?---Correct.

Over the page he then actually quotes from Erickson in relation to the actual treatment:

> "The simple wash ore treatment is as follows..."

and he then details it. Do you see that at the top of p.112?---Yes.

He quotes from Erickson and he includes in the quote the following statement, in the middle:

> "The under size goes to a mechanical classifier. This classifier is essentially a screening device."

Do you see that?---I see that.

That is the way Mr Erickson described the classifier, as "essentially a screening device"?---Correct.

You may or may not agree with that description, but Mr Erickson's viewpoint would be one held by many people, would it not, of repute in the iron ore processing industry? ---I will answer that by saying that I do not agree that a classifier, a mechanical classifier, is in any way a screening device and if I had been a co-author to this paper I would have objected and had it struck out. I do not agree that it is.

What you would say, therefore, is that you do not agree with him?---I say that.

Right; that is clear and I think, if I may say so, it was clear from your evidence in-chief. However, the point about which I asked you was whether or not Mr Erickson's view is a view which would be held by a number of

reputable people?---Frankly I do not believe many people would agree with Steve. Why isn't a classifier called a classifier?

MR SHER: Let me see if we are down to nothing: Is Steve the only one who holds that view or does he have some friends?---To my knowledge, correct; that is the first time I have ever seen a classifier referred to as a screening device.

You know Mr Beukema agrees with the view?---Well, I am not aware of that but if he does that is his opinion. At the very utmost you could argue that a classifier, at the best you could say, is a fine-screening device. That is all.

Mr Herkenhoff, I am not going to even attempt to try and talk you round to Mr Erickson's view; I am prepared to accept you disagree with him?---I disagree.

Right - but you know he thinks, because he has said it, that a mechanical classifier is essentially a screening device? ---He says that. I don't know why he does. I do not know why he made that statement. I see that it adds nothing to the description.

You may find that this is one of those rare occasions where you are absolutely, utterly in conflict with your friend Steve?---That is obvious.

Yes. However, you know Mr Beukema, who had many years at U.S. Steel, agrees with him?---Well, that is his right.

And there may well be others, may there not?---It is possible.

Yes. So is that another example of people within the industry using words differently?---You can say that.

Is a mechanical classifier a sizing device?---It sizes by hydraulic methods, yes.

I do not care how it does it; is it a sizing device?---Of course.

In your affidavit you say, in para.4, taking you to the third-last line on p.4:

> "Screening now connotes, and in 1962 connoted, a process of sizing without more."

That is what you say?---That is correct.

You stick to that?---Yes.

Do you believe you are expressing everyone's opinion about the meaning of the word in the iron ore processing industry or just your own?---Well, I made this affidavit, sir, and this is my belief - - -

WITNESS (Continuing): - - - my belief.

MR SHER: It is what you think the word means?---I do not know anyone who would disagree and I am unaware of any arguments that ever developed over that.

Now that it is clear that you do not believe anyone would disagree, let us see if you are right. What I am going to ask you to do is to look through (I will help you by giving you page references) this compilation of documents. As we go through it I will ask you to say whether or not you agree what you are looking at appears to be a photostat from an American publication. The gentleman who compiled this will be giving evidence tomorrow, we hope, and he will be able to tell his Honour he compiled it and where he got it from. These are photostats but they are photostats of - -

OLNEY J: Just before you do embark on that, going back to the last series of questions, you referred the witness to the sentence beginning "Screening now connotes and in 1962 connoted the process of sizing without more." The next sentence seems to qualify the first?

MR SHER: Yes.

OLNEY J: That is "The process which a screen without washing attributes performs."

MR SHER: I should perhaps take that up with the witness.

OLNEY J: It may be that the screening he is talking about there was not intended to be used in the broadest sense?

MR SHER: Yes. (TO WITNESS): Do you see what his Honour has directed my attention to?---I do.

A screening process that involves washing - - you are not saying that such a process is not called screening, are you? ---No.

Because you accept that a screening process that involves washing can be called screening?---We are now referring to iron ore and, as I have pointed out, if you put water and wash on the screen you are starting to beneficiate, so there are two things operating - you are washing the ore and you are sizing it on a screen.

Right. So, if you have a process which involves washing and sizing, you say in the iron ore industry it can be called and is called "screening"?---Yes, wet screening.

I still wish to take the witness to some of these articles.

OLNEY J: Yes.

MR SHER (TO WITNESS): What we will do as quickly as we can is go to a number of extracts, photostat extracts, from American publications in the 1950s. I would ask you to turn this book over to p.115?---Yes.

If we look down the bottom of the page, do you see there it says:

"March 1957 Engineering & Mining Journal."

It is in fine print down the very bottom on the left-hand side?---Yes.

If you run through the pages ahead of it (they are not from that journal) you will see all sorts of extracts there which carry similar sorts of descriptions, "Engineering & Mining Journal", sometimes the volume and issue number, sometimes a date, and then if you turn over to p.116 you will see an extract from Skillings Mining Review of August 10th 1957?---Correct.

I suppose it is a bit much to ask you this but I will try. Does that look to you as though it is an extract or photostat from the Engineering & Mining Journal? ---The preceding pages, you mean?

The one I took you to - p.115?---Yes.

That is a well-known publication in America with a wide distribution?---Correct.

Similarly, Skillings Mining Review is another well-known publication with wide distribution?---Correct.

And read by many people in the iron ore industry?---Including myself, yes.

We know you have contributed to the first. Have you also contributed to Skillings? You have. A nod does not get taken down?---Yes.

If we go to the middle column on this particular page - - -

MR SHER (Continuing): - - - particular page you will find, if you look at the second paragraph, the sentence:

> "At most mills treating either wash or re-treat ores the concentrates, at some phase of the operation, are wet screened at about a quarter inch."

Do you see that?---Yes.

Will you go down, miss the next sentence or two, and go to the one starting:

> "An almost perfect separation of this size can be made with the wet screening commonly employed at the concentrator."

Do you see that?---Yes, correct.

Reading on it says:

> "If the concentrates are shipped together and, as often happens, mixed with direct shipping ore, this mixture must be screened dry at the steel mills."

Do you see that?---Correct.

The author of that article is distinguishing wet and dry screening by the use of adjectives?---Correct.

The inference I invite you to draw is that without those adjectives the word screening could mean either and hence the need to use the words wet or dry?---I disagree. In the first paragraph it says, "At most mills treating either wash or re-treat ores", beneficiation ores, the concentrates - they have to have been obtained wet.

Therefore, why use the word wet if it is obvious and why use the word dry if it is obvious? Is it not because at the time of publication of this article in 1957 if you just used the word screening it could mean either wet or dry?---To me the first paragraph absolutely reads "wet screening" even if the word wet were omitted, it would mean wet screening.

All the more reason why you would say, "Why on earth is this author using the adjective wet if everyone knows or would have known that it was wet screening anyway?"?---I do not know what the author is thinking about.

MR SHER: But this is a publication for the industry, is it not? ---Right.

And here he is distinguishing, by using adjectives, between wet and dry screening?---It does not detract from the statement to say wet.

It is totally superfluous, the use of the words wet and dry there, according to you?---It may be superfluous but to me it does not change the meaning at all to insert it.

Let us try another one; will you go to p.119?---Excuse me; to go back to this dry screening where they say that, it is pretty obvious at a steel mill you do not have slurry ponds and you try, as I have said before, to keep the moisture content down because everything you start to do in a steel mill you start with as dry an ore as you possibly can.

You are saying the word dry there does not mean dry screening but the effect of the screening?---A screen dry - -

I think you are right, if I may say so, but leave that aside, the use of the adjective wet in the earlier example, you would say is unnecessary?---To me, as someone familiar with the industry, I would say it is superfluous.

But you cannot explain why the author then felt the need to use it?---To people who are not familiar with the industry - there are lots of people read these things who are not involved in the iron ore beneficiation field.

So you would say then that outside the industry the word screening could mean either wet or dry?---To some people, they might confuse it, correct.

Let us look over the page to p.119. We have here an extract from a publication of October 1953, The Engineering and Mining Journal entitled, Minnesota's lean ores. Do you see that?---I do.

You will find, if you read the whole of it - and I am not going to ask you to - the word screening or screen used many times. Let me just point some of them out to you. In the first column, item 2 is, "Dry screening before direct shipment"?---Very specific.

But the word dry is superfluous, is it not?---Not when you say "direct shipment".

But if you say screening means dry screening particularly in reference to direct shipment - - -

MR SHER (Continuing): - - - direct shipment, the use of the adjective "dry" is totally unnecessary, is it not? ---I do not agree. I would say it emphasises the fact that you have screened dry; it does not alter the statement's validity.

Nobody suggests it does. What I am pointing out to you is that if you are right and the word "screening" means dry screening, the author here in discussing Minnesota's lean ores has used an unnecessary adjective?---As far as I am concerned, as someone skilled in the art, yes.

Then, if we read on after we get to the end of that list of nine items, he refers to "direct shipment" and "dry screening before direct shipment" - he has done it again?---Right.

And then in the very next sentence he says:

> "Dry screening is done to separate the fines."

He has done it again?---True.

Then, if we go to the next column and look at the fourth line, he refers to wet screening: "In the context of washing, jigging, heavy density separation and concentration on spirals requiring wet screening"; that is superfluous too?---It is very easy to agree with you. I do.

Yes. Then, if we read on, talking about wash ores, he says:

> "Such ores are first wet screened on a vibrating screen."

So the word "wet"is superfluous; is that right?---Not to people outside the industry.

To people outside the industry the words "dry" and "wet" help there, do they not?---Very definitely.

But for people within the industry they really were unnecessary, were they not?---That could be argued, yes.

Let us look at the next column; here we have a difficulty because he does not refer to "wet" or "dry". He refers in the second paragraph to a scrubber. He says:

> "A scrubber being installed at one plant this summer for the purpose of freeing.....(reads).....The scrubber product will be screened."

To a layman that could mean dry screening or wet screening, could it not?---No, it is impossible. He says the

ore will be scrubbed, will be fed with water to the scrubber.

MR SHER: That is right?---There is nowhere where he says that after it leaves the scrubber you have separated the ore from the water and you are dry screening it. It does not say that at all.

But he talks about the water in the scrubber, and then he says: "The scrubber product will be screened", does he not? ---Yes, sure.

It does not follow to a layman that that product will be screened wet or dry?---I disagree, sir. To me it is crystal clear.

Is it?---A slurry comes out of a scrubber.

But he does not say it is going to be screened - that the slurry is going to be screened; all he says is that the product will be screened?---My comment to this would be that people who read the Engineering & Mining Journal involve both miners and ore processors, not people who write poetry or something like that.

I am glad to hear that?---Yes. These words are crystal clear to anyone who is skilled in the art or knows what goes on in the plant.

I do not know if you have been in Australia long enough to learn the expression "having a bit each-way"; do you know what that means? It means having an each-way bet on a horse race. Do you know what that means?---Sure - I'm not a horse-race better but - -

But you know what having an each-way bet means?---That is a double bet, yes.

Yes; are you having a bit each way here, Mr Herkenhoff?--- Probably, you can argue that.

You see, earlier you told me that the words "wet" and "dry" were for the layman; now, when I point out to you that the author does not use the words "wet" or "dry" when talking of screened, you say: "But only people who know what he is talking about read these articles". You cannot have it both ways, can you?---Well, I cannot agree - -

Do you think the laymen give up after the first two columns and only the experts read the third?---I cannot agree that this word "screening" following "scrubbing" means anything absolutely nothing less than wet screening.

Let us press on, shall we? Do you see the heading "High Density Separation"?---Right.

Does it read as follows:

"The majority of plants now treating
jig ores use high density separation
to treat.....(reads).....is given
a final screening and washing."

Is that right?---That is standard practice.

MR SHER: I dare say it may be, but what does "screening" mean there, wet or dry?---It has to be wet screening.

Why did he not say "wet screening" for the layman?---Because he preceded it with the word "washing". 10

He did not; he preceded "screening" with "washing"; washing comes second, not first - - I see, the washing section is "given a final screening and washing"; you say that conveys the meaning, do you - - -

MR SHER (Continuing): - - - the meaning, do you?---I do.

Let us go to another publication, shall we - p.125? This is an extract from a publication in 1950?---I must observe this is a very good compilation of old articles. It is fantastically well done.

We have hardly started, but you will be pleased to know I am not going to take you through the lot. Let us have a look at the third column "In the log washer plant" - do you see that?---I do.

It says: "On being concentrated or washed the matrix is dumped from trucks....(reads).... to reduce ore material to minus 3-inch size."

Do you see that?---I do.

What is the screening there?---That is all wet.

How would you know?---Let us go back up a little bit. The screen undersize goes to logs. Let us go back to the third line. It says "the matrix".

I am happy to accept your answer. I do not want you to justify it. You are saying that the screening there is wet screening? ---Because the words "washed through grizzly bars" precedes it.

The word "screening" without any adjective conveyed to you immediately you heard it, that it meant wet screening? ---Correct.

But the author used the word "screening" not wet screening?---Yes.

Did you notice that?---I did.

Would you turn to p.149? We are coming back in time. We are back to 1957 in this particular extract at p.149? ---It is a pity you did not go to p.129 because I am the author of that article, the West Hill plant.

Have you used the word "screening" there, can you tell me?---I must have. It starts on 127, if you will notice. You are as bad as Dr Batterham.

"E.C. Herkenhoff" - that is you?---That is me.

Now that you have mentioned it, can I take you to p.128?---Good.

Are you there describing product produced by screening and nothing more?---Which portion?

The third column:

"In many cases the plus 1¼ inch fraction....(reads)....may wash up to satisfactory product."

You are talking there of product being produced only by washing, are you not?---That is correct.

MR SHER: Washing by screening?---Yes.

So Mr Beukema was right when he said in 1954, when you wrote this article, that there were plants in the Mesabi Range which produced product by screening alone? You, yourself, wrote about it?---Preceding this protector screening there was water added on vibrating screens and into crushers. Incidentally, I would find one exception to either Dr Lynch or Mr Pritchard who said he never knew of any case where the crushing was not dry. In this particular plant, we put water in the crusher. It was way up to the head of the plant.

He was wrong about that?---Right.

Dr Lynch was wrong about that, was he not?---He was, because he has not come across sticky ores.

This is very interesting, I know, but can we just get a short answer? This article of yours, which I might say I was going to ask you about anyway, is talking about product being produced by, in effect, wet screening processes alone. Is that not right?---Yes. That was what we called "straight-wash ore".

Right, and that is what Mr Beukema has said in his affidavit. Do you remember that?---Yes, but washed here involved eliminating fine sands.

I do not care what it was for. In this plant, in this article, you were talking about product as a result of wet screening without any further process - - -

EX97. 3.45

MR SHER (Continuing): - - - further process. That is so, is it not? ---Wet screening with washing on the screening - that is correct.

Without any further process?---Right.

And that was one of a number of plants in the Masabi range by 1962 where that went on?---What you are ignoring is the fact that when you washed the ore you eliminated impurities.

Do not worry?---I do.

You are talking of washing by screening, are you not?---Washing and screening.

But you are talking of the washing in the context of it being a screening process, the sort of washing that wet screening results in?----It is a very important difference. You must say washing and screening. You cannot pull screening out from that statement and have it - -

All right; I accept your statement. Washing and screening meaning the washing going on on screens?---Yes.

You knew, apart from the one you spoke of, of other plants on the Masabi range where the product was produced by washing and screening alone?---Yes.

And the washing being performed on wet screens?---Yes.

Can I take you to p.149?---Yes.

Actually it is unnecessary because this I was going to ask you as an illustration of what you have just agreed to, the Oliver Iron Mining plant at Trout Lake. That was one of those ones you have just mentioned where you got product by just washing and screening?---If I remember correctly the Trout Hill plant of the Oliver Iron Mining Co. was one of the first lean ore washers on the iron range and I know that they had all the equipment necessary to treat lean ore; I personally do not know if they ever handled direct shipping ore through that plant but I doubt it.

In any event Mr Beukema ought to know seeing he was one of the senior men at the company, would you not think?---Yes, but I think Mr Beukema would have arrived in the iron range long after the Trout Lake plant was built and operated, long after.

Perhaps he learnt something of its history, do you think?---It is a very famous and, as I say, probably the largest - -

MR SHER: I might even have got it wrong but the point is, those articles to which I have referred you indicate that back in the early and mid-50s authors were using in these journals adjectives such as wet and dry to distinguish one form of screening from another and on other occasions they just used the word screening meaning wet or dry depending on the context?---That is obvious.

I will leave that for the moment and take you to another American publication which you, yourself, have already referred to and exhibited to your affidavit, Mr Taggart. Mr Taggart is a gentleman who, with a bit of help from a few of his friends, has published a pretty authoritative book, has he not?---Several friends, right.

You were not one of those, were you?----No, that was before my time.

Mr Hulme put to you - and I make it clear that I do not wish to quarrel with your answers in any way to those questions but I want to remind you of them - that Taggart's definition of washing is one which involves this concept of carrying away of particles. Do you agree with that? ---Yes.

So if we were to apply Taggart's definition,strictly speaking, to what happens on the wet screens at Tom Price, it does not fit Taggart's definition because there is no waste. That is so, is it not?---The waste is in the minus 6mm stream.

But it is still in that stream and it is not waste at that point?---It is not waste but it is higher in impurity content.

Whether it is higher or lower does not matter; the fact is, there is no waste at that particular point?---You have not thrown anything away.

And that does not come within Taggart's definition of washing, therefore. Do you agree - - -

MR SHER (Continuing): - - - you agree?---I have trouble with that, because why do you wash on a screen if you do not intend to concentrate the impurities in a product that you either further treat or throw away?

We are not talking now about the object of the process and why you do it; we are merely talking about language as used in the iron ore industry for the moment. Taggart and his friends wrote an authoritative text which you regard, I take it, as one of the leading texts in the United States, therefore the world?---Correct.

What happens on the wet screens at Tom Price is not washing within Taggart's definition of washing, because at that point there is no waste. That is correct, is it not - what I have put to you?---You have not discarded anything - -

- - so therefore it does not come within Taggart's definition of washing?---I would like to see just where he says that you have to throw something away. Where is the actual wording to which you are referring, sir?

Are you now in some doubt as to what Taggart says?---I beg your pardon?

Are you now in some doubt?---No. I would like to see just what the terminology is.

I must say I do not blame you, but do you think perhaps when you agreed with Mr Hulme earlier you perhaps agreed with something which is not correct?---I was talking about scrubbing.

No you were not, with respect; you were talking about scrubbing and washing. Mr Hulme put both of them to you. He put to you the Taggart definition of washing involved the carrying away of particles. Do you remember that? ---Yes.

And you agreed. You did agree with Mr Hulme, did you not?---I did.

Did you intend to agree with that on the understanding that the carrying away of particles involved this concept of something being discarded? What are you looking at, Mr Herkenhoff?---I am looking to see this reference to which you are referring which I do not recollect.

You did not have a reference when Mr Hulme asked you about it, and yet you were able to agree with him. Do you have now some doubt about whether or not you - -?---I am questioning the term that it is not thrown away. You are maintaining that nothing is washed on the screen because you did not throw anything away.

MR SHER: No; I am saying to you that Taggart's definition involves the concept of, in effect, waste - that something is carried away?---Would you kindly tell me where those words are used?

In Taggart?---What part, please?

Can we just pause for a moment and just get clear what it is that is causing you some difficulty?---Yes.

What do you understand Taggart to say in relation to washing - that it does or does not involve this concept of something being discarded?---I would like to have - - please tell me where these words are thatyou say that something is not discarded?

Mr Herkenhoff, what do you say "washing" means? Leave Taggart aside for a minute; let us just get your definition? ---Washing means to remove impurities by directing water on it and separating the dilute part after screening and either discarding it or treating it by some other method, but you are concentrating impurities in the washings. Why else would you wash an ore?

Right - and is that what happens at Tom Price on the wet preparation screens?---You are concentrating the clays and the slimes and the minus 6 by zero fraction.

So what you have done is to redistribute within the feed which has gone into other streams the waste, as you put it? ---And the product you are going to sell, I submit, is the plus 6mm.

Well, that is not so; they sell the lot. Did you not know that? ---No. You would not beneficiate the ore if you sold the lot. You have to throw something away.

Yes, but you do not throw away the small bits of ore which are in the minus 6mm; you beneficiate that by putting it through the cycones and the whims?---You try to catch the iron that is in it but what you have done is you have concentrated the impurities in that fraction - - -

WITNESS (Continuing): - - - that fraction.

MR SHER: Nobody is quarrelling with you?---Then that is my definition of washing.

In so far as anyone will ever say to you that washing, strictly defined in the American iron ore industry, involves some discarding, some waste, you will quarrel with that?---No. Washing discards waste, certainly.

So washing may involve discarding waste and may not involve discarding waste?---Washing in the sense it is used in the iron ore industry in the United States means that in the washing process you have thrown away a product which has contamination and impurities in it.

You have used the words "thrown away" there. In so far as we have used it up to now perhaps it is my fault, but they are your words at this stage. Are you happy to adhere to that phrase, "thrown away"?---Well, discarded.

Discarded or thrown away. There is no discarding or throwing away in this beneficiation plant before we get past the preparation screens. That is right, is it not? ---Yes, that stream of the impurities is passed on to some further treatment.

We do not get any discard or waste in this plant until we get past the preparation screens. That is the fact?---Yes.

Therefore, we have not had washing, strictly so-called, until we get to that point, have we?---The coarse fractions have been washed absolutely.

Right, but in so far as the stream that went in has been washed, you have to wait until you get some discard before you can say that that stream as a whole has been washed? ---I do not agree with that.

Surely, you must?---The coarse fractions have been washed, positively.

Yes, but if we are talking of washing the stream that went in, which includes everything, that has not been washed until at least we get some discard, has it?---That is a play on words.

This whole case is a play on words?---All right. You have definitely washed the coarser fractions. You have washed fines, and we have heard the testimony of this with which I completely agree. You have washed fines and clays.

Are you prepared to concede this much then, that people may differ with you - honestly differ with you - about the use of the word "wash" or "washed" in this context?---It is possible.

MR SHER: And that other people might say that washing involves the concept of discarding some waste and until you get that you have not washed this ore?---Some can argue that.

In any event, let us get onto something where I do not think there will be any room for argument between us. This is not scrubbing within Taggart's definition - what happens in this wet screening?---I agree. There is a degree of scrubbing but it is a degree only.

It is not scrubbing within Taggart's definition?---Not in the concept that I accept.

It is not within Taggart, is it?---Not within Taggart.

In relation to this question of jets, we have heard the word "jets" and the pressure of the water used and the suggestion that there is something significant about the jets in this feed box?---Correct.

Can I ask you to look at Taggart at p.10.08? It is part of your exhibit, under the heading "Washing"?---Yes.

Then if we go down to "Screening washers" we will see the following.

> "A washing screen is an ordinary screen....(reads)....more or less powerful water jets playing on the oversize material."

So washing involves the use of powerful water jets, does it not?---In some plants it does.

But the concept of having a powerful water jet and therefore it must be a scrubber is not on, is it? That does not follow logically, does it?---I would have to observe that I have seen more washing screens with what we call fish-tail sprays than I have ever seen with powerful water jets, because of the simple thing that if you direct a stream of powerful water on material on a screen deck you soon wear a hole in the screen deck.

Right, but leaving that aside, I just wish to deal with this proposition. If somebody said to you the use of a powerful water jet means that it has been scrubbed rather than washed, you would not agree with that, would you?---I have already said that to me a method of scrubbing is to impact the ore stream with a powerful water jet.

I am not asking about that for the moment. I am merely asking about this concept of a powerful water jet, therefore scrubbing. If we look again at Taggart, just to remind you, he describes washing as - - -

MR SHER (Continuing): - - - washing as a screen provided with more or less powerful water jets and the expression there, "powerful water jets" is the one I am referring you to? ---I see that.

Powerful water jets do not, of themselves, make something into scrubbing, do they?---Not unless they are impacting on the ore against some plate.

Right, that is the point. We go back to the definition of scrubbing on p.1001. The emphasis put in the definition of scrubbing is, using a water jet as an example, if we look at the middle of that paragraph:

> "Scrubbing is usually effected by rubbing the larger and harder grains together....(reads)....backed by a rigid surface is sufficient."

The emphasis is not on the water jet but a jet backed by a rigid surface, would you not agree?---It is a combination of the two.

Thank you. And if we look at jet scrubbing which really deals with this matter precisely, over the page, you will see that the author emphasises this concept in the second sentence:

> "The underlying principle is subjection of the solid to the mechanical impulse of the jet....(reads)....rather than infecting transport."

Do you see that?---Yes.

You would agree, would you not,that the use of a water jet in scrubbing, to make it scrubbing, involves the use of a rigid or semi-rigid backing?---Correct.

And if we read on we will see how the author deals with how the jet strikes the water and the increasing force of the impact. You do not have to read on; I am just perhaps pointing it out to his Honour. Mr Herkenhoff, therefore, when you looked at this plant and saw that the water jets in the feed box were not backed by a rigid or semi-rigid surface you concluded it was not scrubbing?---I would say that if you directly wanted to scrub the ore before passing it to the screen you would have had a different device.

You would not agree with the proposition that this chute has been designed to maximise the scrubbing effect?---I would say that the operators of the plant have taken what was built for them and they are doing their best to maximise

the scrubbing that they can get within the space that they have.

MR SHER: Right, but they certainly have not got a plant that was designed to maximise scrubbing, have they?---I would say that that is a fair statement.

I will ask you a bit about this concept of wet screening. We have had evidence from Allis-Chalmers who, I suppose, are well-known to you?---Very well known all around the world, yes.

And some of their publications are in evidence in which they set out all the different screen uses and included in that they have size separation and washing and many other functions. Would you agree that wet screening can have a number of purposes?---Yes.

And washing and size separation are two of those purposes? ---The primary purposes, correct.

They would be the two most important?---Yes.

If you wanted to wet screen effectively firstly you have to have some sort of means of getting the feed onto the wet screen, do you not?---That is correct.

You normally have something which is described in the industry by the use of the word "chute"?---If I were to buy a vibrating screen such as an Allis-Chalmers screen - and all screen manufacturers provide the same thing - they have designed integral with the screen - they offer what is known as a feed box - - -

WITNESS (Continuing): - - - as a feed box.

MR SHER: So it is called a feed box or a chute, is it?---And that vibrates with the screen.

So you have a feed box or a chute?---No; the chute feeds the feed box in any plant that I have - -

Very well; you can have the reverse, can you not: You can have a feed box and then a chute, can you not?---No. The feed box I am talking about is on the screen and vibrates with the screen.

Perhaps the detail does not matter; I just want to get some principles from you, if I may. To wet screen effectively the feed ought to come onto the screen wet?---That is correct.

In a slurry form?---Yes, and into the feed box.

Yes, and therefore you would expect before the wet screen to have some device which had as its purpose the wetting of the feed to make it into a slurry?---That is correct.

It is absolutely essential to have that for effective wet screening, would you not agree?---Either that or you won't do very much wet screening.

While we are asking you about Skillings I would just ask you, if you would not mind, to identify this document. I will hand you the original and ask you to retain a copy - and there are two for my learned friend. That is a publication re-printed from an issue of Skillings in Vol.66 No.47 in November 1977, describing the Hamersley low grade iron ore concentration project. Have you seen that before?---I don't recall that I have read this issue.

But you may well have seen it, I take it?---Well, I know if it were published in Skillings that it is a description - - I personally have not read this, sir.

You recognise it, however, as a re-print from a Skillings publication, do you not?---Definitely.

I tender that, if your Honour pleases.

MR HULME: I take it, not having seen it before, that this is coming in as evidence of usage. If it is intended to be as evidence of facts then that may be something else, but if it is evidence of usage obviously I have no objection, your Honour.

OLNEY J: Can you comment on that, Mr Sher?

MR SHER: Yes, I am just thinking about it, your Honour.

MR HULME: The mere fact that the witness knows the cover of a magazine does not make the contents - -

OLNEY J: No.

MR SHER: I seek to tender it, your Honour, for that limited purpose at this stage but as to a more useful purpose I would like to think about it overnight, your Honour.

OLNEY J: Yes; I will take it as an exhibit at this stage, but with that limitation. You may, through this witness or some other witness, be able to legitimately put it to some other purpose.

EXHIBIT — EXHIBIT 24 .... Reprint from Vol.66 No.47 of Skillings Mining Review

MR SHER: I appreciate that you are making your view as to the use of terminology as clear as you can in an affidavit and in your evidence, but you no doubt have been interested to read the material from at least your two fellow-Americans; I suppose there is a higher degree of interest, perhaps, in that than in the other material? ---Are you referring to - -?

