

Mineral Sands Mining on the Gold Coast

Yesterday and To-day

What are Minerals Sands?

Mineral	Composition	SG	Conductor	Magnetic	Typical %
Rutile	TiO ₂	4.2	Yes	No	32 - 35
Zircon	Zr ₂ SiO ₄	4.5	No	No	35 - 40
Ilmenite	FeO TiO ₂	4.6	Yes	Yes	23 - 25
Monazite	(Ce,La,Yt)PO ₄	5.2	No	Yes	0.2 -0.5

Very Early History

- First mining of East Coast beaches was for the recovery of gold from black sand layers in 1870s on beaches near Ballina.
- The gold was usually 825 to 925 fine due to its silver content and was valued at about 4 Pounds per ounce.
- The best year seems to have been 1877, due to stormy conditions, when reputedly 2700 ozs were recovered for the year.
- By 1890, the beaches had been worked over and interest moved to the back dune areas leading to the McAuley's Lead at Jerusalem Creek, between Evan's Head and Iluka, being worked over a distance of 3 kms from 1895 to 1896.
- In June and July of 1878, it is reported that a party mined for gold near Currumbin Creek , recovering 15 to 25 grams per week.
- This seems to be the first recorded beach sands mining on the Gold Coast.



Illust. 7. Working beaches near Ballina, circa 1890. Note feeding black sand, hopper, amalgam plate, and sluice or table (carpet lined).
(By courtesy Richmond River Historical Society)

Background Developments

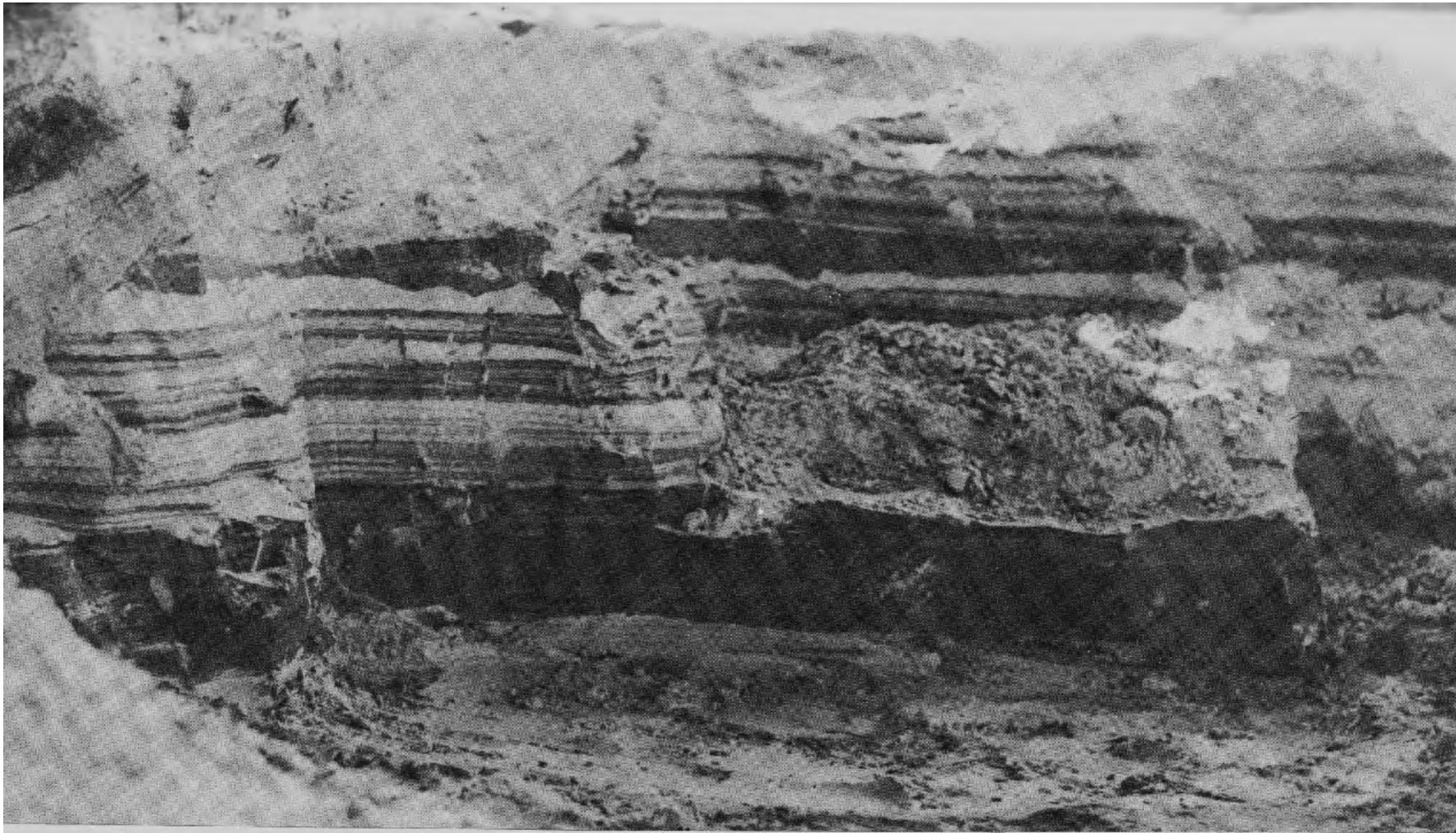
- While this gold mining was going on, technical developments that would impact on mineral sand mining were happening elsewhere.
- In 1870, TAMCO, in Niagara Falls had discovered how to smelt ilmenite to make titanium alloys.
- In 1908, they also made the first titanium white pigment by fusing ilmenite with Na_2CO_3 , washing with water and then HCl to precipitate TiO_2 . It was found to be superior to previous lead and zinc pigments due to its opacity, brilliance, spreadability and non-toxicity.
- At this time, TAMCO also produced a refractory, "ZIOXIDE", based on zircon and zircon based refractories were being more widely used for high temperature castings.
- In 1912, the sulphate process for making titanium white pigment from hard rock ilmenite in Norway was discovered by testwork funded by the Govt. of Norway.
- In 1919, electric arc welding using Alternating Current was invented but took some time to take off but then created a demand for rutile as a welding rod coating flux.