Mr Grosvenor and Mr Beukema?---Yes, of course.

And you have read their affidavits?---Yes.

It is clear that there is a difference of opinion between those two gentlemen on the one hand and you on the other - - -

MR SHER (Continuing): - - - on the other?---Yes, and I have my reservations for such differences.

I do not wish to embarrass you or them for that matter by going into it but does it not demonstrate the point that I sought to make earlier with you, that there are different uses of terminology within the iron ore industry in the United States?---There are probably those differences and more accentuated the farther the people are from what I would call the front line, the nitty-gritty of operating a plant.

Perhaps all we need to get from you is the concession that there are differences in the use of terminology, even limited to the borders of the United States. There are, are there not?---It is pretty obvious that there are.

We have had so many witnesses in the last few days and, unprecedented, three in one day, that I am not sure whether you said anything about this or not but can I ask you something about this concept of beneficiation beginning? I do not want any details but have you ever had an operation on you such as tonsils or appendix or something like that? Have you ever been under the surgeon's knife, in other words?---Fortunately, no.

Has anyone you know had an operation?---I have known some people who have.

Would you regard the operation as commencing when they booked into the hospital?---Yes, because I do not see how you can get into hospital without - -

If somebody were to say to you, "George, when did your hernia operation begin?" and they said, "When the doctor told me I needed it and booked me into the Corpus Christi hospital" you would laugh at him, would you not?---Yes.

Because the operation did not begin until at least the surgeon took his knife out and started to make an incision. Would you not agree?---No. First you are swabbed down with some sort of a disinfectant.

Right; you regard that as the beginning, do you? Would you say that was the beginning?---I would say that was the beginning.

Would you distinguish in your mind between preparation for something and actually beginning it?---If you are going to refer to this medical operation I would say the preparation begins before you go into the operating room; you have to be attended to in some way.

I just used that as an analogy because I thought it would be helpful to us all to illustrate what I want to put to you by simple example. In an operation there is a

difference between preparation and the operation itself. You would agree with that surely?---That could be argued, yes.

MR SHER: It could be argued; I suppose anything could be argued but that is a pretty obvious proposition, is it not? ---You could say that an operation of course encompasses preparation and finishing.

You could, but would you?---You are charged for the whole bloody thing.

I suppose both Hamersley and the defendant would say this case began months ago?---Yes.

On that basis; anyway, the point I am seeking to make is that in talking about the beginning of beneficiation we have to distinguish between preparing to beneficiate ore and actually beneficiating the ore, have we not? ---Yes, but if you apply the term beneficiation, to me it is crystal clear that beneficiation begins the moment you start to raise the iron content of the major portion of the ore.

That, as a definition, I can tell you now, Mr Herkenhoff, will not have the slightest objection from us at this end of the bar table. That does not happen until you actually subject the ore to some process. Is that not right?---Washing commences that in my book.

But when somebody at the plant says, "We'll put that ore there through the beneficiation plant and that ore over there we'll send to product", you would not say that beneficiation began at that point of time for the ore destined for the beneficiation plant, would you - - -

MR SHER (Continuing): - - - would you?---Not if it is segregation dry ahead of an area.

When you scalp off the large size, 200-plus, and sent it off to product, that ore is beneficiated because you have scalped off the ore, and by its very size you have beneficiated it because you have got rid of the rest. Is that right?---That one fraction would be screened out of low grade ore. It is a metallurgical principle to do that if you can - do not crush any finer than you have to. That, I suppose, could be argued is beneficiation. You are improving that production which comes off. You are not doing anything to the screen undersize, except reducing its iron content. It is a debatable thing.

So indeed you would be saying that you not only were not beneficiating the undersize, you were (perish the word) "anti-beneficiating" it?---I could argue that.

Yes - because you are making it worse by taking out the good lumps?---In the straight context of looking at the minus fraction that is correct, yes. By the overall operation you are maximising your recovery of iron because you are taking it out early.

I think that makes the point I wanted to make. I do not think there is much more if any more I want to ask Mr Herkenhoff and I do not think it will be a repeat of this morning's performance, your Honour. Is this a convenient time?

OLNEY J: But you would like to try, anyhow?

MR SHER: I would like to think about it, yes.

OLNEY J: Very well, it is a convenient time to adjourn now. We will adjourn until 10.30 tomorrow.

HEARING ADJOURNED UNTIL 10.30 A.M.

WEDNESDAY, 16TH NOVEMBER, 1 9 8 3

X106. 10.30

EARL CONRAD HERKENHOFF:

CROSS-EXAMINED BY MR SHER QC (Continuing):

MR SHER: Yesterday, when you were being asked about sieve bends (and I might say as the transcript records you kept referring to them as screens) you said they were essentially a de-watering device. Do you recall saying that?---Yes, I do.

But they are also a screening device, are they not?---They are used in certain places as screening devices, correct.

Yes, and indeed in the de-watering process the slurry that gets screened off through the sieve bend contains a lot of fines, does it not?---It certainly does. It contains much very fine particles.

Which in turn are further processed and the valuable ore extracted out of that slurry?---That stream would have passed down to the pulp stream that goes on to the cyclones ahead of the whims.

That is where it is processed again, to extract out of that stream - -?---Whatever is recoverable.

Yes, and that is what happens at the Tom Price plant?---I would say that the fines that actually pass through the sieve bend screen are so very fine that probably the recovery of material is fairly low.

But low or high the fact is that after being put through the sieve bends the slurry goes into further processing with a view to recovering Fe?---That is correct.

When you were talking about the Mesabi Range and the washing plants on the Mesabi Range - and described in this University of Minnesota document - many of those washing plants had washers and scrubbers, did they not?---They did in the latter stages of their life. If you will recall, I said that many of those mines had an evolutionary life. They started with direct-shipping and then as they exhausted the ore bodies they cleaned up the lower grade material.

The Mesabi Range is a good example to illustrate this point, that as the years have gone by the buyers' demands for better quality ore with a higher Fe content have progressed, have they not?---It is true that the standards have been raised but unfortunately for the lean ores on the Mesabi they cannot anywhere approach the kinds of ores you have here.

Hence Australia and Brazil are coming more and more into the forefront of iron ore supply?---Yes.

And you know from your experience that the demands of the buyers have been constantly accellerating in that they have

been asking for more and more Fe content in the ores sold to them?---That is correct.

MR SHER: So the concept of beneficiation has become more and more prevalent in the iron ore industry?---That is right.

That trend was well-established before 1962, was it not?---It was well under say at that time.

I just wish to take up something which has been the subject of a lot of interest in these proceedings, although to date I do not think you have said anything about it. There are at least two alternatives when you are talking of a wet screening process or a washing process followed by another process. Well, there are three possibilities, I suppose. One is that you do the first process wet because of what you want to do later. Another is you do later what you do because you have already done something else ahead of it, wet; or it is just coincidental. They are the three possibilities, are they not? ---Yes.

Once you have decided to wash ore, whether you use a scrubber, a washer or a wet screen, you are committed thereafter to using other sorts of equipment if you want to classify the parts of the product, are you not? ---If you wish to divide the ore streams into different particle sizes and so forth, yes; you use other equipment.

But once you have decided to wash ore, whether you wash it through a scrubber, a washer, a wet screen, or all three - - -

MR SHER (Continuing): - - - all three and whatever you call them. If you want to do something further down the track, a sizing operation after that, you are more or less committed to using a classifier, are you not?---You are committed to use other equipment, among which would be a classifier, but you could not afford to dry the ore thereafter.

No. The reason you use the classifier is because you have already wet the ore. Is that not so?---You use the classifier only for that size range of material that we are concerned with.

We are at cross purposes. Once you have decided to use a classifier for certain sized material you use it because you have already wet the ore. If you had not wet the ore you might use some other sizing device?---Let me - -

Can you not answer that question?---I will answer it in respect of the fraction which would go to a classifier normally only, not the coarser sizes.

Right, that is sufficient?---Okay.

The proposition then is that once you have decided you need to wash the ores for the fractions you need to use a classifier to size you are committed to using a classifier, are you not?---The alternative to a classifier is, in the case of Mount Tom Price, very clearly - -

No. I am not asking about Mount Tom Price. I am sorry to interrupt you. I am just asking you, in effect, about the Mesabi Range, really, at the moment. In the Mesabi Range, for reasons we need not go into, a lot of the ore needed to be washed, did it not?---Definitely.

The washing process in many instances was done by a scrubber? ---Correct.

Sometimes by a washer?---Yes.

And I mean by that machines which are specifically called a scrubber and a washer?---Yes.

You know what I mean by that?---Correct.

Sometimes it was done by wet screening?---Right.

Once you had decided that the ore had to be dealt with in that way and you were using a wet process you really had no option but to use a classifier for the finer sizes to size them. Is that not so?---I will say again that there are alternatives to a classifier.

MR SHER: Of course there are?---Fine screens and say Humphrey spirals.

Right; but once you have already wet the ore in the first instance the further step you take is also normally a wet process, is it not?---I say normally. That is correct.

The reason you are using the wet process at the end is because you have already used the wet process at the beginning?---That is evident.

It is not the other way around. You do not use the wet process at the beginning because of the wet process at the end?---I would say that if you are going to wet the ore you wet it as far up the circuit as you possibly can.

Perhaps you do but you would normally, I suggest, be wetting it in any event so you could put it through either a washer, a scrubber, or a wet screen. That is what would be happening, would it not?---Correct.

So the wetting of it at that stage was to get the washing or cleaning done, which is what you want to do?---Correct.

Having done that, it is inevitable that your final process, your final step, if it involved using a classifier, would also be a wet process?---That is true.

Because it would be crazy to dry it out in the meantime?---I would agree completely.

But the reason you are using the classifier is because you have already wet it for the purposes of cleaning?---That is true.

So you are not wetting it so you can use a classifier, you are using a classifier because you have already wet it?---I would agree to that.

Thank you. That was common the Mesabi Range?---It certainly was.

Finally, can I take you back to Mr Taggart? In Taggart he does not actually have a section which deals with screening and nothing else, does he? He does not have a separate section on screening like he has on scrubbing and washing?---In his handbook I believe he has a separate section on screening which describes all types of screens.

What I suggest to you, if we look at it we will find, is that he deals with screening in at least two different ways. Do you want to have a look at it?---I have knowledge of the Taggart handbook and I agree that s.7 is entitled "Screening".

MR SHER: No. It is not. It is entitled "Screen Sizing". Did you not notice that?---Screen sizing - okay.

Then if we look at the washing section at para.10.08 the washing starts off by defining washing then goes on to screening washers?---Yes.

So what Taggart does is in discussing screening he

is always discussing screening by reference to some other name or process or activity - in the first instance, sizing; in the second instance, washing?---That could be.

That is so, is it not?---If it is in the book, it is so.

Therefore, we can conclude by that, that according to Taggart screening involves sizing or washing or both?---That is a fair statement.

RE-EXAMINED BY MR HULME QC:

MR HULME: Mr Herkenhoff, in your usage do you include the case of simple crushing and screening or exclude it from the terms "beneficiated ore" and "concentrated ore"? ---No, I do not.

I am sorry; do you include it or exclude?---I include it.

So that if ore is simply crushed and screened you would describe that as beneficiated ore?---If it is simply crushed and screened to obtain a maximum lump size, that, I would call, falls under beneficiation.

Would you describe that as beneficiated ore?---Only to the extent that you have improved the structure quality.

I simply want to know, in your terminology; you have told us of various classes of ores used in the United States and if you have ore that is crushed and screened and shipped, under what name would you refer to that?---That is direct-shipping ore if you just crush it and screen it.

I am asking you about ore which is simply crushed, screened and shipped?---That is correct. It is direct-shipping ore.

Would you describe that ore as beneficiated ore?---In that sense it does not imply upgrading chemically, nor the rejection of impurities; therefore it would fall outside it.

I am not so much interested in the reasons. I simply want to get the terminology. Would you describe - -

MR SHER: You cannot cross-examine him, Mr Hulme.

MR HULME: I can make the question plain.
TO WITNESS: I am simply asking you as to the name that you attach to it in industry usage. You say of direct-shipping ore that it has been crushed and screened and you have told Mr Sher that that would definitely be dry screening - - -

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MR HULME (Continuing): - - - dry screening?---Correct.

If you have a process of beneficiation, if ore was not direct-shipping ore and you were going to beneficiate it in some way, will that ore be screened in that process?---It must be.

In what manner is that ore likely to be screened in a beneficiation process?---The beneficiation process is, of course, developed around size ranges of the material, so the crushing and screening of ore fed to beneficiation processes must, more or less, be accomplished in accordance with the beneficiation process that follows.

So what kind of screening will that be?---In the case of heavy media and jigging (as it is called) the top size that I know of is about four inches, normally for top size of any particle. The bottom size is around quarter inch.

I was not meaning to direct your attention to size. As between wet and dry, what kind of screening will there be if it is taking place in a beneficiation or concentration process?---In a beneficiation process very few circuits that I know of handle material coarser than about six-inch.

You have told his Honour that screening will inevitably take place somewhere in a beneficiation process and I am saying will that be wet screening or dry screening? ---In beneficiation that can be wet.

You say it "can" be wet. What expectation would you have in beneficiation - in screening in beneficiation processes?---Most cases it would be wet.

What cases can you think of where you would have dry screening in a beneficiation process?---There is a type of ore which is called "magnetic" ore - magnetites - which can be beneficiated dry over magnetic humming belts. That ore would not need be wetted, although it is beneficial to wet it to remove adhering fines which cause dust and so forth. That is the only instance I can think of where you would beneficiate ore dry.

If the beneficiation processes involve (I am thinking there when I say "process" of actual drums or whatever) the use of water, then will your screening be wet or dry?---Wet.

Would you say in those circumstances, that you are using the wet process in the drum because you have wet screened, or that you are wet screening because you are going to use it in the drums?---Definitely you are going to wet it, screen it ahead, because you are going to have it wet in the drums. You want to clean it as best you can in the case of heavy media.

MR HULME: Could the witness please have either Taggart or exhibit 23,ECH1? That is the exhibit to his own affidavit - - -

K91. 10.48

MR HULME (Continuing): - - - own affidavit which has the relevant section of Taggart.) Mr Herkenhoff, would you go over to para.1008?---Yes.

Do you see the section there that says:

> "Washing is properly separation on a size basis between particles differing so widely in size that the smaller are readily suspended in a fluid current which fails completely to suspend the larger."

Do you see that?---Yes, I do.

Do you see anything there or in the rest of the section as to what has to be done to that liquid, in particular whether it has to be carried to waste?---Certainly the suspended slimes in the fluid must be handled in some other way.

But do you see anything in the definition which makes the question of whether you wash the ore dependent on what you do with the liquid?---Not in the definition, no.

Turning to p.685, I referred you to Mr Taggart's definition and said that he seemed to refer to washing more as the carrying away of the particles in suspension rather than the actual forceful separation of them, referring to the carrying away in suspension as washing?---Yes.

Did you think that what I was saying was something different from what Taggart had said?---Taggart really does not say here what you do with it in this definition. He just simply says you suspend the smaller particles in a fluid current which fails to suspend the larger.

The words I used to you were, "Taggart seems to refer to washing more as the carrying away of the particles in suspension". Did you understand that to be anything different from what Taggart is saying?---I am troubled with the fact that you never wash an ore without taking the washings away; you do not want to save them.

OLNEY J: Is not the use of the word "current" suggestive that the fluid is moving with the particles in suspension? ---Yes, your Honour, it is.

Which does seem to give the idea of a carrying away?---It has to go somewhere.

As distinct from a bath, say; if you had a fluid bath with the particles in suspension it is different from a current? ---Correct.

MR HULME: Mr Herkenhoff, can I ask you to imagine yourself looking at the top screen here, screen A, the top screen in the system - - -

MR HULME (Continuing): - - - the system?---The first washing screen, the top deck?

Yes?---Yes.

There is the plus 30 to 80 ore?---Correct.

That is going to be the overs - water playing on it. It has come through the chute, come down onto the screen, water hitting it, fines being knocked off, and there go the overs out the end of the screen while the rest goes through. Would you describe that ore as having been washed?---Well, definitely. That is a dynamic system and washing is going on simultaneously with, I will submit, mild scrubbing.

Would you regard the fines as having been carried away from stream A?---Definitely. You watered it on the top deck, so the slimes and fines have gone through with the fluid.

Would your answer to whether or not we had washed stream A depend in any sense on what happened to the water and fines that had gone down through the screen? ---No. It has been washed.

When my learned friend was asking you questions a few minutes ago, you made the remark that in Tom Price you would have an alternative. Do you remember?---Yes.

He then said he had been asking about the Mesabi Range and had not been asking about anything including Tom Price. Are you able to tell his Honour what you had in mind as what you described as the alternative that could have been had at Tom Price?--- It is very evident from the cross-sectional view of the plant as presented, I believe, by Mr Booth - - I do not remember what exhibit that was but there was a vertical section through the plant and it is easy to see that the minus 6 mesh by zero passes to the final screen, which makes a sizing at minus .5. It is a lot separation but it is the minus half millimetre by zero which is the fluid stream. That passes to a pump, a sand pump, which is in literally the basement of the plant. That, alternatively, in the iron ranges in Minnesota, would have flowed to a classifier and the classifier would then remove whatever coarse material there is - the coarser range in that stream - and that coarser range would have gone to some other gravity device, being hematite, and the overflow of the classifier would have been a definite throw-away product and would have gone directly to a thickener in a tailings basin.

The classifier sands, alternatively, could go to shaking tables, Humphrey spirals, possibly even to flotation. There are a number of alternatives to that. It just so happens that in Mt Tom Price the next step is some 700 feet distance in the whims plant.

I might comment that the implication that you do not do any washing and upgrading - - -

409A. 10.58

WITNESS (Continuing): - - - and upgrading in the wet screening plant simply because you have not removed the waste product at that point offends my concept of beneficiation. Just because you have not pumped it out of the building does not mean that you have not separated it into streams which you later handle.

WITNESS WITHDREW

EXHIBIT EXHIBIT 28 .... Four pages from Taggart's work.

NILES EARL GROSVENOR, sworn:

EXAMINED BY MR SHER QC:

MR SHER: Mr Grosvenor, I understand your full name to be Niles Earl Grosvenor?---Yes.

You live at 5200 Aspen Drive, Littleton, Colarado, in the United States of America?---I do.

And you are a consulting engineer by occupation?---Yes.

You have sworn an affidavit on 27th October 1982 in these proceedings and I would like you to have a look at it. Will you just look at the affidavit for the moment and identify it as the one sworn by you on that date?---It appears to be, yes.

You identify that as your affidavit?---Yes.

Are the exhibits to it there as well?---Yes.

I think there are four exhibits altogether, are there not?---Yes.

Is the content of that affidavit true and correct?---It is, with the exception that Mr Langridge's initials are turned around.

That is in one of the exhibit numbers? I think you refer to one of his exhibits and instead of saying CRL you say CLR, I think?---Yes; CLR 1, the agreement.

Apart from that typing error - and in case you are interested CLR to an Australian means the Commonwealth Law Reports, I do not suppose you are referring to those - is the affidavit otherwise true and correct?----Yes.

I tender the affidavit and the exhibits, if your Honour please.

MR HULME: Your Honour, I object to parts of it. It will not, I think, surprise your Honour when your Honour sees it. Would your Honour go over to para.4 where Mr Grosvenor is led to give testimony as to the way the words are used in clause 9 of exhibit CLR. "We object to the words as used in clause 9 of exhibit CLR 1, the agreement."

MR SHER: You need not press that. We would be happy to have - -

MR HULME: A similar one at the end of the second sentence of para.9: "However, I note that clause 9 of the agreement

specifically excludes crushing or screening from beneficiation of the - -"

MR SHER: That is harmless enough, I would have thought.

MR HULME: There is one other problem that arises, your Honour, and can, I think, arise with any expression of an universal proposition. The affidavit as it stands makes certain propositions and it is not clear whether they are made in relation to the United States and/or Australia and/or world wide - - -

A88B. 11.22

MR HULME (Continuing): - - - world wide. In particular, the third-last sentence of paragraph 12:

> "But, whatever is the case, the process is still termed wet screening."

Paragraph 13, that wet screening was well-known in theprocessing of iron ore in 1962; and the first and third sentences of paragraph 20, that:

> "The basic concepts were well-known within the industry....(reads).... the terms crusing and screening would be equally applicable" - etc.

I simply mention those now to avoid the position, if Mr Grosvenor later says "Look, I do not have the faintest idea of what was happening in Australia in 1962. What I say is true as to America"; that we do not want it to be said "Well, this has been admitted on a universal basis at an earlier point." It is one of the problems that arise with affidavits - that they are in before one has pursued the means of knowledge. I draw attention to that.

OLNEY J: As to para.4 and the second sentence of para.9, Mr Sher, do you have anything to say?

MR SHER: I have no objection to the objections, your Honour. It is clearly a matter for your Honour to decide what the contract means.

EXHIBIT EXHIBIT 29 .... Affidavit of N.E. Grosvenor.

OLNEY J: The affidavit will be admitted as exhibit 29 but excluded from the exhibit will be para.4 and the second sentence of para.9.

I note what you say about the other matters, Mr Hulme. It will be a matter for comment.

MR SHER (TO WITNESS): I just wish to take up a few matters that are referred to in your affidavit with perhaps some elaboration. Can I ask you to look at p.4? In the third paragraph you refer to the fact that in August of last year you inspected the mine operated by Hamersley at Tom Price and the concentration plant? ---Yes.

Have you inspected the mine and the concentration plant since that date?---Yes, I have.

Would you tell his Honour the dates upon which you made these inspections?--On 19th July 1983 and on 1st November 1983.

MR SHER: Have those inspections caused you to alter the opinions you have expressed in this affidavit? ---No, they have not.

On 19th July of this year, would you tell his Honour what, in particular, you were looking for and what you did on that inspection?---On 19th July we visited the mine and the plant for the purposes of determining if we could see any of the problems so stated - clays and so on. We inspected the mine itself and asked the guide taking us around if he would show us the type of problem ore that you see when you look at the face in the mine.

You say "We" - who was in the party?---There were men from the mining staff of the Hamersley Iron group, Mr Boughton, me, Mr Dalby, I believe.

Mr Boughton and Mr Dalby are people employed by Hancock & Wright?---Yes.

By this time you were aware of the affidavit material which by 19th July had been filed on behalf of the plaintiff?---I was aware of the affidavits that had been submitted up until that time, yes.

They referred, obviously, to this question of some problem clays, or some clays and the like?---Yes.

So on this visit there you were looking to see what you could find out about this particular matter, were you?---Yes, and how they were handled. "I am a mining engineer and I would like to know how you start the entire process, right at the pit."

So you went into the actual mining pit itself?---Yes.

In the company of Hamersley people?---Yes.

You asked them, I think you were telling his Honour, to point out to you some of these problem clay areas and the like?---I asked to see banded iron ore, contact iron ore, clays or shales that were creating a problem - - -

A8. 11.27

WITNESS (Continuing): - - - creating a problem in the plant. I was told and shown these particular areas and told that this material was primarily wasted in a low iron ore content waste pile to be handled at a future time.

MR SHER: Did you get any samples of what you were shown?---I did not take samples from the pit but I did get samples off the belt going to the crushing plant.

Were you still, at that stage, in the presence of some of the Hamersley people?---Yes.

Could you recall the names of the Hamersley people who were with you at the time?---I believe, to the best of my recollection, that his name was Tony Curtis, a metallurgist. He was a metallurgist at the plant concerned with the problems.

Did you ask to have certain matters identified to you and did you take some samples?---Yes, I did.

Would you tell his Honour what happened in relation to that? ---I asked the metallurgist to actually pick off the belt items that he would consider would possibly give him a problem in the plant.

Which belt were you asking him to pick them from?---We were between the primary crusher and the stockpile, the storage pile.

This was the belt before it went into the wet screening and the washing plant?---Yes. It is the belt going into the storage pile for the processing plant.

What happened as a result of that request?---He was nice enough to stand up on the edge and reach over onto the belt and obtain pieces for me. He obtained a series of at least nine pieces that I collected, kept in a bag, and brought those back to Perth.

When you brought them back to Perth did you subject them to some simple test for your own information?---Yes, I did.

What did you do with them?---I did the same as Dr Batterham. I put them in glasses of water. I put nine different pieces from nine selections off the belt. They were taken off the belt over a period of time and I put them in the water glasses and left them there for six hours.

What happened to them?---Nothing.

You saw in court the demonstration given by Dr Batterham of some pieces of water-active - I do not know if it was clay or shale that he selected from one of the exhibits - and how they dissolved after some time in the glass.

Did anything like that happen to the pieces that were picked out for you?---No, it did not.

MR SHER: Did you also observe - I do not know if it was this visit or another visit - whether or not there was any bypassing of any of the streams that were not going through the drums or the whims?---While I was there on 19th July the coarse, heavy media drum, was not operating.

What size does the coarse, heavy media drum take?---That is 80mm by 30mm.

What was happening, as far as you could tell, to the stream of ore 80 by 30? I take it, it was not going through the heavy media drums at all?---No, it was not.

Did you see where it was going?----No, I did not follow it through but I knew that they were making a product of 80 by 30 and that it must be going either to the stockpile to be crushed or to some other point.

It was not going through the heavy media drums, that is the point?---It was not going through the heavy media drum.

Did you observe whether or not any maintenance was being carried out on this particular day?---At that particular short period of time we were standing there, there was not any maintenance going on on that drum, but anything - -

All you can say is what you observed; did you observe any maintenance being carried out on that drum?---No, I did not, at that particular time.

I do not want you to go at large but is there anything else that you observed on 19th July that is relevant to the opinions you have expressed in your affidavit? ---Yes, I believe there is.

What else did you observe?---I did observe the large stockpile of so-called low grade or problem grade ore - it may be low grade or it may be problem grade - but it is placed for future use of a possible beneficiation process or something of that type - - -

WITNESS (Continuing): - - - that type.

MR SHER: You looked at it, in other words?---Yes. I did.

What did you observe?---That there was a rather large pile but I did not go over to the edge of it to sample it or anything because it was too dangerous.

What about on the 1st of November, which is not very long ago? You went up there - I suppose it does not matter if I lead you on this - with Mr Heerey and myself, with Mr Boughton, and with Mr Beukema?---Yes.

Did Mr Tony Curtis show us all around the plant?---He did.

Was there any observation you made on that day which is pertinent to the opinions you have expressed?--- The plant was running and all the drums. The only thing we speculated about, or I did, was that there was a very light amount of waste material coming off the coarse ore drum, meaning that not an excessive amount of waste in that particular size was appearing to be beneficiated at that drum.

What is the significance of that? What does that leave you to conclude - the small amount of waste to which you have referred?---At that particular time the ore grade must have been of very good value going through the plant.

I will now just take up a few other matters. Does the word "beneficiation", as understood by you in the iron ore processing industry, involve any concept of discarding waste or tailings or whatever you might call it?---Yes.

Whereabouts in this plant is there any such discard to your observation and from your inspection of the plans and the like?---From my inspections of the plant and from the plans the material that is wasted is from the heavy media circuitry and after the hydro-cyclone and after the winds.

So up until that point of time, that is the drums, the cyclones, and the winds, according to the plans and your observation is there any waste which occurs?---No, there is not any waste.

I will just take you to this rather interesting topic about sieve bends. Are they solely for de-watering as far as you would say?---No.

What do they do?---I take the Dorr Oliver definition. They are sieve bend screens. There are descriptions and there are pictures which show that the fine

material is carried away with the water, which means that it is a screening process.

MR SHER: Is that water which is taken away containing the fines then in this plant subjected to further processing? ---In the wet - - well, in all cases it is subjected to further processing, yes.

Is that the usual use of sieve bends?---It is a de-watering screening device.

This particular path of the plant about which the name seems to change, from calling it a pulping box to a feed box to a chute on the back - I am not asking you for the moment to give it a name but that is what I am asking you about so you know what part of the plant I am asking you about: have you seen, yourself, in American plants (you perhaps could name one for us) a feed box of like construction?---Yes.

Whereabouts have you seen such a feed box?---At Sunrise, Wyoming, they have a feed box where the ore is coming onto the screen where it has a jet of water placed at that point.

Is it regarded there, so far as you can tell, or by yourself, as anything - - what is it regarded as?---As pre-wetting for screening purposes.

Is it regarded as a scrubber or a washer or anything within the meaning of those terms?---I have not heard it called a scrubber in this particular case.

What about a washer within the meaning of that term?---No. It is not considered as a washer. It is the pre-wetting for wet screening.

Finally, you were in court yesterday, in fact you have been in court most of the time, when I was questioning the previous witness, Mr Herkenhoff, about a lot of extracts from - - -

MR SHER (Continuing): - - - extracts from American publications. Did you compile that series of extracts? ---Yes, we did.

Would you just look at this bundle? (I am certainly not going to tender the lot, your Honour, but I would like to just get the ones I put to Mr Herkenhoff identified.) Are these extracts from publications, the originals of which you either had in your office or had access to back in the United States?---Yes.

Rather than bring all those did you have photostated relevant passages from these magazines and articles?---Yes.

How would you describe the status or the acceptance in the iron ore industry of the magazine called "The Engineering & Mining Journal"?---It is a very highly respected magazine.

What sort of circulation does it have in the United States? I do not mean in numbers but can you tell us whether it is just in an odd State or two?---No. It is rather complete for the mining and metallurgical group.

Is it likely to be found where mining and metallurgical work goes on throughout the United States?---Yes.

As far as you are aware, is it also distributed outside America, or just within the US?---I believe it is distributed outside of America.

There are extracts also from Skillings Mining Review. What do you say about Skillings Mining Review? ---Skillings is a magazine which is read by the people in the mineral industry.

For how many years have these publications been going on? You probably cannot answer that? How far back can you recall seeing these sorts of magazines or articles? ---More than 30 years. I believe we have records here showing 30 years.

Are they reputable magazines?---Yes.

Just open it up at p.108. I think you have compiled this and then hand-numbered each page?---That is correct.

I think I first put p.108 to Mr Herkenhoff. Was that page an extract from The Engineering & Mining Journal published on 24th November 19 - - I cannot make the date out? ---1930-something.

It is in the thirties, anyway. Is that an extract from the publication The Engineering & Mining Journal, published some time in the 1930s?---Yes.

MR SHER: Is p.115 an extract from The Engineering & Mining Journal of March 1957?---Yes.

Are pp.119 and 120 extracts from an article published in the October 1953 edition of The Engineering & Mining Journal about Minnesota's lean ores?---Yes.

Is p.149, which I think in the end I did not put to Mr Herkenhoff - - I will not bother you with it. Then there is Mr Herkenhoff's article at - - I might have put 149. Would you just look at p.149 again? Is that an extract from the March 1957 edition of The Engineering & Mining Journal? ---Yes.

Would you look at pp.127 to 132? Is that an article extracted from The Engineering & Mining Journal of March 1954, written by Mr Herkenhoff?---Yes.

Your Honour, I tender all those pages as one exhibit, if I may?

MR HULME: Perhaps my learned friend will tell us on what basis they are put, your Honour. I have not seen this document. My learned friend is tendering a document on which he cross-examined. He gets up and says "Well, these are the pages I cross-examined on. I will tender them - - -"

MR HULME (Continuing):"- - - tender them." If it is only terminology - -

MR SHER: That is all it is.

MR HULME: Then I have no argument, if it is only terminology.

MR SHER: I should have shown them to my learned friend, your Honour; it is an oversight. I am only using them for terminology and that is how I put them to the witness. I apologise; I really should have shown them to him.

EXHIBIT EXHIBIT 30 .... Pages 108,115,119-120,149, 127-132.

MR SHER: What I have done is to have them photostated by my instructing solicitor. We will make copies available to the court rather than hand this whole thing up. TO WITNESS: Your opinion about this plant and what goes on with it and the terminology that people use in the iron ore industry is set out in detail in your affidavit?---Yes.

CROSS-EXAMINED BY MR HULME QC:

MR HULME: Mr Grosvenor, I want to ask you a few questions as to the matters which have happened in the United States with ore. I will read you several passages and ask for your agreement. They are statements made by a man called Hugo E. Johnson who you will probably remember used to be the president of the American Iron Ore Association. Do you remember that?---I do not remember him.

This was testimony that he gave to the Committee on Ways and Means at the House of Representatives and the testimony is published by the authority of Congress?---I will accept that

MR SHER: Your Honour, I am just wondering whether my learned friend will be able to tell us all when this was said. It might have some relevance to the questioning.

MR HULME: I am sorry, yes. It is Friday, March 6th, 1959 and the testimony was given by him as president of the American Iron Ore Association. I will give you a copy. TO WITNESS: Are you aware of that body?---Yes, I have heard of them.

They are in Cleveland, Ohio. It was given to the Committee of Ways and Means which was considering revenue law amendments at the time. It reads:

> "American ore has been mined in the United States since before the American Revolution....(reads)..... in the iron and steel furnaces without any beneficiation."

Do you agree with that?---Yes.

MR HULME: It goes on:

> "These high grade ores were known in the trade as ore of 'shipping grade.'"

Are you conversant with that phrase?---Yes.

It is sometimes called direct shipping ores?---Yes.

Whatever the precise phrase is, it is to do with direct shipping out from the mine to the steelworks?---Yes.

It goes on:

> "That is to say, they were of a quality suitable for use as a raw material feed by the nation's iron and steel industry without further processing for shipping to the steel producing areas by boat or by rail."

WITNESS: That is what he is saying.

MR HULME: You agree with that? That is consistent with the expert knowledge you have of the history of the United States iron ore industry?---I believe it is a shortcut, a generalisation; not all the steps involved - - -

WITNESS (Continuing): - - - steps involved at this point.

MR HULME: In using the phrase which he uses in relation to these ores of shipping grade, "without any beneficiation", the author is clearly excluding from beneficiation any improvement that comes from ordinary crushing and screening?---Yes. He is excluding the scalping off of the oversize or the sizing and screening on the first to make a product which would be acceptable to a steel mill. He is just saying that crushing and screening is not involved in that.

Beneficiation in that sense - I appreciate your affidavit says it has wider and narrower senses - is normally used in the United States in the iron ore industry as not including that physical improvement which comes from merely crushing and screening?---Minor screening, that is right - crushing and screening, yes.

Then Mr Johnson gives evidence of that nation's insatiable desire for raw materials and the dwindling sources, reserves, of high quality, shipping grade, ores? ---Yes, that is true.

He says it was known that there were vast quantities of iron ore locked in the ground which nature had not concentrated to the high iron and low silica content of the shipping grade ores?---That is true.

Since the shipping grade ores had been concentrated by nature through thousands of years of leaching, the first experiments in beneficiation of the low grade ores involves simple washing processes to remove undesirable waste material such as silica from the ore, thus to increase the iron content of the ore to make it comparable with the ordinary shipping grade ores. Would you agree with that as a short statement of the early developments in beneficiation? ---I believe so.

And, indeed, in this Mesabi Range of which we hear so much, a type of ore developed,did it not, called wash ores? ---Yes.

Can you tell his Honour, just very briefly, what wash ores are?---Yes. Wash ores are ores which were just in the bank and in place in the ground with large pieces of other low grade; maybe taconite, harder materials; and wash ore is an ore which is high in silica with silica around it, therefore it is a specific type of ore which could be put in a log washer or a scrubber and tumbled so you could separate the different particles but the first process would be to scalp off the oversize

which they did not want then, as the size they wanted was four inch and down; all of this material went into the washer. They just tumbled it and tumbled it to separate the silica and other contaminates from the iron ore to free it up; then it went to a classifer and Mr Herkenhoff has been nice enough to tell us that some went to screens.

MR HULME: So the one thing which was done was you may have run two of Mr Johnson's stages together there. You wash the ores - - -

MR HULME (Continuing): - - - the ores to bring about a removal of, in particular, the silicone from the ore, having then less material than you brought in but a higher quality?---No. What goes into the washer all comes out of the washer. Therefore, what you put into the washer is just a certain size, below a certain size. The large pieces did not have sufficient iron ore in them to retain, but it was just a material, say, from 4 inches to 6 inches down, where the iron was concentrated. The washer just tumbled it, kept it all together and just kept tumbling it to be sure that it was truly washed. That is washing - not washing and screening but just washing. All of that material then came out of the log washer and then, by screening off the large size, you had a product and the undersize, the smaller material, went to a classifier or a screen to separate the extra fine, which they did not want, which went to tails, and the fine product that went with the coarse product.

So we finish with four streams there, do we? The original oversize was poor quality, you said, and it was taken away at the start?---Yes. They used a grizzly or something to that effect and took off the oversize.

That is the reverse of the Hamersley situation?---Absolutely.

Where people like the big. Over there, the big in that range often meant low-iron content and the first thing we see on several flow charts is an initial screening and oversize goes to waste?---Most always the oversize went to waste.

Then you have your lump ore and that is going to be product. You will have fines and they will be good fines and bad fines and they will get separated and then the fines will go to the - -?---Yes.

In saying that you have moved on, I think, to Mr Johnson's later stage, "Subsequent processes involved washing and jigging". What you are talking about is a kind of jigging?---No.

So that is a pure washing process you have been describing? ---A washing process.

A pure washing process, and then later came the jigging processes and later came heavy media processes and more recent developments?---Yes, as they realised they were losing iron in the fine particles, rather than discarding them they set up the plant to handle the finer particles.

Whatever form those beneficiation processes take, they are almost inevitably wet processes?---If we are talking about screening heavy media, all these are wet processes, yes.

MR HULME: Mr Herkenhoff mentioned one this morning, a magnetic separation that could be done dry. It is true, is it not, if ever we see words like "heavy media", "spirals", "hydro-cyclones", "cyclones", we know we are talking water? It may be ferro-silicone as well, and other things, but we know we are talking of a wet process?---Yes.

Other than magnetic, are there any significant beneficiation processes - significant in the sense of commonly used - which are not wet?---Not to my knowledge, as commonly used.

If you think of one later, you can let us know, but with that ore if you are going to beneficiate it you have to wet it?---Somewhere in the process it must become wet.

That is virtually a 100 per cent proposition with this ore. If you wish to beneficiate it, you have to wet it?---Under the list that you gave, yes - - -

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WITNESS (Continuing): - - - you gave, yes - spirals, heavy media, cyclones and so on.

MR HULME: I am asking you, other than magnetic separation can you think of any case where one cannot say, "If you are going to beneficiate it you have to wet it"?---Not to my knowledge; it is not common processes.

So we can divide the ores then into two classes, can we not - direct shipping ore, sold after only crushing and screening, which the American usage would call not beneficiated ore but direct shipping ore, and that crushing and screening will commonly be dry?---The one there that you refer to, yes.

Almost invariably?---Almost; there are cases where it is not true.

Just to be clear about this, I suppose, could you have a case where you were bringing ore up out of a swamp or something and it was so wet already that you could not dry screen it?---Yes.

In which case you might have to wet screen simply because it would not work?---Wet screening must be very wet or dry screening must be very dry.

Screening must be very wet or very dry?---Yes.

And if you happen to be in that middle condition it might be more practicable to wet it further rather than to dry it?---Yes.

Other than that kind of situation, the vast bulk of direct shipping ore is and has historically been screened and crushed dry?---I am sorry, you will have to repeat that.

Other than in cases of that sort, the vast bulk of direct shipping ore now and historically has been crushed and screened dry?---I believe that is probably true.

Now and historically the vast bulk of all beneficiated ore is screened wet?---The vast bulk is screened wet.

Subject to one exception that we can think of at the moment, the magnetic, all that beneficiated ore is beneficiated wet?---I believe, yes.

You know something of the history of the Tom Price mine, the broad picture. It started in 1966 - did you know that - roughly? ---Roughly, yes.

And you are aware that for a number of years they sold high grade ore which one may define by reference to it being direct shipping ore. Do you follow?---Yes.

They had a mine and they had some crushers and screens and they crushed it, screened it, brought it down to the port, perhaps did a bit more screening and shipped it?---Yes.

MR HULME: You are aware of that general pattern of events for some years?---Yes, on high grade ore.

You are aware that that was a totally dry process - - -

MR HULME (Continuing): - - - dry process?---Yes.

That is what you would expect it to have been, is it not?---Yes.

Are you able to say that ore at a moisture of 1.5 per cent is pretty dry ore?---Yes, if it is dry. If it is inherent moisture you would not see the moisture. It would be very dry.

Have you been there on dusty days with any wind?---It was warm and dusty on all occasions I was at Tom Price.

You are aware, are you not, from what you learned of that area, that all direct shipping ore in the Pilbara goes out bone dry? Did you know that?---No. I did not know that because I am not familiar with all the ore on the Pilbara.

Do you know that for all these years they were stockpiling lower grade ores?---Yes.

You may be able to help us a bit on this. When you are mining in the mine is it right that you will have certain areas where you are taking out high grade? You may have areas which are pretty pure shale or something, very bad areas. Do you follow?---Yes.

And you may, in between, have contact zones and things where you have quite a lot of ore but not as good as the good ore and, of course, a lot better than the bad shale area? ---Yes.

It is one of the tasks of the mining, is it not, to put in drill holes and things and see where they are getting to in order to ensure that as far as possible when the big diggers go in and lift ore, put it onto the truck, that truck goes to the right place?---Yes. They drill it to blast it or break it up and at that time they sample the drill holes.

Yes. They are working with great big scoops picking up what is it - 20 tonnes at a time or something of the sort? ---Yes.

It does not work with the accuracy of a teaspoon?---No. It does not.

But high grade ore would go to the crushers or stockpile for the crushers and would be crushed and screened and go to the port?---(No audible response.)

The rubbish would be sent away as waste?---Yes.

And the low grade ore would be stockpiled. That would be the normal practice?---Yes.

MR HULME: You often find, do you not, that because of the progressive sequence of mining you may not have a concentrator but you have to mine the low grade ore?---Yes.

You cannot go around it and leave it there, you have to mine it as you go, and that is why although you do not have a beneficiation plant you mine it and stockpile it?---Yes.

Hoping the day will come when you have one?---Yes.

Commercially, of course, it is a pretty wasteful kind of thing to do, is it not, to incur the expense of mining ore in year one, then put it there in stockpile and still have it sitting there years later, with that money having been spent and the return being a long way down the track?---That is correct.

You may be forced into it but you do not like seeing stockpiles ten-years old sitting there awaiting treatment?---I do not like that, no.

One thing one could do would be to put that low grade ore to one side, send it off as waste, and just chase the high grade ore. Is that right? That would be one way of mining it, would it not?---Yes. We would call that high grading.

One of the difficulties of that, of course, is that you might run out of high grade and find yourself - - -

MR HULME (Continuing): - - - find yourself with a lot of low grade that you cannot get out because you cannot blend it?---That is correct.

And good mine management will try to utilise as much of the ore that comes out as possible, will it not?---Yes.

Good mine management will say doing that increases the life of the mine?---Yes.

As far as possible we get to the end of the day and all the ore of low grade or high grade has all gone. We are not left with a mountain of low grade ore that we cannot get rid of because we high graded a few years ago?---That is correct.

You would not be aware in this country but do you know the attitudes in the United States of government towards the adoption of wasteful mining methods of high grading and leaving the low grade ore behind to be wasted?---I am very familiar with our government's position.

Does the United States government like that?---Absolutely.

Pardon?---Absolutely.

They like you to go high grading?---No, they do not. They want you to - -

And you have - -

MR SHER: The witness had not finished his answer.

WITNESS: They want you to mine and they have set limits on what you must mine, too, if you have a government lease - -

MR HULME: For just this reason; they are saying to the mining companies, "It is not just easy game, going in picking lollies. You utilise that whole area as best you can within limits that the government sets"?---Yes.

Because obviously you cannot afford, commercially, to chase the last tiny lump so the government has to set a limit? ---That is right. You are expected to make a profit.

That is the United States government. You have 50 state governments?---Yes, we have.

And a lot of them have mining interests? I do not know if they all have, but many?---Yes.

The general attitude is the same?---Yes.

MR HULME: If you are going to use those low grade ores, what you would call beneficiable ores - and there are various phrases, but with the low grade ores I am talking of an ore which can be upgraded sufficiently by beneficiating - -?---Yes.

Some of the American books call that beneficiable?---Yes.

Some of the Australian ones might, too. If you are going to utilise those low grade ores, then you have to build an appropriate beneficiation plant, do you not?---Yes.

If you stand there on a day when the mine has not had any equipment there for handling these low grade, when it is just a direct shipping ore mine, and watch what is put there so that they can handle the low grade ores, then you will have a pretty good idea of what a beneficiation plant looks like?---I do not see the connection - - -

WITNESS (Continuing): - - - the connection, but if I stand in the pit and I see - -

MR HULME: No?---That is what you said.

It need not be in the pit - wherever they have it. If you are there at a time when it is just a direct-shipping mine, it will have certain equipment and certain things will be there?---Yes.

But if they wish to handle the low-grade ore, they are going to have to put in a lot more plant, are they not? You have to build a beneficiation plant?---Yes, but I thought we were talking about the mine. We are talking about the entire process?

Yes, and the name "beneficiation plant" or "concentrator" will be given to the structure which is built specifically because they wish to handle low-grade ores?---A concentration plant, a beneficiation plant.

That is right. It may not alter the look of things in the pit but outside there will be a new collection of structures put there only because they wish to handle low-grade ores?---If you cannot ship any of the low-grade ores, then you would have to upgrade them to meet contract specifications.

And the beneficiation plant is the structure which is built to do that?---Yes.

I do not mean a single building but a complex of things to handle that low-grade ore?---Yes.

Can I show you a chart? It is a chart in a book put out by Hamersley Iron called "Hamersley Iron Resources Technology Operations". Did you get a copy of this brochure when you were up there?---Yes.

You are familiar with its contents. On p.14 there is shown in yellow the Paraburdoo plant lay-out, the primary crusher, primary stockpile, secondary and tertiary crushing, screens, ore-blending, stock yard?---Yes.

A typical enough lay-out for a direct-shipping ore mine?---Yes.

If we go over then to p.16 we see in yellow something not altogether unlike Paraburdoo and then do you see in the dark blue what you can identify as the concentrator?---Yes.

That being the plant, structures, tanks, belts - things of that sort - that were put there to handle low-grade ore and were not previously there?---Yes.

You would agree that the whole of that plant in blue is proper to be called the beneficiating plant or the concentrator, according to the terminology one adopts - - -

MR HULME (Continuing): - - - one adopts?---It is shown here as the concentrator section of the plant.

Yes. You would apply that name, either that or the beneficiating plant, to that whole collection of structures put there for the purpose of handling the low grade ore?

MR SHER: If your Honour pleases, I have an objection. I am sure my learned friend does not mean to mislead the witness but your Honour does not have this document before you. If you do have it before you, your Honour, you will see that there is part of the plant which is diverting some of the product from this beneficiation plant directly to product and not through the whole of the beneficiation plant, so as to that part at least it is mis-described by my learned friend.

MR HULME: You mean the yellow part?

MR SHER: Yes.

MR HULME: The yellow is not described as the concentrator.

MR SHER: I am sorry. The point is that you have in your beneficiation plant here a conveyor belt which takes ore which has not gone through the drums directly to the product. To put to the witness that the whole of it is the concentration plant in blue is wrong. Part of what was built is in yellow, which is one of the points we have been making for days.

MR HULME: Being in yellow, it is not in blue.

MR SHER: I agree with that.

OLNEY J: Perhaps I am at an advantage in not having the book. I understood the part you were talking about was the blue.

MR SHER: Your Honour needs to see it. Perhaps if your Honour would have a look at p.16 I will then re-state my objection.

MR HULME: I am asking Mr Grosvenor whether he would agree that the blue is the concentrator in the beneficiation plant.

MR SHER: I object to that question,your Honour. If your Honour will have a look at the plant you will see that within the confines of the blue there is clearly a conveyor belt which is not numbered which is in yellow and it sticks out. That, we would say, is part of the concentrator plant, because it is

built as part of it, but it is obviously designed to take material directly to product and not put it through the whole of the plant. The way in which it is put to the witness is to suggest that this part, the yellow, was there before, which it was not as far as we understand it, and it is part of the concentration plant even though it is not used ultimately to take material through, ultimately, the product. So it is misleading, in our submission, to rely upon the colours as indicating either that only the blue was built and secondly that only the blue represents part of the concentration plant.

OLNEY J: I was certainly led by the questioning, without the advantage of the diagram, into thinking that all that is yellow was there first and that all that is blue was built as the beneficiation or concentration plant. That really is the witness's evidence to the extent that he has agreed to the questions put to him.

MR SHER: It is misleading, we say, sir.

OLNEY J: It may well be misleading. Perhaps, having taken the objection - I am not sure what the opposite of misleading is but at least you have pointed that our, Mr Sher.

MR SHER: It is "leading", I think, sir.

OLNEY J: Also, the diagram does purport, for the purposes of this diagram, that blue in the key at the bottom indicates concentrator. Perhaps it is misleading if, in fact, some of that yellow framework was built at the subsequent time.

MR HULME: Mr Grosvenor, I will put it this way: You see the belts which, as I pointed out, are yellow and are therefore not blue? Do you follow that? Do you see the yellow belts?Mingled in with the blue belts there are some yellow?---Yes. I do.

I am not asking you any question about that mingling yellow belt; whether it is the concentrator or not. Do you follow?---But it is in the concentrator. It was built in the concentrator. It was put there when the concentrator was put there.

Perhaps if you would wait for the question we may get on rather better. I am not asking you about that. Would you agree that the concentrator includes the blue - - -

MR HULME (Continuing): - - - the blue?---Yes.

And all the blue?---Yes, as shown on this map.

We can say, can we not, as to that, that that was all put there for the purpose of handling the low grade ores?

MR SHER: If your Honour pleases, I object to that question because it is asking this witness to give evidence of the intent of the designers and the builders of the plant. Mr Grosvenor is neither and he is really just speculating, your Honour.

MR HULME: I withdraw the question.
TO WITNESS: You have seen that plant several times. You have looked at it. You have gone there to look at problems etc?---Yes.

You said to my learned friend that the places where discarding takes place - - Let us be sure about it. Is that the place where the actual alteration in the chemical analysis of the thing as a whole occurs? You discard some rubbish and what is left has a higher chemical analysis over its total than the chemical analysis of what started off at the start of the affair?---I feel the question is complicated but it is a fact that you have a separation in the drum of what we would call low grade or waste, too low to sell, and an upgraded iron content product.

And that process that occurs in several places at each of the drums and at the heavy cyclone and the whims-- there is good product coming out and bad material of some kind going the other way?---In the cyclones, the heavy media cyclone and the hydrocyclone and the whims, yes.

There are five altogether?---Yes.

It is that sending away of poor material which, as I understood what you said earlier, a necessary part of justifying the word concentration or beneficiation? ---Yes. My definition of beneficiation from the handbook, glossary of terms, US Bureau of Mines; you must discard a waste.

You send out less product than you put in as feed?---Yes.

Where you simply crush and screen you send out the same amount of product as you put in as feed?---Yes.

In beneficiation you send out less?---Less product, yes.

Less product than feed.

OLNEY J: When you crush and screen, when you say you send out less product, at the end of the screen you have a division; the whole product divides into two?---That is correct.

MR HULME: In dry crushing and screening your total of lumps and fines will equal the input of feed?---Yes.

In concentration, beneficiation by definition, that cannot happen?---By definition? By the definition I just quoted?

Yes; that is your definition?---Not my definition; that is the US Bureau of Mines definition, the Department of Interior.

Is your view different?---No. 10

You just mean the words. That is a fundamental difference, is it not, between these two different things that one can do with ore - - -

MR HULME (Continuing): - - - with ore?---Yes.

In the long run the efficiency of the whole of that concentrator will depend on what happens in the drums, cyclones, hydro-cyclones, whims and anything else you may put there?---The efficiency of the plant.

It is there that there finally occurs the emergence of the good product and the sending away of the bad waste in whatever form?---Yes.

And the whole plant is designed to make that separation as efficiently as possible?---Yes.

The purpose of that whole construction - - I will put it this way: The whole of that concentrator is to serve the purpose of bringing about the best possible split in the drums and cyclones and whims of the good product and the bad waste? ---Yes.

That is how you judge the behaviour of every earlier component? Does it contribute to a happy outcome in those drums? I include the others. (I say"drums" to say,given a chain of them)?---Yes.

That is the question with everything you put into this plant? "Is it necessary?" If it is not necessary, "Leave it out." If it helps, put it in. If it harms what happens at the drum, leave it out?---A basic principle of design.

In para.18 (it is not contested) you point to the various separations which take place. For instance, four lines down on p.9:

> "For example, in the drums the lower-grade and therefore lighter ore.... (reads)....and heavier ore, sinks."

WITNESS: Yes.

MR HULME: You give similar descriptions for the other components? ---Yes.

You do not, I think, say why that is good but the assumption is plain - you are separating poor quality material from the higher quality ore in each case?---Yes, beneficiation.

It is that separation - - -

MR HULME (Continuing): - - - that separation, being able to have in your hand coming out the bottom as sinks the high grade, and in the other hand, if you are tall enough, the waste going out elsewhere. It is that separation into two distinct streams which is at the heart of your beneficiation, is it not?---Yes.

Earlier on in the life of this ore we had the ore falling onto the start of the first screen. We will talk about that a bit later but you know the place about which I am talking?---The first screen?

Down the chute and onto the first screen?---Yes.

Going to send all the under 30's through the apertures, the over 30's out down the belt?---That is in the middle screen of the series.

No, the top screen is the 30 to 80. The under 30's will go through onto other screens?---Yes.

That first stream, stream A as it has been called in these proceedings, will consist, we have been told, of components having a higher quality than they had when they came just before the screen - let us say when they came down this chute: that is, there came down the chute a lump of good quality ore with fines on it of lower quality and some clay in it. Right?---And some shale.

There may have been shale or there may have been shale in the screen but we had a lump of ore with fines on it and clay on it?---Yes.

In the chute and on the screen the lump lost a lot of adhering fines and lost some clay;down onto the lower screens it went?---Yes.

And away goes that stream. You would expect that stream going away to be better, would you not, than when it came to the screen?---Which stream?

Stream A. It would be better because it has lost its evil companions?---If they are small enough to go through the apertures.

Yes?---If they are not, if it is a piece of shale the same size, it will continue on.

Yes. Adhering fines would be small enough to go through the apertures?---Yes.

Clay would be small enough, if it came off, to go through the apertures. It is a 30 mil aperture, is it not? ---Yes.

MR HULME: I am not suggesting to you that it will not have any fines or clays but that lump will be better than when it came?---It will be washed clean if the sprays have done their job.

It has been washed, it has been knocked about a bit. People say a metre and a half is not very far but it is, in fact. It falls, it has heavy jets of water; it goes down onto the screen, it has more jets of water, and the purpose of that is to make those lumps better for the purposes of going in the drums, is it not?---It is.

That is why we are doing it, is it not?---We are wetting the material coming through the chute.

We are doing what we are doing - - -

EX120. 12.37

MR HULME (Continuing): - - - are doing to help make those drums work as well as possible, are we not?---If you skip lots of processes and say we have a clean piece of ore that we want in the drum.

We do not want that lump to go into the drum with adhering fines and we do not want it to go in with clay?---Yes, that is correct.

And we are not going to do much more to it, are we, because when stream A goes off it does not have many more distinct processes left, does it? It goes along a belt?---On a belt.

It goes into a surge bin. It comes out onto a belt?---Yes.

It goes up onto a preparatory screen and into the drums?---It goes across the sieve bend screen and a preparatory screen.

A sieve bend on stream A?---Yes, I believe.

You are new to us, I think, Mr Grosvenor. I do not think there is a sieve bend arrangement anywhere in - - You are thinking of its dewatering function but stream A is the 30 to 80 and there is no dewatering to be done,is there, with stream A, when it has come off the first screen? There it is on the belt?---But you are going to put more water on it on the preparation screens.

Yes; the preparation screens certainly, but the only thing that is going to happen to stream A is that it is going to go down the belts, go into the surge bin where you have said no beneficiation takes place?---That is right.

Comes out onto the preparation screen, fines washed off or adhering particles whether fines or clays or whatever, into that drum?---Yes.

The less of those fines that there are at that point the better? ---Yes.

Back at that first screen there was washed off from stream A - not all, but you would expect a goodly proportion of the contaminants attaching to it?---If the screening is doing its job it should have separated the particles.

We will come to terminology later but, if the correct thing is being done on the screen, stream A will have lost a good proportion of its contaminants?---Yes.

And as far as stream A is concerned, its mass will be less by the amount of those clays and fines?---There will be less in stream A.

MR HULME: Less as it goes off the screen as stream A than those lumps were when they came down with their adhering fines and clays and whatever? ---Yes.

There will be a reduction in volume and the - --

MR HULME (Continuing): - - - and the typical, Pilbara conduct will be that those lumps will be of higher quality than what they have lost?---If they are iron ore. If they are shale they will not be.

Yes, but there is some iron ore there, is there not?---Yes.

The chemical analysis of it as it goes away will be superior to the chemical analysis of those lumps as they came on?---Theoretically, yes.

And practically?---If it has cleaned the fines away and the fines are low-grade, yes.

If lump is high and fines are low the analysis will be higher. As far as stream A is concerned, therefore, it has lost part of its content - clays and fines?---Yes.

Its content, therefore, is smaller than it was?---Yes.

Its chemical analysis is higher because you have, as far as the iron ore components are concerned, kept the good - the better - and you have sent away the poorer? You have sent away the fines and clays. Two things will have happened, will they not? Your iron content will be up and your alumina and silica content will tend to be down?---If you assume they are in the fines, yes.

Yes, and that they were, in particular, in the clays?---Yes.

So at that point we have a process which reduces the mass of the stream and raises its chemical analysis by sending away components which have a lower chemical analysis?---Yes.

You forget this contract. That is beneficiation, is it not? ---If we just confine it to that very little point where you have a better stream and a poorer stream and theoretically throwing the poorer stream away, you have beneficiated the top ore. Wet screening will do this.

Yes, stream A (I am not saying anything about the others at the moment) - what has happened to stream A is within the definition of yourself and the Department of Mines of the United States?---Yes.

You would both say it was beneficiating. I suppose you never can finish a process of beneficiation altogether? Commercially, you put a stop on it at some point? ---Yes.

If someone said "Could you make this thing wash more cleanly? - something of that sort - "Yes", you could. If you

spent enough money and had enough time you could probably make something work better, in almost any process. Is that right?---Yes.

MR HULME: In this kind of field?---Yes.

The question is this: At what point does commercial, common sense dictate that expenditure stop and the process stop? You might improve screening by making it 100 yards long instead of 15 feet long?---Yes.

But you would not be able to stay in the business if you tried it. It is a matter of commercial compromise, engineering compromise, to decide how far to take any of these processes?---Yes.

With beneficiation you do not say that something has not been beneficiated because it could have been beneficiated more, do you?---Not in that terminology, no.

The fact that food is undercooked does not mean it has not been cooked at all, does it?---That is true.

And beneficiation is the same. You can stop a process of beneficiation when you might in other circumstances have gone further, and you can stop it for whatever reason and if you are asked "Is what has happened to that up to this point - - -"

MR HULME (Continuing): "- - - this point to be described as beneficiation?", then "Yes"; to that extent you have beneficiated it?---Yes.

Of course in the iron ore situation you are aware, are you not, of the blending operations? It is a continual process of trying to blend the ores in the stockpiles so that you will get as near as possible to the terms of your sales contracts at whatever limits they happen to be?---That is true.

So if you have not beneficiated a stream of ore as much as you might have, it will give you that much less blending power when it comes down to the stockpile? ---It will give you less of the component that you - -

Less component; less opportunity to use up other low grade component than you would have had had you taken that one up higher?---That is an assumption, yes.

But that is part of the ordinary events in the running of a mine and the blending of ores?---Yes.

Would you look at Mr Booth's affidavit, please? Would you go to para.20? (It is Vol.2, part 5.) You see the statement there, Mr Grosvenor - that it is important to provide "a competent, clean, carefully sized feed material". It is at p.7?---Yes. I see it.

On the assumption that it is a technical term, can you tell us what "competent" means? Is that a technical term with which you are familiar in this context? ---I would know what "competent" means, yes.

Can you help to bring me into that class? Can you help me to understand?---It is solid; I would say "competent", meaning a solid piece of carefully cleaned sized material.

"Clean" puts it as a different word, so if you had two pieces sticking together with a piece of clay that would be not competent. If the clay broke and they were separate, solid pieces they would be competent pieces?---Yes.

Clean will - if we stick with stream A it is easier to visualise - be mainly a matter of clays and fines?---Yes.

There is shale in the feed but that is not what is being talked of so much under the word "clean", is it? ---If the shale would have anything on it it would not be clean. It has to be clean also.

MR HULME: The shale itself could be dirty?---That is it.

In a drum where we are putting pieces in from 30 to 80, if you dropped in a piece of 90 would that matter?---No, not in that context - - -

A247. 12.51

WITNESS (Continuing): - - - that context, no.

MR HULME: It is easy enough to understand how fines matter but how important is it that pieces be within that limit of 30/80 and not 90 or a piece of 100mm? One would expect it to fall through and behave like a piece of the 80?---Yes.

So is sizing, in fact, so important at that upper end?---Not at the upper end but the lower end, yes.

I am glad because I could not see how it was. Down at the lower end at what point does it become important in that stream which we are doing separately at 30/80? Have you been up to Mount Newman?----No, I have not.

Are there not places where drums operate over a larger range than 30 to 80?---I understand that.

Pardon?---I understand that there are drums that range larger.

It would not matter if a piece of 10 or 20 was in the 30 to 80, would it?---It becomes a matter of the consistency of what you are trying to maintain in that drum. If you have too many fines then it is going to upset the consistency that you are trying to reach in that drum and, therefore, the finer ranges do affect.

I follow that. All of this, of course, will have been screened at the preparatory screens to try and get rid of fines. I am talking of 10 up, or 6 up if you like, but I am eliminating as much as possible of the under-6s. However, from there up where we are talking of lump ore, is there anything, in your view, magic about 6 to 30 and 30 to 80?---They are not magic except in the range in which you are trying to operate that drum, that particular drum.

It would be right to say then, would it not, that in those drums, if one was saying, "Which is the more important here?" the kind of sizes we have been talking about, 90s or 10s or 20s, fines out but 10s, 20s or 90s, 100s, cleanliness is much more important than the accuracy of those size distinctions?---No - -

By cleanliness I mean by fines - -

MR SHER: Let him answer; you are continually cutting him off.

MR HULME: I cut him off because I had not made my question plain. I am saying by cleanliness I mean the clays and fines.

WITNESS: It would depend entirely on the amount of this material and when you start putting the lower sizes, a lot of them,

in a drum, you are going to upset the balance that you are trying to maintain in that drum.

MR HULME: That balance being adjusted in accordance with the feed that you expect?---That you have designed it to receive.

Designed the drum for or designed the particular feed for?---The amount of ferro-silicon and the workings of that. The drum is just a drum.

So that if you put into the drum feed of a quality of size significantly different from what you planned for the day's batch, it will not work as well?---Theoretically that is correct. It was designed for a specific purpose.

Of course, cleanliness remains important all the time?---Yes.

It is both wasteful in itself, good fines can go in the wrong direction?---Yes.

And it interferes with the operation, it interferes with viscosity and spoils the general operation of the drum?---Yes, it could.

LUNCHEON ADJOURNMENT

D57B. 2.15

UPON RESUMPTION:

OLNEY J: Yes?

MR HULME: Mr Grosvenor, I just wanted to look for a moment about what you say about screening in para.8 of your affidavit. We have heard a lot about apertures and one thing and another in connection with sieve bends. You say that the basic concept is presenting the material to apertures?---Yes.

If, for instance, you had a small boy working in a packing shed near an orchard picking out undersized apples as they came past on a belt he would be a sizing device, would he not?---Yes.

He would not be a screening device. Right?---He would be sizing.

He would not be screening?---Not in the terms of an aperture.

And the terms you have here are the terms you think right? ---Yes.

So a distinction is to be drawn between sizing devices, which is a larger class, of which screening devices are one, or screens are a sizing device. There are other sizing devices?---Yes.

If you look at what Mr Gaudin says - exhibit 9 AJL 2 - at pp.8 to 9 - - this is a book you cite elsewhere I think, is it not?---Yes.

He says at the bottom of p.8:

> "Sizing is the separation of a material into products characterised by difference in size."

Do you agree with that?---Yes.

That is something that my boy in the packing shed is doing?---Yes.

He goes on:

> "This can be accomplished by screening or by classifying, the latter being ....(reads)....generally water or air."

Do you agree with that distinction?---Yes.

Also, if you are to screen then it is necessary, is it not, to prepare for choice by the screen when presented to the apertures the particles you wish to size through the screen?---Not necessarily. Prepare them for a screen?

MR HULME: You have to bring them to the screen?---Yes.

If, for instance, you wish to have a piece of rock and screen it in small sizes, then you will first need to crush it?---Yes.

So that you can bring into existence and proffer to the screen the particles it is to size?---Yes.

If you are sizing pearls it is no good putting through oysters. You have to open the oysters, get the pearl out, and present it with the particle you are trying to size - - -

MR HULME (Continuing): - - - to size on the screen?--- If it is pearls you are trying to size, you would have to put pearls on the screen.

That is right. There is one other general matter. If you were asked to draw a flow chart of the beneficiation process at Tom Price - you know the kind of flow chart to which I am referring?---Yes.

That would start, would it not, with the ore coming in from the grizzly? Do you wish to look at the plan behind you?---Yes.

That is where the process of beneficiation - - where your chart would start, the incoming stream?---The reduction of the ore to be presented through the plant. That is the first step.

Yes, it is at that point that you say "There is some ore going elsewhere - the over 200s. Here is the concentrator stream come in." That would be the ore which your chart would course?---You have made a separation. You have taken the good iron ore away at this point in the Tom Price plant. You are taking the oversize, which is good iron, away, and you have a product which you have sent to a surge pile.

That is the product which is going to go through the beneficiation plant?---That or part of it, yes.

That is where your chart of the beneficiation process would start?---That would be the feed to the plant.

Yes. You would then seek to ensure that your chart showed what happened to that feed from then on until the end, after the drums?---Yes.

That would be a chart delineating the process of beneficiation of that ore?---To represent it, yes.

The things done to that ore during that process would be steps in the process of beneficiating that ore?---Yes.

We seem then to run into a difficulty and I wish to see whether it is substantive or just terminology. We have the ore, having gone through the scalping screens and then coming in to - - I pick it up when it is coming in towards the screens, the wet screens which have been talked about. It comes down the pulping box?--- Comes down the wet feeder chute, yes.

We know the device to which we are referring. I will not be saying to his Honour later you agreed it was a pulping box - - -

MR HULME (Continuing): - - - a pulping box. It comes down that device?---Yes.

It gets tipped in there and water put onto it?---Yes.

Once that is done it is apparent watching it, is it not, that changes take place in that feed?---Many changes take place.

And those changes start when it gets hit with water in the pulping box, in that device?---To some degree, yes.

That is the starting point?---That is where water is applied to the feed, yes.

That is the starting point to this series of changes that the water brings about?---Yes.

The longest journey begins with a single step, does it not, and that is the first step?---Yes.

In your para.15 you say:

> "No beneficiation or other treatment except screening takes place in the chute or at the wet screens in the screen house."

WITNESS: Yes.

MR HULME: Changes have started in the chute and are taking place on those screens?---Yes, the matter of wet screening.

You are not differing from anybody else as to whether those things are happening. You are differing, if there are differences, as to what it is called?---Yes.

Can I just pick up one thing that puzzles me? You say in para.16:

> "No beneficiation or other treatment takes place in the surge bins after the screening in the screen house."

WITNESS: Yes.

MR HULME: You have read Mr Booth's affidavit, no doubt?---Yes, I have.

You are aware that Mr Booth says in para.14:

> "Where the contaminant material is softer than the ore and will reduce in size with handling or when wetted ....(reads)....can contribute significantly to this breakdown."

Are you differing from Mr Booth on what happens in there or what you call it?---What I call it.

MR HULME: It is breaking down in there?---It could possibly be.

Under the effect of the moisture? You are looking at the retention bin or the surge bin on this basis, that just as much comes out at the bottom as went in at the top?---Yes.

Therefore, the chemical analysis overall must be the same?---Yes.

Therefore, on your definition of change in chemical analysis by elimination of rubbish, the retention bin has not done that?---It has not done that.

Is it that that is at the heart of the difference as to what is being said as to the retention bins?

MR SHER: There is no difference as to what has been said on the retention bin. I object to the question.

MR HULME: An apparent difference.

MR SHER: There is no apparent difference either, with respect, your Honour. The witness is talking about two different things. Just to make it clear, what Mr Grosvenor said - -

MR HULME: My learned friend has made his objection; I have withdrawn the question - - -

MR HULME (Continuing): - - - the question.

MR SHER: Then I will not say any more.

MR HULME (TO WITNESS): You accept that the breakdown process that began in the pulping box or the chute or the device is still taking place all the way along and, in particular, in the retention bin?

MR SHER: I think, with respect, that that question also is objectionable because it overstates the position. I do not apprehend this witness has said at any stage that the breakdown commences in the chute. That is an assumption my learned friend has made, your Honour.

OLNEY J: He said that changes take place.

MR SHER: Yes, but he certainly has not said that breakdown occurs, your Honour, and that might be a significant difference.

OLNEY J: Perhaps he should be asked whether the changes include breakdown.

MR HULME (TO WITNESS): You have said that the beginning of change is in the chute when the ore is wet?---It is wet. That is one of the changes.

Pardon?---The change is that it is wet.

Yes, and at that point, immediately it is wet, the breaking down of the clays commences, does it not?---If they were thoroughly wetted or in water as Dr Batterham showed.

If they are thoroughly wetted in the vertical device, that is where the breakdown starts?---I do not believe that they are thoroughly wetted in the wet chute.

There are two things there. Why must it be "thoroughly wetted" before breakdown will start?---If we put just a small amount of water on it, that is one thing. If we submerge it in water, that would be another.

You know it is hit with a considerable volume of water at 70 pounds psi?

MR SHER: I object to that question. There is no evidence that it is hit by 70 pounds psi at all. There is pure speculation on the part of a witness, I think Dr Batterham.

OLNEY J: I do not think any evidence has been given as to pressure.

MR HULME: It was given.

MR SHER: It was not given. There was some speculation as to what it was. There is actual, hard evidence as to what it is and it is not 70 pounds psi.

MR HULME: I will stand firm on Dr Batterham. You will remember he was originally in Pascals and then he said it would be approximately 70 pounds psi, and he gave that evidence.

MR SHER: Can you show us the transcript?

MR HULME (TO WITNESS): In the pulping box, have you seen the water coming onto the - -?---Yes, I have seen the inside of the pulping box without anything in it and I have seen the water coming into the pulping box.

At 91 cubic feet per hour?

MR SHER: There was no evidence given by - -

MR HULME: There - -

MR SHER: Pardon me, Mr Hulme, I am making an objection. There is no evidence as to what in fact happens in this pulping box in relation to water quantity and pressure from any witness so far called. If my learned friend says there is, I would respectfully suggest he shows us in the transcript. There is some speculation by Dr Batterham. There is absolutely no hard, authoritative evidence at all, we would submit.

OLNEY J: Yes, I was much of that view, but maybe we can put our finger on it.

MR HULME: This witness's exhibit NEG1 says "91 cubic metres per hour" is the feed rate.

OLNEY J: The feed rate - right.

MR HULME: That is what it says and it is this witness's own evidence.

MR SHER: It is not his evidence. He has exhibited a copy of a letter from Mr Hulme's client.

MR HULME: All right. He has put it in as an exhibit to his affidavit.

OLNEY J: At least this witness believes it to be 91 cubic feet per minute.

MR HULME (TO WITNESS): You believe that a considerable amount of water at a considerable pressure is put onto the feed in that pulping box or feed chute?---Yes.

You believe that the reaction with the clay starts immediately upon the water hitting that clay?---That is a matter of time.

What do you mean it is a matter of time?---The water strikes the falling column and is in contact with it for quarter of a second, approximately, as has been stated before - - -

WITNESS (Continuing): - - - stated before and it reaches the bottom of the box and the water is immediately drained away from it. It is not still in the water such as Dr Batterham showed. The water is drained away immediately.

MR HULME: Has water hit the substance?---The water has hit the stream of ore and I am not positive that all of the particles in that stream have been wetted by water.

I am not asking you whether you are positive that all the particles have been wetted. I am asking you whether you are positive that none of the articles have been wetted.

MR SHER: I object to that question. I object, Mr Hulme, and I would be grateful if you would sit down while I make my objection clear. My objection is that the witness is being asked to assume that all the items in the chute are wetted by this stream. What he has made clear is that he is not satisfied of that, and for my learned friend to put it that he has to be satisfied, as it were,that the onus is on him when questions are being asked by Mr Hulme, is to reverse the roles. My learned friend is seeking to have the witness, as it were, displace a presumption, a presumption which has never been put in place. It is not for the witness to say what does not happen. Mr Hulme, in his question, has assumed that something does; the witness is saying he does not make that assumption.

MR HULME (TO WITNESS): Mr Grosvenor, do you believe that all of that ore is dry when it reaches the bottom of the pulping box? ---I do not know.

You do not know?---No, I do not know.

You have seen the pulping box?---I have not seen the bottom of that wet feeder chute in action.

You have seen the water?---I have seenthe water coming in the side of the wet feeder chute, yes.

You have seen the ore falling through the water?---Yes.

Do you believe that all that ore is dry when it hits the bottom of the box?---I do not believe that all that ore is dry when it hits the bottom of the box.

Do you believe that ore gets wet in that box?---I do not know whether it all gets wet at the bottom of that box.

OLNEY J: You said "all" and not "ore"?---He said "all of it".

MR HULME: No, I am sorry. It may be the difference between r's and l's. Do you believe that ore gets wet in that pulping box?---Yes. Ore does get wet in that pulping box.

And upon getting wet, having water on it, a process of change will start?---The ore - probably not to any great extent.

Clay?---The clays, possibly.

Certain clays have a considerable affinity with water, do they not?---Yes.

And react with it quite quickly?---Yes; it is a matter of relative what you call quickly.

That process involved with the affinity that it has with water I suggest to you starts upon it being wet?---Yes, but my problem is that I have not seen these clays except when Dr Batterham picked them out of a bag and put them in a glass of water. I did not see them in the plant and I asked about them and I looked for them.

That is a matter that will be dealt with elsewhere. To the extent that there are water-responsive clays which are hit by water in that box, the process of change will start - - -

MR HULME (Continuing): - - - will start?---Yes; if water is applied to clay particles.

OLNEY J: Mr Hulme, you were quite right about the pressure. Dr Batterham did say at 479-480 that the pressure was of the order of 70 pounds per square inch.

MR SHER: Could I just address your Honour on that question?

MR HULME: With respect, why in the middle of my cross-examination?

OLNEY J: I do not know whether it is relevant now because I thought the question was withdrawn earlier.

MR SHER: What I would want to point out to your Honour is that that approximation is based upon what the witness said earlier. What the witness said earlier was that in the middle of the previous paragraph the pressure is, from memory and allowing for the fact that it is from memory, of the order of 450 pascals or kilopascals. He then went to talk about the number of times that was in relation to the pressure of a Melbourne garden hose. Then, on that basis, he said, "It is of the order of 70 pounds" which is in my submission, your Honour, no more than a guess on the witness's part and certainly not authoritative.

OLNEY J: I think it is evidence that the water is pumped at, he said earlier, high pressure. He has had the opportunity of observing it. He described it as several atmospheres.

MR SHER: Yes. I merely want to make it clear that in putting to the witness that the evidence is that the pressure was in fact 70 pounds, that was no more than a guess based on memory and a conversion by Dr Batterham, but there is no evidence of the actual pressure. It may be important to the witness.

OLNEY J: Very well.

MR HULME: I will not respond to that, sir, because it is not relevant to any question we are presently being asked.

OLNEY J: I only brought it up because I had expressed wrongly a view of the evidence, or what had been said.

MR HULME: Mr Grosvenor, we have then a process of change which commences upon such substances being struck with water in the pulping box?---In the wet feeder chute, yes.

Yes. It is that process of reaction which continues while the ore is wet, including in the retention - -?---Yes. It will be the amount of water which would affect the rate.

MR HULME: Yes. Of course it will. Indeed, more water of course is added as regards stream A on those wet screens?---Yes. They are in the form of sprays. They hit the particles and immediately it is drained off. Then it is hit again and it is immediately drained off.

Then stream A goes away and into the bin, then up to the preparatory bins to the drums?---Yes - search bin for the drums.

The spraying there is of the same kind, is it not? It is sprayed on and comes off?---Yes.

So the two places where the removal from stream A takes place are on that first screen and on the preparatory screen?---Yes.

They are the removal points. The process has been continuing throughout of the reaction of the material to the water?---Yes.

You would say that the beneficiation does take place at the screens and does not take place in the bin because at the screens the contaminates and other fines are removed, whereas in the bin they may become detached but they stay in the composite mass?---Yes.

With the ore fines I suppose it is not - - -

MR HULME (Continuing): - - - not a chemical process of that kind. It is a physical process of separating them - stopping them adhering to each other?---Yes.

The use of water for that purpose is a process of either washing or scrubbing according to one's definition, is it not?---It is a cleaning process by definition.

That process starts likewise in thepulping box, does it not, when the water hits a lump of ore and washes a fine off?---It just washes the fine off if it hits that particular piece, yes.

Some call it washing, others call it scrubbing and you call it cleaning. It starts again in the pulping box? ---In the feeder chute, yes.

Yes, the feeder chute - and continues subsequently. As I take it, what you are saying in para.12 is that is all still termed wet screening?---Yes.

The washing may be the primary purpose of the wet screening installation?---The cleaning of the particles may be the primary purpose?

I was quotingyour words and I will have to ask you. You say about eight lines up from the bottom of 12, "Depending on the particular application, washing may be the primary purpose of a wet screening installation or may be merely incidental"?---Yes.

Do you mean there what you are calling "cleaning"?---Yes.

And what others call "washing"?---Yes, I would imagine.

Or, as you say, the cleaning may be merely incidental?---Yes.

Here, of course, the cleaning is very important, is it not?---Yes.

But no matter how important that cleaning is, you would say the process is still termed wet screening?---Yes.

If someone said to you that a process of washing was taking place, that would be right, would it not?---If somebody told me that a process, "the" process, of washing was taking place, I would think of more scrubbing and washing and so on than just cleaning, yes.

Assume you have a screen and the primary purpose of the wet-screening installation is washing. Do you follow me?---Yes.

You would in that kind of situation admit, would you not, that a process or operation of washing was taking place?---Yes.

If that is the primary purpose and it is not taking place something has gone wrong?---Yes.

MR HULME: Indeed, here you say the washing is an important part of what is taking place?---Yes.

But you say no matter how important it is, no matter that I have built it for this purpose - - -

MR HULME (Continuing): - - - purpose I call it wet screening? ---Yes.

Can you understand other people saying "True it is it on a screen but the primary thing that is happening is washing and it is a process of washing"?---I do not understand the question.

If someone said to you "What is happening here?" I take it you would say, "Wet screening"?---Yes.

If someone else said, "What is happening here? I am going to look at the essential, the primary purpose. Washing is happening here" that would be a sensible thing to say, would it not?---It may be if the primary design was to wash on a wet screen and they consider washing to be the primary purpose they may say that they were washing on the screen.

I notice if one looks at the Minnesota Mining Bulletin, which is exhibit 23ECH 2 - - this you will see is an out-of-date copy, for reasons particular to this case. It is the 1963 edition. Do you notice that?---1963?

Yes. I just draw your attention to it in case anything has changed. It is 20 years old. If one looks at the type of plant given I think I am right in saying, am I not, that wet screening does not appear anywhere? ---I believe it refers to screening.

When we come down from the A's we have his arcturus washing Eigh D. What does high D mean?---Heavy density.

Heavy density, spirals and cyclones. Bennett, crushing, washing, high density?---Yes.

Cannisteo, washing, and high density?---Yes.

Coons-Pacific, crushing, washing, jigging, high density?---Yes.

Danube, washing, crushing, high density?---Yes.

No plant in that list as far as I can see - not one - says wet screening but a number say washing?---Yes.

Is this bulletin - - -

MR HULME (Continuing): - - - bulletin of the University of Minnesota a publication you are familiar with?---I know of it, yes.

Minnesota being the state, of course, in which is the Mesabi Range, or part of it anyway?---Yes.

Does that suggest to you that a number of people in the United States describe as washing a process that you call wet screening?---No.

Does it suggest then that no plant in the Mesabi Range has the kind of arrangements that are found at Tom Price? ---I did not say that.

No; I am saying does it follow?---It does not say that; it does not indicate that. May I say what washing indicates?

Yes?---Let us just take the one that says "Washing and high density", the fourth item on the list. That does not tell me that that is only a wet screen. That may be a log washer. It may be a scrubber. It may be any other unit to thoroughly mix the material. It says that that is a wash ore. You must wash the silica out. It does not say it is just a wet screen.

So what they are doing here is not saying so much what item of equipment they use but what they are doing?---It appears that is what they are saying.

And what they are doing, they say repeatedly, is washing?---Yes, washing the ore.

There might be scrubbers, there might be washers, there might be screens. They are not bothering about that. The important thing is, they are washing?---Yes.

OLNEY J: Could you comment on a couple? One is Rouchleau, about five from the bottom on p.257, where it talks about crushing, screening and sizing. Again at the top of the next page there is crushing, screening and sizing. Is that not an unusual combination, screening and sizing as separate operations?---As it appears here they are sizing to a specific size to send. They screen oversize, they screen undersize, they size to a certain point for shipment, either plus quarter or minus quarter.

So that would be done as a separate operation from the screening? ---It could be.

MR HULME: Can I show you a book, part of which is an exhibit to exhibit 23, called The Economic Aspects of Iron Ore Preparation prepared by the Secretariat of the Economic Commission for Europe?

TO HIS HONOUR: Your Honour will remember we looked at some of the pages yesterday. We had meant to put in p.270 but forgot.
TO WITNESS: Do you see that book, Mr Grosvenor, put out by the United Nations - - -

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MR HULME (Continuing): - - - United Nations concerning iron ore. Have a look at the cover and satisfy yourself just what it is?---Yes.

Do you see table 184 on p.270, a list of beneficiation plants on the Mesabi Range in 1963?---Yes, I see the table.

The first five saying "washing"?---Yes.

And, indeed, not all but almost all of them saying "washing"? ---Yes.

There is reference, frequent reference, is there not, to the end units involved - for instance where you get things like "washing, high density, spirals, cyclones"? Do you see that for Arcturus?---Yes.

Canisteo, washing and high density; Mesabi Chief, washing, high density, hydrosizer. In not one instance do we get told where the washing takes place. Look and satisfy yourself as to that?---Yes.

The important thing is that it is washing?---Yes.

It does not have scrubbers or washers or wet screens. It just, in those instances, says "washing" and then tells you what it does after that. That again, would you agree, is in line with what we see in the Minnesota Mining Bulletin; that people are looking to the important thing that happens rather than where or in what piece of equipment it happens? ---It also designates the type of ore as well. If it does not have the washing in it, just crushing or screening, it would be one type of ore; if it had washing in it, it would tell you on the range that you must wash something away from it.

That is right. Washing tells you that instantly - that you have to get rid of rubbish of one kind or another? There is something to be got rid of?---Not during the washing process. The washing is the process in which they mix it all up and then later, if it is on a screen, you must separate it and wash it off; but with a true washer it is all in the machiner.

Yes, but as you say you would not know with these whether they are talking of scrubbers or washers?---No, I would not.

What you do know is that the ore gets washed?---Yes.

That is the key fact, that it gets washed.

Your Honour, can I hand up p.270 separately?

OLNEY J: Is that a page from the same publication as exhibit ECH3?

MR HULME: Yes.

EXHIBIT EXHIBIT 31 .... Page 270 from United Nations publication, "Economic Aspects of Iron Ore Preparation".

MR HULME: From the viewpoint of a screen as a screen in its function of letting particles through - - do you follow me? You were saying earlier that the basic concept of screening is presenting particles to apertures?---Yes.

From the viewpoint of the screen in that capacity being offered a particle and accepting it or rejecting it, a funny thing happens when you wash like this, does it not, which is this: You have a piece of ore, a big piece of ore, a piece the size of a fist. It is not going to go through the aperture. It hits an aperture. The screen says "No" and it goes away. However, as the washing function takes place, there is not one piece of iron ore, that is not the whole story; there is now a loose fine or a piece of clay coming off. We have two particles or three particles to be presented to apertures instead of just one?---Basically, if you say iron ore, a chunk of iron ore that is dirty with some stuff on it, you are washing the fine stuff off and putting it through the holes, yes.

You are creating more particles all the time to be offered then to the screen?---Yes.

The ore, of course, is all uneven shapes and sizes?---Yes.

The sizes of the piece of ore that the apertures are concerned with are kind of the exterior dimensions, are they not?---Yes.

Let us say you had a piece of ore of a certain size with a small hole in it and a piece of clay in that hole: From the point of view of the screen that piece of ore is the same size whether that piece of clay is in that hole or not from the point of view of the screen?---Yes.

The mass will be different but the dimensions the screen is interested in will be identical?---Yes.

Once that piece of clay or part of it comes out of that hole it becomes a separate particle and one that the screen might well quite happily take?---Yes.

Which would not have been presented to an aperture but for the fact that it had been washed off the piece of ore?---Or out of. You mentioned a hole.

Yes. I took one - it could be inside corners, anywhere; but it is when it comes in, takes its separate phsyical existence, that it can then be offered to the aperture as a separate,competent particle?---Yes.

MR HULME: You say in para. 13 that the wet screening, whether for sizing or washing, was wellknown in the processing of iron ore in 1962 as was pre-wetting the ore before it reached the screens.

MR HULME (Continuing): Your experience has not previously brought you to this country?---No, that is correct.

The countries with which your firm interests itself,in relation to iron ore at any rate, do not include this country? ---No.

The clients do include the Electricity Trust of South Australia. I thought there was some Australian mentioned but that is not you and it is not iron ore?---It is not iron ore.

Do I take it that you would not be putting yourself forward as able to say what was or was not well known in the process of iron ore in this country in 1962?---I am not putting myself forward as knowing what was - -

And similarly with pre-wetting the ore before it reached the screens; as far as you are concerned, you simply do not know, for this country?---For this country I do not know.

We have looked at 15 and 16. We looked at 18 earlier; this is the actual separation point. Can I just go back for a moment to para.12? You have adopted large slabs from Taggart here. I take it you regard that as a work of authority?---Taggart was the book I used when I took mineral dressing.

A book you have looked at since or you have remembered it terribly well. Your second sentence is, in fact, straight Taggart, is it not, from para.1008 of Taggart? ---It could be.

Your fifth sentence also from "A washing screen" down to "Confined splash" is straight out of Taggart so it is a book you continue to - -?---Use; yes.

Do you take your meaning of washing to be the same - Taggart seemed more to say that washing is the carrying away of something, I had assumed, already separated. You use cleaning to include the act of taking off and then of throwing away?---Yes, I believe so.

That is your usage?---I think so.

Paragraph 17 and the preparation screens we had mentioned in the course of discussion: This is basically the removal from causes that have happened since the screens? Would you say what is coming off at these preparation screens, the effect of water and of dumping into the surge bin and of coming out of the surge bin, the exchange points between belts we have seen pictures of - - Have you seen those photographs - - -

MR HULME (Continuing): - - - those photographs?---I have seen the photographs.

That is the kind of thing you would expect - that it comes out clean and as it goes along it gets slightly dirtier and dirtier in appearance?---At transfer points, moving through the surge bin, wherever it might drop, you might get some chips.

Yes, pieces of clay can come off and clean-faced ore can roll in the clay as you move from one belt to another? ---We hope we have cleaned the clay off, I suppose, on the upper sizers.

We have something there, have we not, that is making things dirty still?---Yes.

You would agree with Dr Batterham, would you not, that you cannot measure it from photographs but you can get an indication of the qualitative change taking place? ---You can see it on photographs taken at certain times.

That, of course, reflects among other things the continuing effect of water and the rubbing and the bouncing and all the other forces taking place?---If they fall in the category of movement and so on, yes, these would be the pieces that you would see.

They then get taken off at the preparation screen because we do not want them in the drums?---That is correct.

The kind of cleaning to which you have referred would be treatment within your broad sense in para.6, would it not? Have a look at para.6? You have a broad sense and a narrow sense. "The subjecting of the ore to a physical or chemical action with the object of bringing about a result." That is a very broad definition?---Yes.

And would seem to include the process of cleaning to which you refer?---Yes.

It would not be treatment, would it, in any of your narrow senses? ---It would not include anything like pelletising refining.

It might form part of a treatment, depending on what you are doing? ---Yes.

When you confine it, as you seem to here, to some particular form of treatment, such as pelletising, is what you are saying there that sometimes you use it in a context where it can be seen that that is what you are referring to? Can I explain the kind of distinction I am making? You say treatment, in a sense, means pelletising, but you might say "Here is my pelletising plant. The treatment I give here is" - such-and-such - and we would know you were meaning the pelletising treatment?---Yes.

MR HULME: In relation to sieve bends, no doubt you have strong views here because they have apertures?---Yes.

If it is going to use apertures and have fines flowing away with the water then, in that sense, it is a screen?---Yes.

If the purpose of having it there ("there" being any particular place) is as a de-watering device immediately ahead of a vibrating screen, then it would be perfectly normal, would it not, to talk in terms of the screening being done on the vibrating screen and the draining being done in the sieve bend?---No. The sieve bend has a dual purpose - - - 10

WITNESS (Continuing): - - - dual purpose. If it is therefore de-watering the slurry, as Mr Herkenhoff referred to it, or the fine, in that slurry are the fine particles and you want them off as well at that point or on the preparatory screen, so therefore it is both a screen and a de-watering place.

MR HULME: You say there "if you want the fines off" so does one look at what it is that one primarily wants? If one says, "I am primarily trying to get rid of water. I know fines will go but I am primarily getting rid of water"?---In this particular case if I am getting water I am getting rid of the fine material because that is the purpose of the operation; the sieve bend and the screen are preparing the material to go into some process where you do not want it, therefore it is a part of the screening operation.

I see, and part of a drainage or de-watering operation?---Yes.

It depends what one is trying to do. There you say, "We are trying to do both" so it is both?---Yes, definitely.

Mechanical classifiers would seem to be, as far as you are concerned, a sizing device but not a screening device? ---It is a sizing device, yes. It performs essentially the same function as a screen.

It sizes?---It sizes.

It is a sizing device?---It is a classifier, yes. It classifies.

It may be performing a function which could be done by a screen?---Yes.

Or it may be performing a function which you would have liked to do with a screen but a suitable screen does not exist down at that size?---They did not exist when they started. That is why there are so many of them.

That was why they had them. They did not have screens in the small sizes, could not do it with screens, did not know how to do it with screens but could do it with a classifier?---Yes.

It is easy enough to understand someone saying, "It is essentially a screening device. It is doing what I would do with a screen if I had such a screen"?---Yes.

But it is not, in fact, a screen?---Physically, it is not a screen.

It is not a screen and physically it is not a screening device, whatever that is if it is not a screen?---If it takes a screen to make a screening device then it is not a

screening device. It essentially does the same function as a screen.

MR HULME: Yes. In those days it has the function that a screen would have if such screens existed. The classifier was used because the screen did not exist?---Yes.

You used the phrase earlier - I think we have it accurately - "pre-wetting for screening purposes". You used it before lunch?---I may have used that, yes.

There is rather a habit these days of putting "pre" before certain words. I do not know whether you have pre-owned motor cars, pre-loved and all this kind of thing. It is something that takes place before, is it not?---Yes.

So when we pre-wet something for screening purposes, we are wetting it before it comes to the screen?---Yes.

And that is the whole purpose and what you had in mind with that word, pre-wetting?---Yes.

RE-EXAMINED BY MR SHER QC:

MR SHER: I will run through a few matters on which I just want some clarification from you, Mr Grosvenor. We have seen photographs and you have been asked questions about this - I will call it degradation that occurs with this ore as it progresses through the beneficiation plant. You will recall the points that were being made; thatthis is said to have been as a result of the wetting, amongst other things. Do you recall that degradatior referred to?---Yes.

With high grade ore that is not wet at all and is just put through crushing and screening but conveyed on conveyor belts and dumped, goes around corners and the like - does that sort of ore go through a similar process of degradation; that is, bits breaking off it? ---Yes.

So, as between a dry and a wet process, you get this sort of degradation in both, do you?---Yes, absolutely.

I suddenly realised when Mr Hulme started to ask you about it that we had heard very little from anyone about the preparation screens and perhaps I should ask you something about them. In this plant, the preparation screens are, I take it, constructed so as feed comes on the preparation screens through a feeding device?---Yes.

Is water added to those or can you not recall?---I cannot recall but I would say yes; you want a further wash.

Is that feed to the preparation screens pre-wet like the other screens are pre-wet? If you cannot recall say so? ---I do not recall.

But certainly there would be water on the screens, I take it? ---Yes.

Is there anything basically different between the screening process that is going on on the preparation screens from the screening process that is going on on the first group of screens about which we have been talking? ---No. We just want to clean it off and screen any undersize off that will go through the apertures

and the oversize will go into the apparatus, whatever that one is.

MR SHER: When we look at this list that Mr Hulme took you to, this list put out by the University of Minnesota, and washing is there referred to, washing strictly called in the American system - what sort of equipment would you normally expect to find involved in washing? ---I would expect a unit such as the log washer or scrubber or some specific unit that actually washed the material, tumbled it for a certain length of time, maybe minutes, with the addition of water to have in the unit so that you have every side of the piece of material exposed to a water stream and so on and so forth. That is what I would expect.

You were in court when I put to othe witnesses some of these extracts from publications showing washers and scrubbers. They are quite separate machines from wet screens?---Yes.

Are you referring to that sort of machinery?---That is what I am referring to.

What do you regard the feed chute is doing to this feed as it goes in and it is hit by the sprays, gets turned into a slurry and goes onto the wet screen? What doyou say is essentially happening with that water there? ---You are trying to wet the ores that drop down the chute. You are trying to apply water to it so that - - On wet screening you must have sufficient water - - -

WITNESS (Continuing): - - - water to do the job on a wet screen; therefore it is a part of the first step in wetting the ore so you can further wet it on the screen and do a better job.

MR SHER: What is the primary purpose, then, of the wetting of the ore in that feed chute?---It is so that it will become very wet, if you can get it that way, if you can possibly get it wet, so that as it does its function of wet screening then it will do it to its best ability.

So it is wetting that you are doing?---It is wetting.

Then correct me if I am wrong but it seems to me as a matter of logic, and I want your comment on this, that if you wet something by putting it through a screen of water, a spray of water, then it drops and goes onto another device where water then pours all over it through other sprays from then on, when it is wet the second time, how do you distinguish between the wetting the first time and the wetting the second time?---You do not.

In the industry, does anyone do that?---Distinguish between the first and second?

Yes?---No.

Do you find people like yourself and Mr Beukema and Mr Herkenhoff, and so far as you have been out of the USA and spoken to other people in Australia-- do you find them going around talking about the effect of the first wetting as opposed to the second wetting in the split second that it passed through a spray? Is that how people in the industry talk?---No, not to my knowledge.

The sort of division of processes about which Mr Hulme has been asking you and putting to witnesses in this court; is that the way people normally talk in the iron ore processing industry?---Not to my knowledge.

Just two other matters. Mr Hulme showed you - and we got into a little bit of a contretemps but barristers are prone to do that, particularly after a few days in court - about this chart on p.16 in this Hamersley publication. Do you have that there with you - p.16?---Yes.

As I understand your evidence, correct me if I am wrong, you were telling his Honour, after I interrupted - I want you to make it clear whether or not you were telling him because I interrupted or whether it is the fact - that that yellow part we see under the words "HM Cyclone Plant" and leading up to "Feed

from wet screening and the product screens" and leading right across to what is the No.2 blending stockpile; as you understand it, were they constructed at the same time as the rest of the beneficiation plant?---To my knowledge they were put in when the plant was built as a unit, yes.

MR SHER: Yes; but they are shown there in yellow as, in effect, indicating that whatever goes on those conveyor belts is not going otherwise through the concentration plant?---It indicates that at some point in that plant you could take material directly right off to the stockpile.

I tender that page if your Honour pleases - p.16.

MR HULME: I meant to. I am sorry.

MR SHER: It is all right, it is in now so we are both happy.

EXHIBIT EXHIBIT 32 .... Hamersley Iron Resources Technology Operations Booklet, p.16.

MR SHER: Finally, Mr Grosvenor, Mr Hulme touched on and asked you quite a number of questions about the importance of the size of the feed into the coarse drum, the 30 by 80?---Yes.

Most of the questions appeared to be directed towards the question of whether if it was a bit over 80 it would matter. The transcript will record what you say and you said it did matter in relation to the lower sizes, but how important is it to have it sized correctly at the lower end of the range - - -

MR SHER (Continuing): - - - the range? Forget about the upper end - down about the 30 size?---It is very important because the function of the drum, to be operated properly under a certain set of conditions, is programmed, so to speak, for certain sized material. If you start putting all small material in there, then the balance would not be the same. The end product would not be as efficient as you started out to do.

Just say you had lumps of mainly Fe - iron ore - which were under 30 and say 25 even, going into that drum. What would be likely to happen? Would they come out in the sinks or the floats?---Again, on the finer sizes, and he was talking down to 10, then it is possible they would come out as float and would not be carried out as a product that you want.

So you would lose them, would you?---You would probably lose them.

OLNEY J: Would you turn up p.16 again of that publication of the concentrator plant? Can you just indicate to me where the sieve bends are located on that plan?---In the lower, right-hand corner of the picture, in the wet-screening plant.

That includes what has been called the wet-feed chute, the wet screening and the sieve bends?---Yes, the wet-feed chute - - the material goes across a set of screens, down this way and goes across, and the very small material at the bottom is taken across right underneath to a lower deck and the sieve bends and screens are there and the separation is made from 6 to half and half to zero.

Just above that block of machinery, there is a thing called "product screens". That is a description which has not been used. What happens there?---One part of this goes to the coarse drums and the other goes to the medium drums, doing essentially the same thing.

Those product screens are called the "preparatory" screens?---No, they are not preparatory screens. Preparatory screens are just before, on the left-hand side of the blue; the preparatory screens are just as the material goes into the coarse ore drum. That is the coarse drum, medium drum.

So they do not get a special mention on the diagram?---No.

But the product screen is doing the same thing as the wet screen, is it?---I would read it that way on this drawing, but I am not sure.

Is that diagram up there any more help to you? It seems to be basically the same?---It is basically the same.

The material coming off the crushers at this point, the underflow or the material that has been crushed at this point is brought right over and right up into the bends and it is essentially the same.

MR SHER: If your Honour wishes someone who is absolutely confident that he understands the working of this plant (and I am not sure there are too many in this court) Mr Boughton, I think, knows exactly what happens.

OLNEY J: Good. I was going to ask if you had a witness who might.

MR SHER: Mr Boughton is the gentleman who put all those colours and arrows on that drawing and he will be called.

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OLNEY J: I will not press this witness any further then.

MR SHER: Yes; Mr Boughton, I think, does have a very detailed knowledge of it, your Honour.

WITNESS WITHDREW

MR SHER: My learned junior will call the next witness, your Honour.

PETER FORBES BOOTH, sworn:

EXAMINED BY MR HEEREY:

MR HEEREY: Mr Booth, what is your full name?---Peter Forbes Booth.

Where do you live?---At 72 Viking Road, Dalkeith.

What is your occupation?---Chartered engineering in the practice of consulting engineering.

(May Mr Booth be shown the two affidavits which have been filed in this matter, one sworn 27th October 1982 and one sworn 30th June 1983?) Will you look first at the affidavit sworn 27th October and I want to take you firstly to para.9 at the bottom of p.4?---Yes.

There is a sentence there which reads:

> "With the Pilbara ores crushing and screening can be used to upgrade ore either separately as part of the beneficiation process."

Is it clear to you that the word "or" not "ore" is omitted there from the last line on that page after the word "separately"?---Yes, that is an error.

Can I take you to para.1(c) of your affidavit on p.2? You set out the history of your involvement with the Mount Newman mine. We have heard that the mine first commenced production in 1969. Is that correct?---Yes.

That is, by 1969 the mine was producing ore and ore was being taken to the coast by rail. Is that correct?---Yes, the project was initiated in April 1969.

That, I take it, was a fairly well known and not concealed fact? ---I gather it was one of the world's finest opening ceremonies.

Anyway, your own involvement, as you have said, with Mount Newman commences in 1969 and then by 1971 you were appointed the project manager. It follows from that then that

the mine was already in operation by the time that you joined Mount Newman. Is that the case?---Yes, the initial construction phase was complete.

MR HEEREY: Did you intend to convey in that affidavit that you had been responsible for the design of mining plant literally right from the start?---Not at all.

From the time you did join Mount Newman up until the end of the 70s, did substantial expansion take place - - - 10

MR HEEREY (Continuing): - - - take place, both in the mine and plant operations, the township and the railway? ---Very major.

To give some idea of the expansion that took place, can you tell his Honour what, in terms of output per annum, was the output of the Mt Newman mine at the beginning of the 1970s, as against 1979?---When it was first opened, it was established with a capital investment to provide a production of about 6 million tonnes per annum. That is when I joined. A short time after joining I was finally made project manager and then I was responsible for the whole of the works, in all areas, to take it to a level of 40 million tonnes per annum. That was an increase from about 6 million tonnes per annum to 40 million tonnes per annum.

That increase, in fact, took place while you were responsible for, as you put it, the design and construction of the project?---Yes.

In terms of money invested, in broad terms what had been invested in this plant - in the mine, the plant, the railway, the town, etc. - when you arrived?---When I arrived it was about $170 million in a programme which was to take it approaching $200 million.

By the end of your period with Mt Newman, what was the total of the investment?---About one billion dollars.

Subject to that typographical omission on p.4 in para.9, and subject to the matters you have just explained to his Honour, in relation to para.1(c), is the affidavit that you have sworn on 27th October 1982 true and correct?---Yes, it is.

Do you hold the opinions that are expressed in that affidavit? ---Yes.

As to the second affidavit, the one sworn on 30th June 1983, are the matters to which you have deposed there true and correct?---Yes.

And do you hold the opinions, in so far as that affidavit holds opinions, there set out?---Yes.

I tender those two affidavits.

MR HULME: We must again object to what is said in para.4 of the first affidavit, and in the second affidavit, in line with what happened earlier, what must be the sheerest hearsay, I would think, as to Mr Beukema's "vast, personal experience of the Mesabi Range." That is para.2.

MR HEEREY: I do not press either of those matters, your Honour. No doubt we will hear from Mr Beukema in due course.

EXHIBITS	EXHIBIT 33	Affidavit of witness of 27th October 1982 (with exception of para.4)
	EXHIBIT 33	Affidavit of witness of 30th June 1983, with exhibits thereto.

OLNEY J: I will simply note that the passage referred to in para.2, to which Mr Hulme has referred, is obviously hearsay.

MR HEEREY: Just to clarify what was said about para.4 in the first affidavit, your Honour, I understand the objection to the words "as used in clause 9 of exhibit CRL1", and as I said we do not press that, but I did not understand the whole of the paragraph - - -

MR HEEREY (Continuing): - - - being objected to.

OLNEY J: I think that is how I understood it. The objection is to that part which relates those meanings or appears as though it is relating those meanings to the contract.

MR HEEREY:
With, as it were those deleted, the rest of it is still admissible and it stands, yes.
TO WITNESS: There has been some evidence in this case about water pressures, both in relation to the feeder chute at Tom Price and in relation to domestic garden hoses. What is the water pressure under which the domestic reticulation system is supplied in Perth? ---As I understand it in this metropolitan area the design pressure they aim for is about 24 pounds per square inch but what this means is that in practice the range is considerable. Where people are at the end of a reticulation line and when usage is high, pressure is dropped to about 8, and when you are at the bottom of a hill where you have additional head the pressures can approach 100 psi. So I am told the range is between something like 8 and 100 psi.

Depending on where you happen to be and where you are using your garden hose in Perth, the pressure of the water coming out of the hose could be as low as 8 and as high as 100?---That is possible, yes.

In the course of your work at Mount Newman were you involved in the planning of the township?---Yes.

Including the reticulated water supply?---Yes.

What was the pressure for that supply at the Mount Newman township?---We had a design standard which we followed and progressively used without significant change as I recall. That was somewhere in the range 55 to 65. I am not lacking precision here but these things are not precise. They vary with usage and conditions.

So again if somebody is using a hose to water his lawn or wash his car up at Mount Newman the pressure is coming out somewhere between 55 and 65 pounds per square inch or of that order?---Yes. I would say we were a little mean with capital and consequently when everyone was using their hoses those pressures would be down a bit.

What about in the plant at Mount Newman - what was the pressure of the reticulated water system there?---Our practice was to use one pressurising main and the industrial area and the plant were on that main. This means that the industrial plant would see the same sort of pressure. Once again we had expansions which in some cases let that pressure drop. Consequently, booster systems were put in. However, when they

were put in they were put in to make up for pressure drop in pipelines which had not been increased to take additional flow. This means that the industrial area generally would have been in that same range, 55-65. Perhaps it is worth just noting that I had an obligation to maintain that order of pressure because for fire fighting purposes the fire mains were connected to this same system.Under the fire brigade's controls and for insurance purposes the pressure you must maintain is about 35 pounds per square inch in order to get the firemen's nozzle work properly. So I could not permit our system to go below 40-45 psi in the worst case.

MR HEEREY: My instructions are that in the metric system the figure of 450 kilopascals is approximately equivalent to 60 pounds per square inch. Is that correct, to your knowledge?---I think that is about correct.

CROSS-EXAMINED BY MR HULME QC:

MR HULME: Mr Booth, did you read your affidavit carefully before you swore it?---I certainly tried to.

Did you regard yourself as having read it? Were you in doubt as to whether you had read it carefully?---Not at all, no.

When you saw the sentence, "I was directly responsible for the design and construction of the Mount Newman project including the mine, plant, township, railway system and port facilities", did it occur to you that that might be capable of being understood by people that you had been in charge of the design and construction of that plant, township, railway system and port facilities?---Are you referring to the original project that was established?

You go on to say that the project involved an expenditure of about one billion. Did it occur to you that people might think that project was the Mount Newman project for which you say you were appointed project manager? ---That did not occur to me because I said from 1971 I was appointed project manager and went on to say I was directly responsible. Perhaps it would have helped if I had said that that was for the expansions to that project. To me I did not realise that it could be misunderstood.

Do you remember what your appointment as project manager was for? Normally there is a project when one has a project manager. Is that right?---That is one use of the term,yes.

Is that the sense in which you were appointed a project manager?---No, that is not the sense.

What did it mean, inyour case, to say that you were a project manager?---I was, in fact, the project manager responsible for all capital works programmes and other allied engineering matters.

When you built the beneficiator was there a project manager for that?---At that specific time we had a slight reorganisation in Mount Newman Mining. Whereas my job prior to that, as manager engineering, was responsible not only for capital works but for a number of the operational engineering matters, at the time the beneficiation plant was constructed as an individual project amongst others, in that particular case my job was subdivided and another person was appointed to construct the facility, leaving me with the responsibility for total design and some co-ordination of construction.

MR HULME: Was there someone called a project manager for the project of the construction of the beneficiator?---Within the Mount Newman Mining Co. I do not believe there was. That role of mine was divided into two parts and that meant the project was in two parts, with my team, if you like, being responsible for design and engineering matters and another officer who had the job of construction, working with the Bechtel Corporation to build it.

There was a project or projects relating to that plant. Was there a project of designing it and a project of constructing it?---I am sorry; this is confused. It is unusual to split a responsibility such as that but this was done as a specific need within the Mount Newman management structure at that time. In effect, the co-ordination of the whole relied with the general manager which is truly unusual.

The beneficiator was some hundreds of millions, was it not? ---The Mount Newman Mining beneficiating project was initially put forward to the board at over 100 million, including the township and various peripheral matters. The final cost of the beneficiation plant itself - - -

WITNESS (Continuing): - - - itself, as I define it, was under 50 million.

MR HULME: Do I understand you to say that someone other than you was responsible for the construction of that plant?---Yes.

Did he report to you or report to someone else in the hierarchy? ---For his direction he reported to the general manager - that is, his personal direction - but in terms of the technical content of his work he reported to me, of course.

In the sense that you were the designer?---Yes. Not only that, but the hierarchical structure had been that he traditionally reported to me and that lingered.

But in relation to the construction he reported to whom - his manager?---He reported to the general manager of Mt Newman Mining Company.

There was a general manager there at all times? Your appointment as project manager did not put you in charge of the Mt Newman operations up there?---No. There was a general manager in charge of six executives, of whom I was one.

There was another fairly recent dry-crushing system installed, was there not, in the last few years?---There were a number of very significant works. I can only think you might be referring to number two primary crushing line at Newman.

You were in charge of the construction of that?---I was totally responsible for all construction and operation engineering standards and co-ordination matters, up until the beneficiation project was put into the construction phase. Then my role was divided to a point of construction manager for that project only.

Have you had actual mining experience, as opposed to design and building experience? I mean, in the pits? Do you understand the distinction I am drawing?---I have not worked in the pit full-time as a solely responsible task.

You are able to answer questions as to the procedures followed with things of that sort - what is regarded as good mining practice, what is not regarded as good mining practice, etc?---Partially, yes. In some areas I was responsible for decisions relating to mining practice, where they interfaced with what you might call engineering experience, such as the position of haul roads and matters of that kind. When it comes to blasting technology and matters of that kind, that was not my task.

MR HULME: You are, of course, aware in general terms of the existence of the Tom Price mine as a direct-shipping mine, in the terminology we have been using here, sending out high-grade ore for a number of years before it had a beneficiation plant?---Yes, I understand.

You have seen that same kind of thing - - -

MR HULME (Continuing): - - - thing happening at close quarters at Mt Newman?---Yes.

That will frequently involve you, will it not, in mining low-grade ore that you cannot sell until you have a beneficiation plant?---Yes.

You must mine it, though, and put it somewhere so that the mining process can continue?---Yes.

If you continue to chase the high grade ore you can eventually produce a position where your high grade is gone and you are left with low grade you could have sent if you had blended it with your high grade over the years. Is that general pattern true?---That is a possibility. I do not believe the pattern is true.

What do you mean by that?---I do not believe I would see high-grading, so-called, taking place.

If you do not build a beneficiation plant what do you suggest would be done with the low grade ore?---The low grade ore would be dumped. It would not be processed, inasmuch as you can not use it in a blend to meet the high-grade ore specification.

The rest gets dumped?---That is correct.

If one builds a beneficiation plant and beneficiates low-grade ores, one is able in total to take out more ore than if one is dumping, is one not?---Correct.

In your experience, do governments take an interest in the amount of the natural resource the miner can get out over a period of years and the amount of resource which is there which he wastes by bad mining practice in that respect?---I am not really familiar with that line of thinking.

You do not know whether governments care in this country whether or not you have a system of mining in which ore which could have been beneficiated gets dumped?---I understand the principle completely; it is just that I have had no personal involvement with the government in that respect.

In saying you understand the principle, do you mean that you are aware that governments do take an interest in that matter?---I am aware of an interest but again not personally. I suppose the reason why I cannot be very helpful in this regard is that in the mining practice we adopt that every tonne costs money and dumping tonnes was a waste of money. Consequently,

our motivation when I was with Mt Newman Mining was to sell as much of the ore as possible so that the ore sold was the highest possible proportion of material handled.

OLNEY J: You did not need any urging from the government. That is what you are saying?---That is what I am saying and that, I think, is why I cannot answer this question more closely.

MR HULME: What is it that you are saying? You said to his Honour, "That is what I am saying"?

OLNEY J: I put it to the witness that - -

MR HULME: Yes. I know.

WITNESS: We were trying to maximise the tonnes sold to specification and needed no urging from anybody that I am aware of, including the government.

MR HULME: Your activities in relation to the beneficiation plant - did they include joining in the decision to recommend that it be built?---No, because as I understand that question - - -

WITNESS (Continuing): - - - that question, that would be a matter for the board of directors.

MR HULME: No-one makes recommendations to the board?---We, in the company --and I was part of those making the recommendation on which the decision was made.

You had no part in the making of recommendations?---The recommendations for the board went through me. They were prepared under my direction, approved by myself and then submitted through the general manager for approval by the board.

So you, on your responsibility (and I am not suggesting you should not) forwarded on the recommendation?---Yes, and I understood it.

You were able to do that. It was no part of your business to concern yourself with what might be the attitude of the governments from whom your various mining interests were held?---I am not quite sure I understand that question?

I had understood you to say that as far as you were concerned it was a matter of getting out the ore that you could properly get out and that you had no personal involvement with government and that you did not know what attitude the governments took?---In terms of beneficiating ore, perhaps I should go back one step. The Mt Newman Mining Company worked under an agreement with the government, the State government, and part of that agreement, like others, involved some form of secondary processing at some time. I was aware of that, of course, and at various times, approaching that deadline, the company progressed evaluations, realising that some kind of scheme would have to be examined.

The plant being within your agreement (we are not concerned to interpret) secondary processing, within that agreement?---Yes.

And there being an obligation on you under the agreement to do such things?---Yes.

If then you have ore which, with the best blending in the world, is going to be left behind because there is not enough ofthe higher grade, as it comesout of the mine, to carry it, one accepted way of dealing with that position is seeing if that ore can be beneficiated? ---Yes, that is correct.

If that is to be beneficiated, one has to build a substantial plant? Yours was built, you say, for something like 50 million. Others have cost more?---Yes.

MR HULME: That plant will be built because you are bringing down and putting through ore which otherwise would have been stockpiled or sent out to waste somewhere?---That is correct.

You have seen the Hamersley plant, so you are familiar with the chart of the plant?---Yes, generally familiar with it.

Could the witness please have that exhibit, 32, which is perhaps clearer for us? (TO WITNESS): I must ask you to be
A237 very careful about the yellow line coming into the blue?---I understand.

You see, marked in blue, one section and into that there coming two yellows. Are you able, looking at that, to visualise, from having visited the site, what you are seeing there?---Yes.

Starting at the grizzly and the concentrator, feed stockpile, coming down the right-hand end of that page, scalping screens and crushers, wet-screening plant and product screens, coarse drum plant, medium drum plant, cyclone plant, de-watering bunkers, an ore drier, a thickener and, of course, a number of smaller pieces and various belts, etc. Would you regard the whole of the blue as being part of the concentrator or the beneficiation plant? We have used both terms?---I think I would need to understand Hamersley's thinking to really answer that question. I can give an opinion, casting my eye over this, as to what I think, and clearly some ore is bypassing, or able to bypass, through the yellow exits, but it appears that the only feed to the plant comes from the low-grade tip head, which is the start of the blue section. In the main, therefore, the beneficiation sections, or concentrator sections, can only be fed from the low-grade tip head, I think. However, some of that feed is going to bypass the concentrator sections. There seems to be a mixed answer to that question.

Are they the yellows you are thinking of there?---Yes.

Put them out of your mind for the moment. Would you regard the blue items as part of the concentrator?---I would regard the blue as part of the concentrator project, represented by all the capital invested to establish the project. For the concentrator, I have some trouble with it, because clearly there is a possible intent for some of this feed not to go through the concentrator, as such; so in that sense part of the established capital is working towards a different end.

HEARING ADJOURNED UNTIL 10.30 AM

THURSDAY, 17TH NOVEMBER, 1983

PETER FORBES BOOTH:

OLNEY J: Yes, Mr Heerey?

MR HEEREY: Before my learned friend continues, your Honour, there is a passage in the transcript that I want to refer your Honour to. It is at p.836, the last question of my examination in-chief, where I put to Mr Booth my instructions of what 450 kilopascals were. My fairly clear recollection is that the figure I put was 65 pounds per square inch because I was looking at a copy letter where somebody had made a calculation of that figure.

OLNEY J: You think that should be 65 and Mr Calloway thinks it should be 65; yes, that was my recollection, too. I will amend the transcript to read 65 where 60 appears.

MR SHER: Your Honour, before Mr Hulme continues, we have not been able to agree on the question of the admissibility for all purposes of that extract from Skillings that was admitted at this stage only for a limited purpose. It does not appear that anyone other than Mr Langridge is able to answer questions relating to the document. Mr Tompsitt apparently does not know. I do formally apply, your Honour, to have Mr Langridge recalled. I regret the necessity of asking to have somebody recalled and, in fact, he is at Dampier, but all I can say in support of that is that it was an oversight on my part not to put it to him. It was a document that we desired to rely on and I should have done so. All I can say in my own defence is that there are so many things on my mind that your Honour might understand why I overlooked it. I do ask to have Mr Langridge recalled so I can put that to him and ask him something about it.

OLNEY J: Yes. Thank you, Mr Sher. Mr Hulme, do you have anything to say on the application to recall Mr Langridge?

MR HULME: Yes, your Honour. We are faced with this position; we have been given the article as a whole and have been asked to admit it. We do not; we say a lot of it is inaccurate, some of it is inaccurate, and I have invited my learned friends to indicate which parts of it they are interested in so we can say either that is accurate or inaccurate. My learned friend is not willing to do that. He says he wants the whole article. I do not criticise him but merely state the fact that he will not indicate to us - - It is mainly a technical description. We have technical descriptions; if he wants a technical description we can give him one that we say is accurate. If it is other things that are mentioned in there then they can be attended to but parts of it are on a topic on which my learned friend has asked Mr Langridge questions and has had answers from Mr Langridge. There may be other parts in it

that were not put to him - We cannot tell - but it is submitted to simply say, "Will you please take him away from his job?" - he has already been away and to bring him back for a mere oversight, "and I will not indicate what it is. I will not help to see whether it can be solved in Perth because we have no-one here who can deal with it" - - It is submitted that we should not be put to that trouble and that Mr Langridge should not be put to that trouble of being brought back. We remain willing to discuss with my learned friend, who must know why he wants it, any particular proposition so we can say either, "That is admitted" or "It is not admitted." While we are faced with a package deal on every word in the commercial article published in the United States and asked to admit the lot or reject it, we have to simply say we reject - - -

MR HULME (Continuing): - - - we reject it, but we are willing to co-operate if my learned friends will say which part of that article they seek to have us submit. It may be that there is something there they want and we say, "Yes, that is accurate" but that is not the invitation as put to us at the present time.

MR SHER: I would like to say something about that, your Honour. If all I desiredto rely on this document for was to seek to rely upon it as evidence of fact then my learned friend's invitation would have been accepted but there is another use to which it is desired to put this document and that is that, we will submit, these are in view of the case presented, some extraordinary omissions from the description of this plant in this document. It is what it does not say that is as important as what it does say.

OLNEY J: But then if I do not see the document I do not know what it does not say and therefore I am not influenced by the omission.

MR SHER: That is the very reason why we want your Honour to see the document so that your Honour can see what it does not say, so I cannot accept my learned friend's invitation. I wish to make it clear that we are going to rely upon this, if it is admitted, to point out that in a comprehensive description of this facility and what it does there are matters which are just not mentioned at all.

OLNEY J: Are you satisfied that Mr Langridge would be able to give evidence which would enable that document to be put in as an exhibit?

MR SHER: I believe he is the only witness I can ask, your Honour. As confident as one can be, I believe Mr Langridge will be able to deal with it. As my learned friend has pointed out, a number of the matters in it have already been the subject of cross-examination and it is because of that that I am confident I can get a great deal out of Mr Langridge.

OLNEY J: If you show the article to Mr Langridge, he may or may not have previously seen it. He is probably like the other expert witnesses. He probably knows about the publication and may be a regular reader of it.

MR SHER: He may have written it, your Honour.

OLNEY J: Well, he may know something in it.

MR SHER: Without going into any detail this purports to be a comprehensive description of this project and what it is intended to do and what it does. It is likely that Mr Langridge, on whom the plaintiff relies on in this case for that evidence, could well have been the author of this document or played a part in it. It is therefore, I would submit, probable that he will be able to make some relevant answers to it.

OLNEY J: The other thing, too, about recalling witnesses is that it may well lead to the need for the other side to recall other witnesses who have been examined and cross-examined in the interval between Mr Langridge's last appearance and his recall, if he is recalled.

MR SHER: I do not believe that will happen, your Honour.

OLNEY J: That is always a potential - -

MR SHER: One cannot deny that.

OLNEY J: - - and it is something which in terms of costs may well have to fall on your side, if the recalling of a witness does have that effect.

MR SHER: All I can suggest, your Honour, is that we wait and see if that happens; it may not. I suspect it will not.

OLNEY J: Is there something else you want to say about it?

MR HULME: No; only that what has been put to your Honour is omissions in an article that may have been written by Mr Langridge and may not have been written by Mr Langridge, and we say that that is not relevant to any issue that has emerged here in any event - - -

Y11A. 10.41

MR HULME (Continuing): - - - any event; at the most it is in the field of the collateral and we would say it is just one of those things which my learned friend will have to bear, as your Honour says. It is always possible that cross-examination on that leads us to ask further questions - to want to ask further questions. I do not know what is intended to be done with my learned friend's witnesses but it has potential for inconvenience, for further inconvenience. In itself it is highly inconvenient with a potential for further inconvenience. It is not a proper basis on which the application which my learned friend makes should be granted. I do not think I can add any more to that, your Honour.

MR SHER: Your Honour, this is a case involving millions of dollars and we are worrying about the cost of flying a witness from Dampier and back for one day!

OLNEY J: Yes. It is my view, in the nature of the proceedings and the way they have been set up initially, and the way they have been conducted, that I do not wish to exclude any party from calling any evidence or attempting to call evidence, which may be helpful. In this case the defendants' counsel considers it is relevant to put to a witness something which, by omission, was not put to him. I propose to allow the defendants leave to recall Mr Langridge for the purpose of cross-examining him on the particular exhibit, 24.

This would be done, of course, on the basis that any costs involved or thrown away would lie against the defendants and I would expect, without making any order, that Mr Langridge be recalled at the earliest possible time, so that we obviate any possibility of their witnesses being released and having to be recalled.

MR HULME: We will have to make inquiries about transport, etc., but I would ask that he and the operations there be inconvenienced as little as possible; that, if we get him down in the morning, he be interposed (subject to any crisis) so that he will be away as little as possible.

OLNEY J: You have my complete co-operation on that, Mr Hulme. If you can come to some time-tabling arrangements with Mr Sher, certainly the court will fall into agreement.

CROSS-EXAMINED BY MR HULME QC (Continuing):

MR HULME: Mr Booth, do you know the timetable?---I believe, sir, he could be down on any day you propose. He could get down in the morning, I think, and go back in the evening.

OLNEY J: Yes, Mr Templeman?

MR TEMPLEMAN: I take it your Honour would not include the sixth defendant in any order that might be made as to costs?

OLNEY J: No. I apologise. When I said "the defendants" I meant the parties represented by Mr Sher.

MR TEMPLEMAN: Thank you, your Honour.

MR HULME (TO WITNESS): At the end of the beneficiation plant - - -

MR HULME (Continuing): - - - beneficiation plant we have the drums, cyclones, hydrocyclones, whims, all doing their job?---Yes.

In relation to the feed which comes through the beneficiation plant, that is where the ultimate separation takes place of what is going out as product on the one hand and going out as waste or tailings on the other?---Yes.

In the end the question of whether you have a good beneficiation plant or a bad beneficiation plant, the question of whether you are operating it well or operating it badly, will be determined by reference to what is happening at those drums, the result of the operation of the drums, cyclones, whims, etc?---Yes, I think that is right.

Are you getting out as much iron ore as possible? Are you wasting iron ore in your tailings? Have you got waste in your product? Things of that sort are judged by the product at the end and the tailings at the end?---Yes.

It costs you a substantial amount of money, does it not, on the kind of scale that these things are operated on, to do anything to your feed? I think things like crushing and screening, every time you do anything to it, cost you money?---Yes, you are right. It is significant amounts of money.

You do not do anything to it except with a purpose?---Yes.

You judge the efficiency with which you have spent your money by the return that you get, the benefit you get in your processes from having done whatever it is you have done?---That should be the case.

In a concentrator, a beneficiation plant, if someone said, "Let us spend some money and put in another piece of equipment which will do this to the feed on the way through" the way in which you would, in the end, judge the desirability of spending that money would be, "What is going to be the effect of that new activity on the product and the tailings and waste at the end of the process?"?---That is my view.

And that applies to every single thing done to the ore from the time, in this plant, it leaves the grizzly and comes into the beneficiation plant?---Yes.

It is all being done for the end result at the drums - and I am using drums to include cyclones, the end of the process?---Yes. We are addressing the preparation steps with the end concentration processes in mind.

MR HULME: As far as the concentrator is concerned, that is the bottom line, what is coming out of the concentrator - - -

MR HULME (Continuing): - - - of the concentrator?---I think I know what you mean. That is the point at which the separation that you are trying to achieve actually is achieved.

In para.21 of your affidavit you say:

> "Beneficiation takes place in the heavy....(reads).... contaminants or low grade ore."

Do you see that passage?---Yes.

It is correct, is it not, to read the first and second half of that sentence as being connected with each other, as if the word "because" was there; so "Beneficiation takes place because that is where the more valuable ore is separated from the contaminants"?---You are looking at - - after the word "whims" one could insert the word "because". Is that correct?

Either "because" or some other link; that is, you are not making two independent statements; you are saying that is where beneficiation takes place because that is where the ore gets separated from the waste?---Yes; that is the idea behind those words.

Because "beneficiation" in that sense involves the withdrawal of waste in some form so that the chemical analysis of what is left is better than the chemical analysis before you effected that separation?---Yes; "separation" is the word I would prefer to use rather than withdrawal. It is the separation of the ore from the non-ore.

And a permanent separation?---Yes; that should be permanent.

If you were using an ordinary dry screen process and simply dry screening into lumps and fines then the chemical analysis of the total that you were sending away afterwards would be the same as the chemical analysis of what you put in, but it would be in two separate lots?---When you say "chemical analysis" you are looking at a stream and averaging, for example, Fe content of each of those two streams. When they are divided naturally the lump fraction has a higher Fe value than the fines on the traditional Pilbara ores, so there is a separate stream and separate - -

There are separate streams but there the total ore content would be identical with that that you put into those

streams?---Yes. Nothing is lost. It is altered, shall we say, but not lost.

MR HULME: In beneficiation, when you are removing the contaminants etc. you are sending them away; they are going to waste and the chemical analysis of what goes to product will be better than the chemical analysis as it came into the process?---In terms of the whole stream this is so but with an individual particle, for example, that would not be the case. In other words, if we are talking of total streams - that is total feed in - if you could take a slice of that it would have a certain value of Fe or any other measurement you wish to take - - -

WITNESS (Continuing): - - - to take, and then, when you looked at the streams that were product and the streams that were not, .. the stream of product would have a different feed in that case.

OLNEY J: That would be assessed in terms of the proportion of Fe in the total stream. Your beneficiation does not turn something into Fe that was not Fe?---I was trying to see if I was misunderstanding that point, your Honour. That is absolutely true. The lump that comes in as high-grade lump but may be in a low-grad position in the ore body, will go through this whole process and emerge as that same lump.

So it is the proportion of Fe to the total mass?---Yes.

That in fact changes the beneficiation?---One could go in very broad terms, which I think is the sense of this question, and in the Hamersley case they feed a certain number of millions of tonnes per year and recover as product a lesser amount. That, in broad terms, is precisely the answer to this question.

MR HULME: From the same point of view but in reverse, you would hope to find that in the stream as a whole the Fe was higher but that the contaminants were lower?---With the broad proposal you have this must be the case.

Both of those - the increase in Fe content and the decrease in contaminant content - can be of importance?---If I understand you correctly, that is, in fact, the objective - that we are putting feed into the circuit with a view to recovering a particular component of that original feed. That is the concept of separation which takes place finally in the plant items you have already mentioned.

So that separation there, as complete as possible into the desirable high-grade ore which is going out as product and the undesirable contaminants or shale or whatever else you have going out to waste ore tailings, is for you at the heart of the concept of beneficiation?---I think so. That is the objective.

That kind of meaning, Mr Booth, is somewhat more narrow, is it not, than your wide meaning in para.5? Would you look at para.5? You will see the wide meaning, "is the treating of ore to improve its physical or chemical characteristics". Then you go on to give various narrow meanings. The wide meaning given would include an ordinary dry crushing and screening process with the purpose of altering the physical characteristics, altering the size and having the two streams there?---That could be the case.

MR HULME: But when you are talking in 21 it is a somewhat narrower meaning. I am not suggesting to you there is a single meaning for beneficiation, but you have a somewhat narrower meaning involving disposal of rubbish or waste or tailings, separation of one from the other - a permanent separation, with one being sent out of the system - - -

MR HULME (Continuing): - - - of the system?---It could be described as narrow. I would say that is the word "concentration" within the meaning of beneficiation and I would tend to use these words similarly, but I tend to use the word "concentration" there more because that is a better definition of what takes place precisely.

I follow that; various engineers and companies use both terms?---In my experience in the Pilbara the terms have been used a little loosely - they have been used loosely in the sense that sometimes they are used broadly and sometimes more narrowly.

Yes, but Mount Newman puts out glossy books, does it not, in which it has pictures of its beneficiation plant? ---Yes.

These plants are called beneficiation plants or they are called concentrators - both words are used?---Yes.

Can we go back to an earlier stage in the process on the primary screen? Any time you wish to identify from the chart behind please do so; you may or may not carry the thing in your head so any time you want to look at it just ask. On the primary screen which is screening, you will remember, from 30 to 80, they are going to be the overs, it is an 80mm feed coming in and we are screening off the 30 and below, those pieces that go out on stream A will have been dropped down the pulping box or chute - - Can I make it plain that if I ask a question in the terms 'pulping box' I am not going to hold that against you for saying yes or no. If I use the word "chute" my learned friend Mr Heerey will write it down because Mr Sher pushes him and says, "He said 'cnute'". Can we be clear as to this; that I am not trying to trick you by asking questions either pulping box or chute?---I am no longer sensitive to the point.

You know the thing we are talking about. It has come down there, I do not want to continue calling it a vertical device; down the chute, gets wet in there and is hit with jets of water coming out under pressure, gets further wetted on the screens and two things will happen. There will be, as you have said, a cleaning function?----Yes.

And that involves different things, does it not? It involves a cleaning function by separating adhering fines from the lumps?---Yes.

And there will also be a cleaning function by wetting the clay, the process you have spoken of in your affidavit; the degradation or decomposition of that clay will begin and some of those clays will go off on the screen?---I

referred to the breakdown of material and that means that if there is material that can be broken down, then that breakdown might take place.

MR HULME: To the extent that clays come off lumps in stream A and go down through the screen while stream A goes over the end, stream A will be that much improved - - -

MR HULME (Continuing): - - - that much improved?---By improved I presume you mean in Fe content, the aim of the exercise. In that case it will separate - -

Fe content and particularly with clays, contaminant content?--- Yes.

It is right, is it not, that most of the alumina and silica is in the clay or the shale rather than the ore?--- It is in the fines, shall we say.

MR HEEREY: Your Honour, may I at this stage point out something which seems to have crept into the questions as an assumption and that is my learned friend's reference to stream A being improved. Your Honour will recall that the term stream A and stream B etc. are not working terms; they are - I think it is fair to say - lawyers' terms that come into these proceedings for better identification, but the evidence does seem clear that the stream goes into the concentrator in the one stream 80 by 0 and it is only after the screening process starts that you can say stream A and stream B etc. emerge.

OLNEY J: I think for the purposes of Mr Hulme's opening stream A is the oversize that comes out from that first screening operation, so I understand his question to mean that stream A - according to our definition - is improved compared with the feed that went into the thing - whatever it might be called.

MR HEEREY: I do not want to be taken as being critical of my learned friend but it is perhaps a little confusing to talk of improving something by a device when that thing really did not exist until after the device operated.

MR HULME: You were saying that contaminants were mainly in the fines?---Yes.

Alumina; would that be mainly more in the clay fines? You can have ore fines, can you not?---The alumina in Pilbara ores generally, as I understand them - and you will recall I do not know Hamersley ores intimately so I must be general here - have the alumina content in the fines and that has its origins in the shales and where there are clays, which I personally have not experienced in the terms that I believe clays to be, then alumina will also lie in the clay fraction.

We are then breaking down clay and getting rid of it in the form of fines; we are knocking off adhering fines and getting rid of them and as stream A goes away in its lumps from 30 to 80, they will be in a condition such

that their chemical analysis is better than the chemical analysis of those identical lumps in dirty form would have been had you been able to identify them before you dropped them down the pulping box?---I think you are talking of lumps of ore, and the ore will be cleaner and without some of the likely lower grade fines than that ore. If you took the whole of the mass and the particles that might have been with it, then in the fact those particles - the fine particles - are no longer with it; then the lump is bare and the Fe of that lump will be higher. I am sorry; the Fe of the lump is not higher, let us say the lump is there and consequently what you are measuring is a higher grade of Fe.

MR HULME: I have spoken of lumps of ore going, but I mean measuring the whole of the stream of those lumps of ore, not particular lumps. Do you follow - - -

MR HULME (Continuing): - - - you follow?---Yes.

There is stream A, which consists of lumps - still with some clay, no doubt, and some adhering fines - with a higher Fe content and a lower contaminant content than those lumps in their dirty form would have had if you could have identified them back in the single feed that came into the pulping box or chute?---Yes, that has to be do.

That is not accidental. It is one of the things that is meant to be happening. You are getting rid of these because you mean to get rid of them?---That device we are on, called the screen, is deliberately there for that purpose.

Stream A then goes on belts into a surge bin and from belts to the drums?---Yes, I understand that.

Which it reaches through a preparation screen? It goes through a preparation screen before it goes into the drums?---Yes, that is correct.

As it comes off the screen, one can say, can one not, that it has been beneficiated within your clause 21 - para. 21 - definition; not as much as it is going to be, but there has been done to it something which is within the concept of beneficiation in para.21?---In my clause 21 I have excluded screening.

I know. I am not talking about screening and I am not saying what has been said anywhere is wrong. I am simply saying it has in fact been beneficiated to an extent? ---Yes. I think I know what you mean - that ore appearing off the preparation screen in front of the drums is improved in its quality over the ore, originally, that would have been fed to the wet screening or "washing and screening" plant, as Hamersley term it.

It has been beneficiated here by the separation and removal of contaminants and fines and clays - whatever the particular ones are?---Correct.

It still has its lump shale? We have not been able to get rid of that, but other things which are undesirable have left it?---Yes. This is a marginal improvement that we are talking of.

You are aware, are you not, that what leaves stream A on the screens never gets back to it?---That is correct.

If we go down to the next screen, we are screening 6 to 30 and sending that 6 to 30 stream on as the over on that screen?---Yes.

What we have said as to stream A is equally true of stream B? ---Yes.

There is no difference in principle between those two streams? ---No. This is a fundamental, Pilbara ore principle,

that the lump size ranges are better in quality - - -

S95. 11.16

WITNESS (Continuing): - - - in quality than the lower ranges; and the better that separation takes place and, if you like, the cleaner the fractions you obtain, then the more pronounced is this effect.

MR HULME: Again, what leaves stream B will never rejoin it? ---It should not.

Various words have been used - scrubbing, washing, screening, cleaning - and can I take the three, washing, scrubbing and cleaning? All are referring to this effect on the ore of using water under pressure to wet clay, to remove adhering fines, remove clay as it breaks down, and then the screen making that initial separation, the one from the other, and then making it permanent by taking the unders away and leaving the ore on top, leaving the lumps on top?---Yes; that is a precise sizing situation. That is a definite sizing situation.

I am simply saying that is the process, that is what physically happens, whatever name one attaches to it of cleaning, washing and scrubbing?---Yes.

Ore which goes from that process and bypasses the drums.

MR HEEREY: Your Honour, I wonder if my friend could be more precise about what is meant by "that process". He has asked some very compendious questions.

MR HULME (TO WITNESS): Let us take stream A. We know how much has happened to stream A and it bypasses the drums because the drum is being maintained. It follows, does it not, from what you have said that that stream has been beneficiated? I do not mean as much as it would have been yesterday if the drum had been working; it has, in fact, been beneficiated?---Yes. It is a question of degree but the fact is that it has been beneficiated somewhat.

It will not be as useful to you when you are blending on the stockpiles as it would have been had it been through the drums?---That is possible but depending, naturally, on the original feed.

It will not be able to, as it were, support as much lower grade ore in the stockpile as it would have supported had it been beneficiated more?---I think I know the question; the answer is yes.

I know I am using the wrong term, that there is not a term support?---Yes. The higher the Fe content of the product, then the more blending opportunity you have for the lower grades in the object of meeting the overall specification for sale.

MR HULME: If I am trying to do a stockpile of, let us say, 62, if I put on something at 62, that does not let me put on a piece of 61?---Correct.

If I had got it up to 63, I could have put on a 61 as well - is that the broad principle?---Yes; that concept is right.

When that ore, stream A, comes to the drum - - -

PR22A. 11.20

MR HULME (Continuing): - - - the drum, it will have been continuing the process of breaking down throughout the whole period from the end of the drum, end of the screen, until it gets onto the preparatory screens. As it goes down the belts, any part of it which is subject to breakdown will be continuing to break down and the movement of the belts will no doubt be jigging it around a bit. We have photographs showing it. Have you seen those photographs?---Yes, I recall the photographs.

You will remember the clean-looking ore coming off the screens but looking dirtier as it gets further down the process?---There is some continuing break down of that fraction that can break down. That is inevitable.

A breakdown as the various pieces jostle with each other and drop into the bins. It seems to be a spreading of the fines over their surface, so that they look brown rather than clean, as when they first came out of the screen?---Something like that happens, yes.

What will be washed off on that preparatory screen (or you could say "screened" off), what will be detached and washed away in a flow of water, will consist to a substantial extent of fines which have broken down since that stream came off the end of the screen?---Not quite. There are two processes here, because we have two broad classes of material. One class is the harder ore, naturally, and the other is the softer shales and products that later on will be discarded by gravity separation. So the two processes are not covered by the word "breakdown". I understand this transfer of ore quite well. The iron ore particles will be partly degraded in the process of this handling, so chips of ore will break off, but that is not breaking down. That is a degradation through force.

For example, the ore dropping into the bin when the bin is nearly empty - - we have many metres of fall and whilst you can assume the clays will more readily break down if they are there and the shales might, some of the ore may as well. So the breaking down to which you are referring really only comes to the very softer materials that might break down due to the water.

This process of degradation is well-known and is a problem in the industry.

MR HULME: So what is still on stream A has various sources. Partly, it is soft material which has broken down on the way through?---Yes, that is a component.

Yes - partly it is - - -

E55. 11.24

MR HULME (Continuing):. - - - it is fines which have degraded - fines arising by degradation?---Yes.

I think you had a third component?---Only the physical handling, but the ore and waste is subject to - - I think that might be another component.

When you say, as you do, that the system of breaking down continues in the storage bin when they are sitting there, what you are referring to there is the breaking down of the softer materials simply by continuing to be wet and what follows from that?---I was talking of the whole subject of degradation with those words because I am well aware of the ore and the shaling material both being subjected to some degradation and breakdown in this handling process.

What you said is "retention" in the storage bins can contribute to this breakdown?---Yes.

There we are talking of stationary ore, are we not?---Yes.

The process continues and those materials are there and they are going to be washed when it gets to the preparatory streams because we do not want them in the drums?---Yes.

To the extent, of course, that they are breaking down after the screens and as late as the retention time in the drums, it is apparant that the breaking down process can continue for quite some time?---There may be some clays that would continue to degrade with water and time. I do not know of these at Hamersley, but I would expect that this is possible. I have no experience of that kind of material in the Newman operation. I know from my Newman experience and the fact that I had to be aware of others as part of my job, that Hamersley iron has some material that is worse in terms of deterioration from material I was familiar with. I would anticipate in the Hamersley situation that there would be some ongoing breakdown of any clay material it may have.

You mention in para.20 that it is important that the feed for the drums be carefully sized. Do you see that passage?---Yes, indeed.

In stream A we are talking 30 to 80. The main size difficulty would arise there, would it not, if what you had in the 30 to 80 drum had a substantial or significant proportion of fines?---Could you just repeat that?

Would you be concerned if in your 30 to 80 drum there were some pieces of 90?---I would say broadly no, but I do not know the Hamersley drum - - -

P72. 11.29

WITNESS (Continuing): - - - Hamersley drum. The only reason one should be reticent in answering that question is that once a drum is designed for a particular large size, then the various rakes and fittings in the drum are designed for that size but, in broad terms, in the operation of the drum, the 90mm particle is not a real problem.

MR HULME: But if I said that that feed has a high proportion of fines in it, going into the 30 to 80 drum, then you would be concerned?---I would be very concerned for the process and my own job.

Because all you take off on the preparation screens is fines, is it not? I do not know whether you know the Hamersley preparation screen size. It is 6mm?---Yes. I understand that. That would be the object, of removing the fines.

So that if there were any pieces in it from 6 to 30 they are going to stay there. They will not go through that screen, will they?---That is correct.

But they obviously, as shown by the screen, want to get rid of anything less than 6?---Yes.

In particular I suggest to you, the finer the particles concerned the more they want to get rid of them?---Yes.

It is the real fines that are the real enemy in the drums? ---I do not know the answer to that question precisely because I have not been involved in that particular area of drum plant design. Hamersley have a drum situation there where they have 30 by 6 material in a drum which is meant to be operating to cut out 30 by 80. I would guess that the 6 to 30 fines would not be a significant problem and,presumably, their design is to cope with that.

To the extent that what has been washed off there is fines which have arisen by breakdown rather than by degradation, the fact that that ore has been wetted a long time ago is of importance, is it not?----Could you phrase that again, please, or else I will have to try and put that back to you a different way?

You are aware that the amount of water spraying on the drum preparatory screen is not as much as the chute and primary screen?---I would not expect it to be, no.

No, you would not expect it to be and if you brought the ore in fresh to the preparatory screen as dry ore, and just put it through the preparatory screen with the sprays there, you would not, in general, expect that to get off as much material as you would get off by putting those pieces through a pulping box and

on the primary screen?---I cannot agree with that concept.

MR HULME: In what respect?---In that question it becomes a matter of design. It is a question of what you set out to do. If, indeed, you are going to treat the dry feed in a wet screening situation - - -

WITNESS (Continuing): - - - wet-screening situation in front of drums, as suggested, then it is possible to design that satisfactorily and that would be the objective and that objective should be met; so that is a possibility.

MR HULME: What we are talking of here is ore which has gone through the pulping box, through the first screen, but has contained clays and others which have continued to break down afterwards; in spite of the fact that they have been through the pulping box and the primary screens, they are still there - have to be still there or they could not be continuing to break down?---Yes.

If they have survived that, in the form that they went through that process, you would have expected even more to have survived had they merely been put through sprays of the type that are on the preparatory screen before the drum?---Yes, that would be so.

Because they are the result, not of an immediate explosion, but of a slower process of breaking down since the first wetting?---Yes.

They are soft and ready to be washed off and the spray on the preparatory screen is sufficient?---It is a point of detail, perhaps, but I do not think it would be a case of washing off so much, as just washing away. These particles do change their size because of time and I can imagine there would be some material that could do that. Then I see that the particles are splitting down in size and possibly then going through the 6mm screen, whereas previously they would not.

Is therenot a considerable washing activity there in that, if one looks at the pictures of those streams, one certainly gets the impression that if you picked up a clean piece straight off the drum, that would be a piece of ore, but if you picked up a dirty piece after it had been in the retention - those brown-looking ones in the photographs - you would have a kind of smear on your hand? Is not that fines?---Yes, that is really very, very fine material.

And certainly material which you do not want in the drum?---That would be right, but that is the very fine, powdery material which, in water, gives it its colour. It is almost colloidal in nature.

You get that off with water?---The sprays would wash that off very easily.

And it goes down through the screen and the ore goes over - the clean ore goes over - into the drum?---Yes.

MR HULME: If you have a stream of ore (and no doubt in practice this would not happen) and you are satisfied it is clean - no adhering fines, no clays - you would still wet it, would you not, before you put it in the drums? ---That, I would prefer to hear a metallurgist say. On my knowledge of having to make decisions on what they have told me before, I would say I would, to be sure and to be safe.

You can make the assumption for these purposes that you are safe. Are there not a lot of holes, and porosity, etc., and will you not want to wet it before it goes, in order to help facilitate the recovery of the ferro-silicone?---That would be one reason, I think - - -

WITNESS (Continuing): - - - reason, I think.

MR HULME: If you were using a ferro-silicone process and wanted to recover it, then that in itself would be a reason for having the ore wet with water before you put it into the ferro-silicone solution?---Yes; that would be one reason.

The breakdown which has produced some of the material which we have been getting rid of before the drums began, did it not, in the chute or pulping box?---I do not think so.

In there the clays are wetted?---All the material is wetted to some degree.

If the clay is wetted, does not the breakdown of the clay begin when it is wet?---I do not know because this is Hamersley material of which I have no experience. The immersion test that I saw here would not give me a belief that it breaks down immediately; no. Some of the clays, if they were water active, would absorb some water if they were surrounded by water and they had time for that to take place. To suggest that this happens in any feed-wetting situation of any kind I think is something I could not comment on.

Does not the process in the clay begin as soon as it is wet? I can understand clay being dry, but when you put the water on it are you suggesting that there is a delay for some minutes before the clay suddenly notices it is wet?---Some of the clays will certainly get hit with water but to suggest that something is happening then, for me, is something beyond my knowledge.

You are a civil engineer?---My disclipine has been lost in the work that I have done. I now can handle most disclipine areas.

But you would not disagree with a chemist skilled in this area if he said that the process in the clay begins when it is wetted?---If he said that and it was important I would need to understand it. I would need to know how he had reached that conclusion. The reason I cannot be precise is that I have never had the opportunity to talk to anyone on that point and I personally doubt it.

It has not been part of your original university studies to study the precise chemical effect of adding water to clay?---I have had to be aware of that in general terms, of course, and my work has been involved in it, but to suggest that it might happen

with a particular clay instantly, is a matter on which I cannot comment.

MR HULME: If it does not begin when it is wetted, the process of breaking down which you say is taking place must begin at some point after it is wetted?---I would see it happening steadily because a lump of clay does not break down at its extremity so much and the question as to when it starts to break down is something one would need to look at, I think. Earlier in these proceedings it took some 10 seconds or so, as I understand it, to see a definable result. I can only suggest that is one measure of this.

When you say it may take 10 seconds, it may take 10 seconds for something to be become apparent that one can see?---Yes, that is correct.

If that in itself is the result of something that has started when it was wetted, then one would say there is a process - - -

MR HULME (Continuing): - - - is a process, the first 10 seconds of which produce no physical change discernible with the eye, and then continues as a change discernible to the eye?---Yes, that is very possible.

In para.8 you give a description and you say "It is a means of separating material into two or more size fractions" and you refer to certain possible forms that screen devices may take. You do not, in terms, use the word "aperture" but in para.2 of your second affidavit you quote an Australian standard relating to coal and that does refer to apertures?---That is correct.

I take it from your citation of that standard and the fact that you refer to screening as "a" means of separating according to size fractions, that you do distinguish between screening and sizing?---I would not have intended to try and make that distinction, I do not think. I think they are two separate things, possibly, screening being the function which is taking place and sizing being the result of that. I tended to link them together.

There are means of sizing. A screen is what sizes using apertures. Is that right?---Yes.

Taking an example I gave to Mr Grosvenor, if you employ someone in an apple-packing shed to pick out any small ones coming through, he is performing a sizing function? ---Yes.

He is not performing a screening function?---I had trouble with that parallel then. I have not found it any easier. I think that is right, in broad terms.

You would not call that boy a screen?---I do not think so.

You would not even call him, essentially, a screening device? ---I do not think so.

If you do, all you are doing is wasting a very useful distinction between sizing in the broad sense and screening?---Yes, I think I understand.

Indeed, that kind of example - - you would be aware, would you not, that in a number of South African mines, what was then cheap, black labour has been used for functions which, in other countries, are done with machines? Picking out pieces of shale: You could afford to pay people to pick them off as they came down a belt. Are you aware of that kind of thing in South African mines?---Yes, there are specialist applications there, in fact. I do not think that parallel is quite right, but the general meaning, yes.

And the essential part of screening - - -

MR HULME (Continuing): - - - of screening is the presentation of material to the aperture?---I do not know that that is essential. The essential part of screening is to provide the aperture and then use it to best advantage which is related to efficiency.

If you say of something that it has been screened, if you are talking of the unders, the essential statement you are making of it is, it has come through an aperture? ---That is correct.

And if you are talking of what has not, with the unders, you are saying of something, it has failed to get through an aperture?---Yes.

It may not have reached it. It may have been adhering to something else. However, the essential part of the definition, I suggest to you, is the offering in whatever form, vibrating or however, of apertures to receive or reject particles brought to them?---Yes.

If you are, let us say, crushing what you are going to screen, you would say, "I am doing this process to prepare the particles which will be put onto the screen and profferred to the apertures?---Yes.

"I am not screening; I am preparing the material that I am going to screen"?---Yes.

When you come to wet screening there are a number of things going on, are there not? You are using water,in some way at any rate; you will be wetting material. Are there occasions when you use the water, not to alter the feed in any way but simply to assist, by a lubricating function, the passage or non-passage of those particles through the screen?---Yes.

But here the water is being used, in the first instance, for purposes beyond that?---You said "here"; do you mean the primary screens?

I am sorry; let us say in the primary screen. What you are doing there is to screen at 30mm a nought to 80 stream? ---Yes.

Do you know anywhere on the Pilbara, outside a beneficiation plant, where water is used to help screen at 30mm? ---No.

The water coming on there is not continuing to - - -

MR HULME (Continuing): - - - not continuing the dislodgment of adhering fines which was effected to some extent in the pulping box?---No, I do not agree with that line of reasoning. As I understand the design of the Hamersley situation I cannot accept that.

I am trying not to have a line of reasoning, just to stay with physical facts. Does not that water coming down on the screen in fact dislodge adhering fines from the lumps?---On the screens, certainly.

At the earlier stage in the pulping box when lumps are hit by that water coming in there, is not one effect that occurs dislodgment of adhering fines?---I do not believe so. I cannot prove this and I have never had a chance to test that concept, but I do not believe that to be the case. I believe the objective is somewhat different and the facts are somewhat different.

Can I stay with what physically happens and not with objectives for the moment? Is it your belief that no adhering fines are dislodged in the pulping box?---It is possible. I just cannot see that being significant, and to agree with it it would have to be meaningful to me and I cannot understand that.

Certainly the clays get wetted - some of the clays get wetted?---Some material in that chute must be wetted.

Both of those things continue on the screen; that is, dislodgment of fines and wetting of clays?

MR HEEREY: He has not agreed with the possibility of dislodging the fines. He said they continued. The question assumed the witness's assent to the proposition that there was removal of fines in the chute.

OLNEY J: The witness certainly says he does not know.

MR HULME: Mr Booth, just let us be clear as to this. I am not at the moment talking of objectives or purposes. Are you really saying that in your view, as those lumps fall through the water in the pulping box no adhering fines are dislodged from them?---I do not believe fines adhering to lumps are significantly separated in the chute.

Now will you answer my question? Do you believe that fines are dislodged from lumps in the pulping box?---It is possible but I do not accept it as being a fact.

MR HULME: I wonder can we go behond that? You have . jets of water coming out in forceful sprays and lumps of up to 80 millimetres passing through that. Is it not highly likely that some fines will be dislodged - - -

MR HULME (Continuing): - - - be dislodged?---In trying to understand that, I appreciate that the velocity of all the particles is significant and that there is a relative velocity between water and the particles; that there is no retention or support that would allow significant work to be done by the sprays on the material and because the ore is dry the real effect, I think, of the water must be to achieve wetting and the wetting must occur before other things can really happen. I just find the concept difficult to comprehend and I have no previous experience to measure any achievement of this kind. Knowing the ores as I do as being generally difficult to wet, the most one could expect, I think, when spraying material like this in that situation, is to introduce water into it and to get some kind of mixing of the water with the particles. To suggest that the water,in that time and in that situation of ore passing the curtain, can do work on it and can achieve definable separation, I think is possible but I cannot comment to that having been achieved significantly.

You cannot comment beyond saying that it is possible?---No. I think that is the correct answer.

You are saying the removal of adhering fines itself can involve a function of time?---Time and opportunity. The material from which you must remove the fines or want to remove the fines must be put in a position where this can happen such as under a spray with an identifiable piece of material.

Was I following you right, that you can wet it at this point in the pulping box and it does not come off straight away but you have begun something which will facilitate its coming off, in wetting it?---Yes. I would say the sprays, in wetting the material, are preparing it for a wet following process.

A process is happening for the purpose of removing fines but the fine itself has not yet come off?---No. I am suggesting that the water, at this point, is introduced and mixing with this material to get it wet. When the material emerges, the water is going to separate from this lumpy material in all its fractions; the water will run off, and the material will then move across the apertures of the screen. There is no initiation of really what you might call washing of removing the particles or washing particles off; this water is slurrying the material and then runs away, but it has not really, in my view, done a washing process. It is carrying away those particles which it has collected in slurry form which will be a small amount of those that can be collected.

MR HULME: I am looking not so much at the - it is a vague word - "carrying" away, because that can relate to being separate and in the stream of water; I am looking at the actual detachment, if I can call it that, of the fines from the lump. Do I take you to be saying that the wetting of it with water, the first lot of water in the pulping box, puts it in the condition such that the next lot of sprays are more likely to effect the detachment?---I have no real test or evidence of that. I can give an opinion on that point.

What skill do you bring with the giving of that opinion? ---I beg your pardon? 10

You obviously said, "I don't know. I can offer an opinion." Is it within your field of expertise?---Inasmuch as this is an engineering device working to achieve - - -

WITNESS (Continuing): - - - to achieve definite objectives, I can certainly give an opinion. I have had to have that responsibility.

MR HULME: In your experience, is the detachment of fines facilitated by the material having been wetted? ---If there is thorough wetting it should help because the particles, to some degree, will have a water meniscus around them, which means that when the particles flow across the screen then the water sprays can do a better job. This is the slurrying process of getting material wet. A wetting of the material aids in the separation that takes place on the deck of the screen thereafter.

The wetting of it affects the meniscus of the moisture which is causing the fine to adhere to the lump. Is this not right?---In essence, that is the situation. I hope I have got this point across, as to why I could not agree that dislodgment is taking place in a chute.

I am just wondering if it makes it easier to detach it if one reduces or increases the angle of that but I am getting into chemistry and I will not, perhaps, bother you with that. From the point of view of the screening function, when you detach the particle from the lump you are in a position to offer to the apertures a particle that did not have a separate existence before?---In real terms I am sure one did. We have a situation in the Pilbara where dust suppression water is added at various points, and one of the results of that is that ore that would not have very many fines attaching to it quite often has more because of the slight wetting that takes place. That is a better way to put it, I think. That is a better way to describe the material.

Can we stay with my way for a minute? Let us assume you have a lump of ore with an indentation in it and some clay in there. From the point of view of the screen it has no chance to deal with that clay while it is dry, other than in conjunction with the lump. It is offered a lump of ore and if the lump of ore goes through the clay goes through. If it rejects the lump of ore, it has rejected the clay?---That is right.

If I put water there and wash some of those off - some of the clay breaks down and goes onto the screen - now, instead of a lump, I have a lump and particles on the screen?---Yes.

The screen will accept the particles and continue to reject the lump?---That is absolutely right.

Which it could not do before?---That is correct.

It might happen accidentally. If you had a piece of clay on the end, dry screening; a piece might rub off - - -

MR HULME (Continuing): - - - might rub off but in general one of the effects of the water to the extent that it detaches fines or breaks down clays, is to offer to the screening function material that was not separately offered to the screening function before?---If it was dry. Yes; the answer is yes.

So, again from the point of the screen in its essence as a collection of apertures, it is looking at material different to that which it would be looking at if it were screening it dry?---It is passing more fractions of undersize than it would if it was operating dry.

At the point of the apertures where the particles come, one can say that on this basis different particles come?---Yes.

Then, as they have come to the apertures the screen then performs its screening function of accepting or rejecting those particles?---That is correct.

In para.11 you say in the middle of it, "Water also washes or cleans the material being screened"?---I have found that.

Assume that you have a screen like, let us say, the Hamersley primary screen - any washing screen doing washing - if you see water coming down on to the material and fines and clays disappearing down into the screen, you are able to say at that point, are you not, that that material has been washed?---I think one would be able to say that. Yes; one could say that.

You would not need to know what had happened to the wash-away water that you had seen disappearing down the screen in order to be able to say that the overs on that screen had been washed?---No; that is a matter of fact that material has been washed with water.

If you have seen the water come on and disappear, pick up some particles and go to the apertures and go away through the apertures, as far as that washing process is concerned you say it is finished?---As far as that wetting and washing, as you say, is finished at that point in time. The event is over.

And you do not need to know whether the water has got to the tailings dam or gone to waste or gone elsewhere; you can say that as far as the washing is concerned, when I see it go through the screen and go away I can say that what is on the screen has been washed - - -

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MR HULME (Continuing): - - - been washed, to the extent that a washing has taken place?---You can say that. That is a correct comment in isolation. I agree with it.

Can I ask you to go to para.12? You say:

> "As in the case of a dry-screening facility....(Reads)....and feed-sizing facility."

I am having some difficulty in understanding what that means. The "feed preparation" seemed to suggest that one was talking part of an overall plant? Can you help me to understand what is said here?---I think in that case I was outlining the separation of functions. They are all preparation facilities in their own right and it is possible to have this feed preparation part in its own right, as a stand-alone unit.

I am not quite following that?---Giving the wet-screening example, which I think is your question, a wet-screening plant may be separate from a main treatment facility such as some kind of concentrator - that is, to prepare the feed, or it may be part of the plant as in the case of the preparation screen which is immediately ahead of a drum. I think I was indicating that these things may be separate or they may be part of stand-alone areas of plant.

I have no difficulty with it as part of an overall treatment plant. I can see wet or dry screening being part of an overall plant but what does it mean, in both cases, to talk of a separate feed preparation and feed-sizing facility? Can you give me an example of a wet-screening plant as part of a separate feed preparation, without being part of an overall treatment plant?---I think there I was making the distinction between, in the Hamersley situation, the Hamersley washing and screening plant as a separate entity as part of an overall plant, with the preparation screen, which is part of a particular plant. That was only the distinction.

The wet-screeningplant we have here could surely be described as part of an overall treatment plant, could it not?---Looking at the overall beneficiation project, that would be right.

The minute you talk "preparation" you are talking in terms of purpose, something further still to come for which you are preparing. That is the difficulty about it? ---I see.

Can I take you on to paras 13 and 14? This is where you talk of the breakdown I asked you about earlier. The things you describe here as happening because of the water are clearly enough in the case of Hamersley meant

to happen. The breakdown is meant to happen?

MR HEEREY: It is difficult for the witness to answer that question when he plainly does not hold himself out as being involved in the design of the Hamersley plant - - -

MR HEEREY (Continuing): - - - Hamersley plant.

OLNEY J: Perhaps the witness can say whether he knows sufficient about it to answer that question. TO WITNESS: You have heard the question. Is that something that is plain to you; that what happens is meant to happen?---I cannot say that what is happening there is meant to happen but I can say that I would expect that in wet screening there may be an accelerated breakdown.

MR HULME: If you were putting ore into drums or if you saw someone building a beneficiation plant involving putting ore into drums and the ore had clay on it, you would expect them to want to get the clay off before it went into the drums?---Yes, certainly.

When you look at the plant, if you say, "What is this plant meant to do? I see it getting clay off", you would have no difficulty in saying, "That is one of the things that this plant is meant to do; to get rid of the clay, as it is doing"?---Yes. The sizing into screens for concentration is the heart of this whole process. That sizing must be carried out properly for the selected concentrator units.

In para.17 you refer back to the operation as described in Mr Langridge's affidavit. You say that in your view the operation is screening. If you were asked to describe what was happening there, is screening the word you would use?---I believe that in the Hamersley washing and screening plant, it is screening that is taking place. I am quite definite on that point.

But if someone said, "What kind of a plant is that; that section of the plant?" would you say, "That is the screen"?---Which section of plant?

Adopting your terminology, I would say, "The wet screening plant". If someone said to you, "What's happening there?" would you say, "Screening is happening" or would you say, "Wet screening is happening"?---I would describe it as a wet screening plant.

If someone said, "It's a wet screen" and someone asked you, "What happens on the wet screen?" your phrase would be, "Wet screening happens on the wet screen"?---That is correct.

If you are then asked, "What happens in wet screening?" you would say, in this particular instance anyway, "Two things happen; ore is washed - - -"

MR HULME (Continuing): "- - - is washed and a classic screening takes place with unders going through apertures and overs not?---I actually wouldn't use the terms that ore is washed. I would have no necessity to use those terms.

You would not use those terms?---I would not use the term "ore is washed."

What would you say?---I would have no need to use those terms. I would not go beyond the need to say that wet screening is taking place. If I was asked, "What does that mean?" - which is your question, I think - I would say that the material is being wet and sized into its two or three fractions.

Yet you have sworn that the material is washed and is cleaned?--- It is certainly cleaned in that wet screening.

You have sworn it. If you look at para.11 you have sworn it is washed. Why when someone asked you what happened would you not refer to something that you swear happens to it?---I think that is a question of, really, degree because if you keep questioning obviously there is washing taking place; yes. It is, in other words, difficult to get wet without being washed, but you are asking of wet screening and what I would say. I believe that facility is set up for wet screening and in that process the ore does get cleaned. That is not where it is totally cleaned and that is why I would call that type of a plant wet screening. This is an important difference, I think.

Is it that you say that because it is not fully cleaned you would not refer to it as having washed or cleaned?--- Not as a primary role but that does happen. That certainly does happen but it is not a primary role. Washing, really, in my view, takes place elsewhere in this total plant.

"More of the undersize articles are removed as undersize and a cleaner oversized material leaves the screen surface." That is what you say in para.11?---Absolutely correct.

You are doing this as part of a process leading to drums which require clean feed?---That is correct.

Washed feed?---In the process of cleaning it must be washed.

You have in the case of streams A and B, the pulping box water, the primary screen water and in the case of stream B the secondary screen water and you would not refer

to anything that happens there in terms of washing?--- Not as the primary function. Washing is inevitable and a cleaner set of particles results but I do not see that as a primary washing function. As I say, I believe washing takes place at a different point.

MR HULME: The washing takes place where?---I say that washing as a primary function takes place at a different point in the process than in the primary and secondary screens.

Where is that point?---That is at the medium recovery screens where wet screening is what is done and a deliberate stage of washing is taking place. I cannot speak for Hamersly but in the Newman situation our international consultants there set up the sprays quite differently to achieve a primary washing function. In that case, what one does is to use floods and sprays: The flood meaning a large quantity of water spilling out and flooding the material to use the volume of water to wash, and floods and sprays are alternated in some particular manner to achieve a washing function - - -

WITNESS (Continuing): - - - function taking away the very fine particles from the much bigger lumps. That,to me, is a primary washing area.

MR HULME: Let us take stream A here. Where do you say it gets washed?---If one looks for more of a washing role, then the correct place to look for that is in the area precisely established for that purpose and that would be on the preparation screens immediately in front of the drum.

Your proposition is, if you were asked, "Where is stream A washed in this process?" you would simply say, "At the preparatory screen above the drum"?---If I had to answer where it was washed, meaning a real washing motion as I understand that word, I would say that is the point where more of a washing function occurs.

If I asked you, "Where is it washed?", what would you say? ---Stream A would be washed on the prep screen if one used that terminology.

And you would regard that as a complete answer?---In the first instance I would say that is the appropriate answer because the prep screen is where there should be little real screening; it is there as a safety step where any residual fines can be taken off so it is a selective screening process at that point. That is why it is called the preparatory screen. This is a feed preparation step as a precise step. That is why I would go to that point to identify more of a washing step. On the primary screens this is a function of sizing into different streams, as we understand it, and there I see a very, very primary role in sizing and I could not look there for any significant component of washing because that is destined to follow at a later point where it is vital.

"Any significant component of washing" - that is - -?---I beg your pardon?

I missed your last few words?---I say that the significant component of washing is at the preparation screen rather than at the primary screen.

Does that mean that there is an efficient sizing process because fines have not come off on those screens? ---Do you mean the primary screens by "those screens"? Is the question directed at the primary screens?

I am talking of stream A and its primary screen. It will only be able to size those particles to let them through if they come loose, will it not?---That is correct.

MR HULME: Is what you are saying, that detachment occurs, they do come, they go through, but that is being done for sizing purposes?---Yes. I believe that. I do not understand the Hamersley design thinking so I can only speak from what conclusions I must draw but Hamersley have been careful to show on the drawings that a primary screen is a primary screen and they identify the next screen, which is the sizing screen following, as a secondary screen. These terms to me are meaningful because, as we understand the crushing process, we have primary crushing and secondary crushing and then, later on in stages, we have tertiary crushing. These words are selected for specific reasons. In the crushing process this is related to the size of the product - - -

WITNESS (Continuing): - - - product that emerges. Consequently, when I look at the washing and screening plant and see that we have four streams emerging in the course of time and that one screen is set up as a primary screen and the other as a secondary screen, I am conscious of the sizing that is being obtained, recognising that the primary step to cut out most of these sizes is destined to take place in that one place; and then, at a later stage in the process, the other essential points of preparation of clean particles to enter a particular concentration process take place.

MR. HULME: As regards the clays and adhering fines on the 30 to 80, the sizing can only be effective if they are got off?---That is correct.

Is that not intended to happen to a considerable extent on the primary screen?---Yes, it certainly is. In terms of efficiency you are looking for a good result but not a totally efficient result.

You are, of course, conscious, when deciding what to put there, that you will be washing again at the preparatory screen?---That is an important point.

Yes, but when you are looking for the good response for your sizing purposes, that is dependent on good detachment for presentation to the apertures?---Yes. In my engineering terms, one would have an objective to do that job well at that point, dependent solely on the feed coming to it.

You have an intention to do well that which is washing but you would not, yourself, attach the label because you say "The reason I want to do it well is for sizing"?---Yes. I see it as a screening and sizing situation, as a primary role, and to me the objective there is so much the predominant one that I see washing, as a word, as a separate point and not as important, in that sense, as at the preparation screen.

Although you would not describe it as washing, for the reasons you have given, the greater part of what I might call "the washing function" in fact takes place there?---That is right. I should make this point, I think. If, at that point, material washed off - was discarded - then I might have a different view, but that is not the case. I am aware of these concepts, of course, so it is important that I acknowledge that, I think.

I am happy to accept that. Then your para.17 follows from your definitions, does it not. Beneficiation takes place. It is a beneficiation which you term screening, for the reasons you have given?---Yes, certainly.

And equally at 18 when you get to the preparation screens and we are washing and this time we can not only wash but we can say we are washing. Beneficiation is taking place

but you call it screening?---I see that as a wet screen and it is defined - - -

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WITNESS (Continuing): - - - it is defined in various places as a wet screening operation.

MR HULME: You were saying to his Honour that you did not regard what happened earlier - or you would not attach the label "washing" to it because you would be looking for where the primary washing took place and the primary washing takes place on the preparation screen?---My point, I think, was that that is a better place to say that a washing function exists but - -

And that is the preparation screen?---Yes. If one had to choose, and I think I was asked to make that choice, that is where I would choose to apply more of a washing connotation but I cannot do that completely because what is washed off, as has been already described, is ore particles and the degradation of the softer material that exists. That ore is recovered, of course. In the case of the 80 by 30 drum the 6mm size is selected, I believe, for the reason that it is minus 6mm that goes to the cyclones and that material then goes to another part of the process, so whilst it is a preparation screen it is also a process screen having a particular process function.

If you were asked to attach your label to what happens on the preparation screen, would you say "washing and screening" or "washing" or "screening" or "sizing"?---I would say simply screening and wet screening because I have had no reason to adopt any other terminology. Working with the international consultants' concern, I still had no reason to change that terminology from either their input or advice.

If I said to you "What happens at the preparatory screens?" you would say "washing happens"?--I would say it is a preparation screen, a wet preparation screen. If I was asked whether a washing function took place there I would say it is inevitable, washing occurs because it is getting wet.

Or would you say, it is wet because we want to wash it?---In that particular case before the drum it is important to clean and that is done with water.

So, at that point you say, we are wetting it because that is part of washing it?---That is part of cleaning that material for the drums.

We will turn now to your second affidavit, Mr Booth. You refer in para.3 to some alternative conceptual designs. It is important that any chute of that kind suit the particular ore and what is being sought to be done with it?---Yes, certainly.

These designs illustrate - - -

MR HULME (Continuing): - - - designs illustrate ways in which the ore would be banged about more than in the chute as it is?---That is not what it really is showing. The drawing indicates that that could happen and it undoubtedly does to a degree but that is not the purpose of the arrangements shown.

It is implicit in para.3, is it not, that these chutes would provide a greater scrubbing effect? Is that not what is being said?---In terms of having an arrangement which, to use the words of others, maximises a scrubbing effect - then these concepts have been provided.

You are saying that any of these would have a greater scrubbing effect than the chute which is there?---Correct.

They seem to hit more things or have more sprays than the chute which is there - each of these designs?---Yes; the two points are primarily that those designs expose more of the feed to water. The idea of the bars or the arrangement of the rock ledges is to split the ore curtain into more component parts and when having split it to expose it to far more water. That is the primary function there; to expose the ore into many more curtains or splits and then drive the water into it in order to slurry the ore in a better way.

All of this is on the basis of producing more scrubbing and you are simply saying that from that point of view these will produce more scrubbing effects?---I believe that the original chute provides practically no scrubbing whatsoever and anything that I could present of this kind would provide an improvement on that.

It would provide more scrubbing effect?---Yes. The scrubbing effect that I can achieve here, I believe to be insignificant because I really would not know how to measure it.

You say these will provide greater scrubbing effect than that which is there?---I believe so.

Whether in the total plant a greater scrubbing effect at that point is desirable is something which you yourself do not know?---No; I do not know their ore.

You have worked from the word "maximise" and said "If you wanted to maximise I could maximise it more. Within the same space I could make that effect greater"?---Yes. I believe these arrangements would achieve a better result - maximise it greater.

MR HULME: You do not believe that, do you?---Maximise it greater.

It would maximise the scrubbing result. Whether it would achieve a better result is just the kind of thing that you cannot say without knowing a lot more than you do about the plant as a whole?---No. I can talk in relativity, naturally. I understand chute designs and I can say relatively there is not the slightest doubt that this arrangement would give a better scrubbing effect.

Can I just ask you - - It will provide a greater scrubbing effect, you would say. Is that not right?---I think the words are the same to be - better or greater.

Are you saying that under all circumstances you want as much scrubbing effect as you can conceivably get?---I have already said that I do not believe there is significant - -

Would you answer my question? You are really not saying, are you, Mr Booth, not intending to say, that - - -

MR HULME (Continuing): - - - to say, that every time we design a beneficiation plant we seek to get the maximum scrubbing effect we can?---I do not believe scrubbing comes into it. I do not quite understand the question?

I am drawing your attention to the difference between saying "We are getting more scrubbing effect" and saying "It is a good thing to be getting more scrubbing effect"?

OLNEY J: I think the questions have to be construed in the context of what they are responded to and that is Dr Lynch's statement; that the box was designed to maximise the scrubbing effect, and this witness is saying "If the object is to maximise scrubbing, I could maximise it - give you better scrubbing, more scrubbing - by doing it in a different way."

MR HULME: And with that, your Honour, one has no quarrel but he has twice gone on and said, once, a better result, and once a better scrubbing effect.
TO WITNESS: What you are really saying is that you would get a greater scrubbing effect with your devices than the one which is there?---I believe so.

If Hamersley looked at your designs and said "We had better investigate whether to do that" they would need to look at how much scrubbing effect they want in good engineering practice?---They certainly should. In my view, there is practically none that I - -

I wonder if you would just answer what you were asked?---I am sorry.

You have assumed (and I do not criticise you for it) that because the word "maximise" is used it was simply a question which could be answered by saying "Here is how to get more; more scrubbing effect could be got this way"?---Correct.

If what was being sought was to optimise rather than maximise and get a certain amount of scrubbing but not enough to do other things, you would need to know more about the material and more about how these chutes work than you do at the present time?---I would need to know about the ore. My reticence with that comment is simply - and I am sorry to come back to it - that the question of scrubbing, to me, cannot occur in this situation.

You can have situations, can you not, where you scrub too much; cause unnecessary degradation?---I could conceive of that with particular kinds of materials, subjected to particular processes. That is a possibility in that particular situation.

What one seeks to do in looking at design, deciding what to do, is to optimise the best balance of different factors, normally, rather than try to maximise one?---This is very hypothetical. I could give a precise answer if I was given something more precise to respond to.

MR HULME: Can we go then to PFB2? You point out that the Newman chute is twice as high as the Tom Price chute.

> "The ore stream is split, tumbled, exposed to more sprays....(reads) ....than is the case at Tom Price."

Your design was chosen with the object of maximising the wetting of the ore - - -

MR HULME (Continuing): - - - of the ore. Can you tell us, Mr Booth, what one is to infer from what you say? It finishes by saying:

> "The Mount Newman chute has never been described or referred to as providing a scrubbing effect."

Is your intention that it therefore follows that the Hamersley one cannot have been intended to either?---I could not say what Hamersley's intent was.

Was is the purpose of this comparison? Why have we got the Newman chute sitting alongside the Hamersley chute? ---I was indicating a wetting process and pointing out that this Newman one illustrates a better method of wetting the ore.

So are we meant to compare them and say, if this is simply for wetting so must the Hamersley one be?---The point of the comment in my affidavit there was related to scrubbing or wetting and as regards wetting, it is illustrated with this Newman chute that a better wetting of ore is achieved.

If the wetting is the point of the comparison will it not depend on what you are wetting?---To some degree that is certainly relevant.

In general it is true, is it not, that the smaller the particles the greater the relative surface area?---Yes; per particle.

Surface area to mass is greater the smaller one is?---Yes.

For that reason fines can be very much harder to wet than lumps. Is that right?---It is the fines that one has to wet.

That sounds very profound somehow. Does it mean the lumps get wet automatically;if you are wetting the fines then the lumps will automatically be taken care of?---No. It is, indeed, perhaps profound in that the Pilbara ores are difficult to wet and, of course, it is the finer particles that are the ones that are difficult to wet.

In the Hamersley pulping box they are wetting nought to 80?---Yes, I understand that.

What are you wetting in this chute at Newman?---In that particular location the ore there is about minus 6mm or minus 10. It is in that range.

MR HULME: You are comparing a chute for wetting fines with a chute for wetting nought to 80?---Yes.

Which are two very different things, are they not?---They are different in the size of the ore but the wetting is wetting that fines fraction. It is the fines that one wants to get through the screen deck. It is the fines that one is trying to get through and wash through and that is what has to be wet.

Here you have a throughput merely of fines?---Correct.

Did it not occur to you - - - 10

MR HULME (Continuing): - - - to you that you should have pointed this out to those who might be comparing these chutes; that they were being used for ore feeds of different sizes?---I don't think that is tremendously relevant as I was only illustraing a point, a point regarding wetting. Why it is, perhaps, not so relevant is that in fact, as I understand the sizes of the screens we are talking about, the screen sizes are similar, so in other words the fines content going through is similar. In other words, the screen following this Newman wetting chute has a similar surface area - it is slightly bigger in fact - to the one located at Hamersley serving the same function; consequently the amount of feed of this size range which is being wet is similar and I didn't think that was sufficient to change the illustration regarding a point of how to wet the material.

One would also need to look, would one not, at where the ore goes afterwards; that is, is it going to be wetted more elsewhere?---That is another consideration.

In the case of Hamersley the fines will come through onto the primary screen and will be wetted there?---Yes, that is right.

And will go onto the second screen and will be wetted there?---That is also correct.

And will then go away in a stream of water towards sieve bends and screens?---That is right.

Here in Mount Newman, am I right in thinking that you come out of that chute into the sieve bend?---It goes almost immediately onto the sieve bend. That is correct.

Would you look at this booklet which is the exhibit 20 which is in for identification - Mount Newman Mining Beneficiation Plant - -

OLNEY J: No; it is MFI 20. I think this might be an appropriate time to adjourn.

LUNCHEON ADJOURNMENT

H50. 2.15

UPON RESUMPTION:

MR HULME: Mr Booth, I would ask you to look at exhibit 20, which is marked for identification? Turn over the first inside page. Is that a diagrammatic presentation of Mt Newman's beneficiation plant, as a whole?---Certainly.

Can you give us a rough idea of the dimensions involved? Let us say one starts near the bottom, left-hand corner, the main sub-station?---Yes.

And goes up along, roughly, the length of it, on the middle of the right-hand page, to No.3 "Primary crusher". Can you visualise that line along there?---Yes.

What kind of distance are we talking about?---Somewhere 250 to 300 metres, I think.

The diagram is roughly to scale, very roughly?---Yes, that is the case.

Just to see where the wet screening plant works, the mountain up at the top is the stockpile?---Yes, there is a stockpile situated in the left-hand corner, which is a small stockpile.

The ore comes in through what is called their No.3 primary crusher?---That is correct.

Down past oil coolers, up a Luna Park-looking kind of belt, into the secondary crushing?---Yes.

That is all the ore?---Yes.

From that secondary crusher do the 6 to 80s go to the dry-screening plant, the over-sixes?---No. At thatpoint there is a secondary crusher screen which allows some material under 100mm to by-pass the crusher and then it is recombined, so 100 per cent of original feed leaves the secondary crusher on its way to the dry-screening plant.

So everything comes up to the dry-screening plant on the right and then, if it is 6 to 80 it leaves the dry-screening plant, goes along a little to its left, and then does a 90-degree turn to the left and comes to the drum plant?---That is 6 or 10. I am just not certain now because that was changed, but it is in that sort of order. That is 100 down to about 6mm.

And 6 down to nothing continues along back in the direction of the secondary crushers and then does a 90-degree turn and comes up to the wet-screeningplant?---That is correct.

That is the ore about which we are talking, 0 to 6, for the chute? ---That is correct.

MR HULME: If one goes over three pages, turns three pages, do we have a page called "ore-handling plant"?---Yes, I have that.

That shows from left to right the primary crusher, which is dry, the secondary crusher, which is dry, the dry-screening plant which everything has gone through, and then we come to the wet-screening plant and at the time this brochure was put out it was certainly operating on 6?---Yes.

~~Is~~ that minus-6 ore put - - -

MR HULME (Continuing): - - - minus-6 ore put in the first place into a surge bin which is there at the top - the large white blob - from which it comes down into a component beginning at the bottom left of the surge bin but does not have a name attached to it?---That's correct.

That is the chute we are talking about?---That is exactly the one.

From that chute there is then a small kind of grey coloured connection and the material is brought onto a sizing single deck screen?---Yes.

Is that grey connecting item, in fact, a sieve bend?---That's correct.

Its main function being to dewater the flow before it goes onto the screen?---It dewaters and removes a lot of the fines that would otherwise make the screening operation less efficient.

It is the kind of function that we have heard spoken of by other witnesses?---I think so.

That means, does it not, that in your chute is the only place where that minus-6 mm feed acquires water before going onto the screens?---That's correct.

It goes on instantly afterwards and, in fact, a good deal of its water is taken out in the sieve bend?---A good deal of the initial water is taken out there.

The additional water, yes?---That is correct.

I do not mean the feed is dry - the water goes off. The fact that it is going to go instantly out of the chute into sieve bends and onto a screen is different from the situation at Hamersley, is it not?---Yes, indeed.

It is going to get two more lots of, in a sense, unnecessary water on the primary screen and on the secondary screen and then flow down - - Is it called a launder pipe?---Yes; that will be a launder transferring Hamersley's underflow from the primary screen towards the sieve bend.

If you were being responsible for the design of a plant and one of your young men brought along a drawing and said, "Here you are. I have just designed a chute. It ought to do the job" you would need to know, would you not, not only the feed he was trying to wet but also whether it was going to get wet elsewhere

before it got down to the business end of life on the screen that was dividing it?---Yes. I would need to know the whole of the facts.

MR HULME: One cannot draw comparisons between different chutes just by looking at the chutes; you have to look at where they fit into the total system?---For a proper identical comparison that must be true.

I ask you to turn back to the first picture we looked at, the plant layout - - -

MR HULME (Continuing): - - - plant layout?---Yes.

You have said it is the beneficiation plant but I just want to ask you, you would regard all of those components, right back to the primary crusher there, as being part of that beneficiation system?---The Mount Newman situation is a little more complicated so the answer is 'no' for specific reasons.

Which part would you not regard as part of the beneficiation plant?---The facility nominated as the dry screening plant was in existence from the early 70s and was not established as a part of the beneficiation plant project so the first point, as a matter of clarity, would be to say that whilst what is on this sheet is the beneficiation plant project, the dry screening plant previously existed and was excluded from the construction.

Just let me understand that. You would say it is now part of the beneficiation plant, would you?---It is integrated into the beneficiation project as a whole, yes.

Would you not go beyond that? Admittedly, if you were building the plant you might not be able to claim credit for having built that as beneficiation plant but it is incorporated into the plant now, is it not?---Yes, it is.

If you were having trouble with that particular part of it you would say, "We've trouble with part of the beneficiation plant"?---Yes; that is integrated now.

I follow the qualification you have made for history. Is there any other qualification?---Yes. The second qualification is that this beneficiation project is linked to the other crushing systems in two ways. To the top of the page from the dry screening plant is a conveyor noted as M12 and that conveyor is a feed conveyor from the No.2 primary crusher and secondary crushing circuit. That is put there so that the other crushing lines can provide feed to this beneficiation project. Similarly, at the bottom of the dry screening plant is a conveyor unnumbered which is running in the opposite direction to M13, that is towards the right, and the purpose of that is to allow material coming in through the No.3 primary crusher to the beneficiating plant project to, in fact, go back to the No.2 screening plant which is a direct shipping plant.

Yes, I follow. Accepting those two qualifications,what appears is the plant?---Yes.

For instance, looking at the very end, a sample station: I suppose the essence of a sample station is that it does not alter anything; it takes a sample and tests it? ---That is correct.

MR HULME: You would still regard that as part of the beneficiation plant?---Yes, indeed.

Mr Booth, you have been good enough to do some sketches for Hamersley. I will make a suggestion for the Mount Newman plant. Do you follow?---Yes.

Let us just look at it. We have here the dry screening plant screening at 6 to 100 off from what is below that? ---Yes.

I appreciate that you have said it may vary?---Yes. I assume that is noted.

At the time of this brochure, if you look at that plant layout on the right-hand side, you will see it in terms of 100 to plus 6?---Yes.

Being dry screened - - -

MR HULME (Continuing): - - - dry screened for purposes of beneficiation?---Yes.

You were responsible for the design of it - this particular plant?---Yes.

You designed to screen that dry?---Yes.

On the basis of that being that you could perfectly well screen that ore at 6 mm for the purpose of directing the two streams into beneficiation?---Yes.

It does not surprise you with Pilbara ore, does it, that you can screen it dry at 6 mm?---No.

What if I then said to you, "Look,when I look at this dry screening plant I see the 6 to 100 going over towards the drums" and I go over a couple of pages - - I turn over to a blue, red and grey page with the word "Concentrator" on the top left hand side. That is the drum plant?---Yes.

The dry material comes in at the left-hand side to the surge bin - that white 500 ton surge bin?---Yes.

It comes down into preparation screens and then straight into the Wemco drum separator - the barrel looking object sitting in the middle?---Yes.

I say to you, "Look, I am prepared to help Mount Newman. Hamersley is talking a bit about these things. They say you get a better result rather than just wetting that ore at the last minute. It gets wet for the first time before it goes into the drum. You get a better result if you wet it earlier. Your clays would break down more and you would get a better separation in the drum"?---Yes; if that was the case, that would apply.

I beg your pardon?---That would apply if that ore - -

That would apply if what?---If the ore was of that kind.

If the ore had clays that broke down?---Yes.

If the ore had clay that broke down you would do it before so it had time to break down?---Except here, of course, we are dealing with plus-6 material.

You are dealing with plus-6 but at Hamersley we are dealing, are we not, with 6 to 30 and 30 to 80; but the Mount Newman ore does not have the clay, does it?---No; there are no water active clays in the Mount Newman ore.

MR HULME: No water-active clays; therefore, knowing that you can satisfactorily screen at six and knowing that you do not treat material unless you have to, because it costs you money and it is wasting it unless you have to, and knowing that it will give you an adequate proper performance if you wet it at the last minute just before it goes into the drums, that is what you did- - -

MR HULME (Continuing): - - - you did?---Yes. It was in fact a little more important than that, the process, for another major factor.

Yes, but they are essential parts of it, are they not? You did not have to screen it to dry it? I am sorry. You did not have to wet it to screen it, so you did not, and you did not have to wet it to break down the clays, so you did not, but you did have to wet it to put it in the drum, and you did, to get anything off it that was there, and you did it at the last minute, very sensibly?---In fact, because of the ore type Mt Newman has, that is necessary. Mt Newman ore has another water-active feature because the shales break down.

Yes, so you set up this scheme which suits the ore best from the point of view of the result you are going to get out of the drum?---Certainly.

With the Hamersley ore, I suggest, you have no reason to think that it does not screen adequately dry at 6mm?---I have good reason to think there would be problems at 6mm.

You know they screen about 40-45 million of the direct-shipping ore a year, or 30 million, or whatever it is?---Yes.

At 6mm?---That is similar to the work we were doing at Mt Newman when I was there. That was similar to the screening operations at Mt Newman when I was there.

A straight, dry operation at 6mm?---Yes.

That is what you have in this concentrator?---Yes. The Mt Newman ore does not have the clays and screening at 6mm with iron ore is easy.

But what you can - -

MR HEEREY: Sir, I think the witness was interrupted?

MR HULME (TO WITNESS): Do you wish to say it again?---Yes. It is important, I think, for me to say matters that are important to answer that question. The screening at 6mm at Mt Newman, without having clayey material, on run-of-mine, low-grade ore, is something which can be as easily accomplished as with run-of-mine, direct-shipping ore. I do believe, in the Hamersley case, where they do not have ore - -

Do you know about the Hamersley case?---I do, because I was very careful in the design of this plant to make sure that we were not going to encounter ores that would give us trouble and being aware that Hamersley's ores were a little harder to handle wet than Mt Newman ores was, in some ways, reassuring. It helped me proceed along this path which is so different from that which Hamersley have used.

MR HULME: One of the basic things is if your ore is already dry and you can screen it at 6 satisfactorily, you will do so?---Certainly.

If Hamersley brought 30 to 80 ore and wet it at the last moment before the drum, there would be a bad result in the drum, would there not, if there was clay on it?--- There could be if the clay particles lie in that range, and that I do not know.

No. We have been told about that.

I will tender that document absolutely, your Honour.

MR HEEREY: Your Honour, in my submission it is quite proper to tender those parts of the document about which the witness has been asked, and indeed I would have called on my friend to tender them had he not done so, but apart from that I submit the document is not admissible as a whole.

The parts about which my friend asked questions (the pages are not numbered) are the two pages described as "Plant layout", the two pages headed "Ore handling plant" and I think the one page headed "Concentrator".

MR HULME: Your Honour, I do not know how far all these surrounding circumstances are going to be said. A lot has been said earlier about the construction of this concentrator; that it was Hamersley's decision - - -

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MR HULME (Continuing): - - - Hamersley's decision.I think the remark was made, "There was no consultation with the royalty owners." Your Honour will remember that early part as if there was something wicked in having a concentrator or beneficiation plant. We would say that if anything of that sort is being said, then the ways that other companies speak about their beneficiation plants, how rather proud they are that they built them, is of relevance to the view that your Honour would take - -

OLNEY J: But, Mr Hulme, the witness so farhas been directed to three separate parts of this booklet.

MR HULME: I will ask him whether he thinks the whole document is reliable or authentic.

OLNEY J: Yes. If he gives some evidence about it, it may be admissible then.

MR HULME (TO WITNESS): Mr Booth, can you identify this document as one which is prepared by Mount Newman and which they make available to people who ask questions about the beneficiation plant or who visit Mount Newman? Is one of these left waiting by your bedside to tell you about the plant?---Fortunately not but, more specifically, this booklet was prepared by the public relations department which has quite separate objectives from the engineering department and it was prepared specifically for the opening ceremony at the time that the Premier and the group travelled to the Pilbara for that purpose. So it is very much the glossy public relations document. It was available, I think, after that for some limited distribution but I really do not know whether it is still available.

OLNEY J: Have you ever read it?---I read it during the opening ceremony.

You were not listening to the Premier?

MR HULME: Mount Newman, presumably, does not let the public relations department just write descriptions and send them off into the world without them being looked at by an engineer?---I do not know. I believe one of my engineers did go through this to help them make sure it was technically correct but I cannot be certain of that.

Can you draw our attention to inaccuracies?---For one point, I am not certain about the minus 10mm or minus 6mm as recorded in this document because, at one stage, we were designing for minus 10mm and quite honestly I have forgotten and that is why I had to make that point.

MR HULME: I am asking you whether it was accurate at the time. It is not meant to be a crystal ball as to what would be done in the future. We accept what you say, that that 6 may have been changed to 10?---Without reading it word for word, of course, I would say this is a generally good public relations document and I do not think there would be any significant technical errors.

OLNEY J: I am prepared to admit it on that basis and particularly the pages that have been specifically drawn to the witness's attention will, of course, be of primary importance.

EXHIBIT EXHIBIT 20 .... Mount Newman document. (Formerly MFI 20)

MR HULME: The other document I would ask to be shown to Mr Booth is exhibit 21 marked for identification. This is the operations guide.

MR HEEREY: We do not have a copy of this document, your Honour. We asked for one the other day but my friends did not have one. It underlines the difficulty in dealing with documents by a company which is not a party to the proceedings.

MR HULME (TO WITNESS): I take it you have seen this publication before or earlier editions of it as it is kept up to date, no doubt?---I have seen earlier editions but I notice that this was published and it says, "The information contained was correct at June 1st, 1980." At that time, of course, I had left Mount Newman.

That was soon after you had left Mount Newman - - -

MR HULME (continuing): was relevant then, I can say I saw the earlier versions. In general, there was some common thread running through these, so this is probably something I could generally accept.

The text is somewhat altered as new plants are built or anything of that sort?

OLNEY J: Am I to take it they corrected your errors after you left?---Your Honour, I am not aware of public relations departments even owning up to having error.

MR HULME: I tender that absolutely.

OLNEY J. (TO WITNESS): That is a document put out by Mt Newman public relations department?---Yes.

You say that generally you can accept what is in it?---As far as it develops on previous issues, I would believe it to be something I could expect to be generally familiar with and understand.

I will accept it as an exhibit on that basis. Hopefully, if it is sufficiently important for me to read, I will be directed to those parts which I should read.

EXHIBIT — EXHIBIT 21 .... Document issued by Mt Newman public relations department.

MR HULME: It has become a rule that no-one is allowed to leave the witness box without talking about sieve bends? ---I see.

In the usage you had of it at Mt Newman you say it had two functions, de-watering and reducing the volume of the pulp to be put onto the screen immediately afterwards?---Yes. The prime objective in a design context is that that screen is there to try and remove as much of the very fine material as possible, so that the vibrating screen can be sized to its optimum. That means that if the sieve bend was not there the amount of vibrating screen capacity installed must increase to make up for the fact that the concentration of fines is then on the vibrating screen and that would prevent the stratification and the screening efficiency. So the prime purpose is to do a task ahead of the vibrating screen, which then enhances the efficiency of the whole.

If you did not have the sieve bend you would have to have something else which reduced the water flow in some way, would you not, before putting it all onto the screen?---Not necessarily, but if the same quantities of water were introduced as would be introduced if a sieve bend was there, then some other device might be needed.

MR HULME: That is a common situation, is it not, of having a sieve bend before a vibrating screen?---In the cases similar to that we are talking about, I would think it is.

The mechanical classifier, you would agree, is not a screen? ---I do not term it a screen.

Because it does not have apertures, it works on a different basis. It is as simple as that?---I think that is good enough for the purpose.

RE-EXAMINED BY MR HEEREY:

MR HEEREY: You said this afternoon,in reference to the screening of ore at 6mm at Hamersley, that there would be good reason to think that there would be problems screening at 6mm. That was with dry ore. What did you have in mind when you spoke of "good reasons"?---As I mentioned, in the Newman case the low-grade ore has similar constituents to the high-grade ore, with additional shales but no real clays. In the case of the Hamersley ore, I believe that is not quite the case and that there are clays and these clays would appear in the smaller fractions, in the main, and then the screening of 6mm material with their low-grade ore feed would, I believe, be much more difficult because of the change of the nature of the feed.

Is there anything of particular significance about screening at the 6mm level in the Pilbara?---To me, talking in engineering terms now of accomplishing the tasks one has to do, the 6mm deck is the key deck in the Pilbara. That is because the products that are sold from the Pilbara almost totally are - - -

WITNESS (Continuing): - - - almost totally are in two ranges; one is 6 mm to 30 mm commonly called lumpy ore and the other one is minus 6 mm termed fines. In the case of the lumpy ore the specification calls for the usual grade qualifications but also provides a penalty should there be an excess of fines in that lump ore. Consequently the real challenge in producing to the market place, in the Pilbara, is to accomplish efficient screening on the 6 mm screen deck. It is a key element in the total process. With the high grade ores, if there is too much water it can give problems on that screen deck and if there were some times where the clay content or alumina is rich, which can sometimes happen, then in many cases those 6 mm decks, in my experience, will blind; that is, they will get so matted with the damper high alumina fines ores that the screening process is inhibited; consequently the 6 mm deck is one that requires due attention in the process of design.

MR HEEREY: Incidentally, you said in evidence that while you were at Mount Newman you had occasion to visit the Tom Price plant. Was there any particular reason relative to your own duties at Mount Newman why you engaged in these visits to Tom Price?---This was undoubtedly of interest to me personally but it was also a courtesy because the director responsible for the Tom Price beneficiation plant and concentrator project and I each visited one another's projects. That was a return visit on my part.

You have also said in your affidavit that you had overseas visits to iron ore establishments related to the work that you were engaged in in designing the Mount Newman plant. In your experience both internationally and in Australia, what do you say as to the degree of readiness or otherwise with which people in the industry are shown around other plants?

MR HULME: I do not see that that comes out of my cross-examination.

OLNEY J: I suppose it might. It is obviously going to be relevant but we will wait for the answer.

WITNESS: The readiness for exchanges of visits between iron ore producing companies' plants?

MR HEEREY: Yes?---I find that to be of a high and genuinely insterested level.

OLNEY J: It seems every witness so far has been to every other

plant,practically.

MR HEEREY: It does not seem a very secretive industry at all, your Honour. The trouble is to find a plant that is not on strike, your Honour. That seems to be one of the major problems.
TO WITNESS: You were asked about the decision that you made at Mount Newman as to whether or not the ore would be wet before going to the drums for the larger fractions. Do you recall that?---Yes.

You said there was another major factor. What did you have in mind there?---We were very concerned when designing the beneficiation plant at Newman for one particular reason. Whilst we believe that we had the knowledge and the ability to handle these procedures dry and even offer something to others around the world from our experience, when it came to tackling a wet plant for the first time that, to us, was a new experience and therefore our main concern was how to handle the ores and ore material when it became wet - - -

WITNESS (Continuing): - - - became wet. In establishing this very clearly in relation to the Newman plant we were able to establish that the shales we were dealing with, which were the problem material there, did start to break down due to the influence of water but only after some 15 minutes and this was a very crucial point. If that point was not true in practice then the Newman plant would not perform well at all. We relied on the fact that the ore being wet just before it went into the drums would emerge at the other end before it had a chance to really, significantly, break down.

MR HEEREY: You were asked about the matter of spending money on the various operations which the ore is subjected to. If one looks at the wet screening plant at Tom Price, as compared with the part of a plant where the drums, the cyclones and the whims operate, are you able to say in very broad general terms whether they are likely to be of comparable cost or whether one is likely to be more costly than the other?---In the Tom Price situation?

Yes?---The facilities contained within the concentrator areas, the drums and cylones and so on, I would expect to be much more capital intensive than the Hamersley washing and screening plant.

In terms of operating costs, are there any features relevant to the drums, cyclones and whims as against the wet screening plant which make one more costly than the other?---The operating costs of the cyclone plants are recognised as being exceptionally high in comparison with other plants because of the pumping horsepower required to circulate all of the material to the height required at those plants and also in moving it around as it has to be moved around.

What about the operation of the drums in terms of operating costs? Is that an expensive item?---The drums would be expensive but not to the degree of the cyclone plant on a per unit cost basis for a number of reasons, one of which is that the drum plant would normally handle more ore, with more ore lying in that range, in Hamersley's case, 80 down to 6mm.

In terms of operating costs, comparing on the one hand the drums, cyclones and whims and on the other hand the wet screening plant, how would you expect the operating costs to compare between those two components?---I can only say that the concentration facilities would have a much higher level of operating costs than the washing and screening plant.

WITNESS WITHDREW

IN THE PRIVY COUNCIL NO. 28 of 1985

ON APPEAL
FROM THE COURT OF THE SUPREME COURT OF WESTERN AUSTRALIA

B E T W E E N :

HAMERSLEY IRON PTY LIMITED	Appellant (Respondent) (Plaintiff)
- and -	
1. THE NATIONAL MUTUAL LIFE ASSOCIATION OF AUSTRALASIA LIMITED, 2. LANGLEY GEORGE HANCOCK, 3. ERNEST ARCHIBALD MAYNARD WRIGHT, 4. HANCOCK PROSPECTING PTY LTD, 5. WRIGHT PROSPECTING PTY LTD AND 6. L.S.P. PTY LTD	Respondents (Appellants) (Defendants)

RECORD OF PROCEEDINGS

PART I
VOLUME III

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