The Real Beginning

- In 1928, TAMCO sent a geologist to Australia to look for deposits of rutile, ilmenite and zircon, but particularly, zircon.
- During this visit he met Alf Neumann, a local builder, who was part owner and caretaker on a small plant near Flat Rock Creek, Tugun.
- During this visit, the plant was operated to produce a sample of cons for TAMCO in USA but nothing came of it.
- This plant had been established in 1928 by a group of families, who spent their holidays there, with a capital of \$20,000.
- The plant was bought from the Finney's Hill silver lead mine at Indooroopilly and consisted of pumps and tables run by a suction gas engine.
- It was designed to treat 200 tons per week and produce a cons containing gold, silver, tin and platinum. Ilmenite was a by-product. A parcel of cons was sent to England with no known result. It was an unsuccessful venture but it was a start.

The Take-off on the Gold Coast

- By the late '30s, there were 3 main mineral sands mining companies on the East Coast , Zircon-Rutile Ltd(Byron Bay), TAMCO (Yamba) and Metal Recoveries Ltd (Ballina). The first two were interested in zircon and the third, rutile/ilmenite.
- Then WW2 started and brought the first boom period due to increased demand for rutile for welding rod coatings for the building of Liberty ships, etc in USA.
- TAMCO operations moved to Cudgen Beach and Metal Recoveries to Mooball.
- In 1940, Mineral Deposits Syndicate was formed by entrepreneurs Knowles (Canadian), Moffatt (Scot) and Watson and started mining at Little Burleigh. Knowles brought to the syndicate the leases at Little Burleigh and approval to mine from the Nerang Shire Council.
- In 1941, MDS produced 1000 tons of mixed concentrate, valued at \$15,116.
- In total, 1750 metres and 15 hectares of Burleigh Beach were mined over 20 years.
- In 1942, Rutile Sands started a small plant at Currumbin, mining beaches south to Coolangatta



Illust. 5. Rich mineral seam, 77mm thick, Broadbeach, March 1949. (By courtesy Mineral Deposits Ltd.)



Illustr. 11. Hauling black sand from beach by horse and dray, Yamba, circa 1935.
(By courtesy late W. H. Derrick)

Illustr. 12. Hauling black sand from beach by trucks and diesel locomotive, Yamba, circa 1937. (By courtesy late W. H. Derrick)

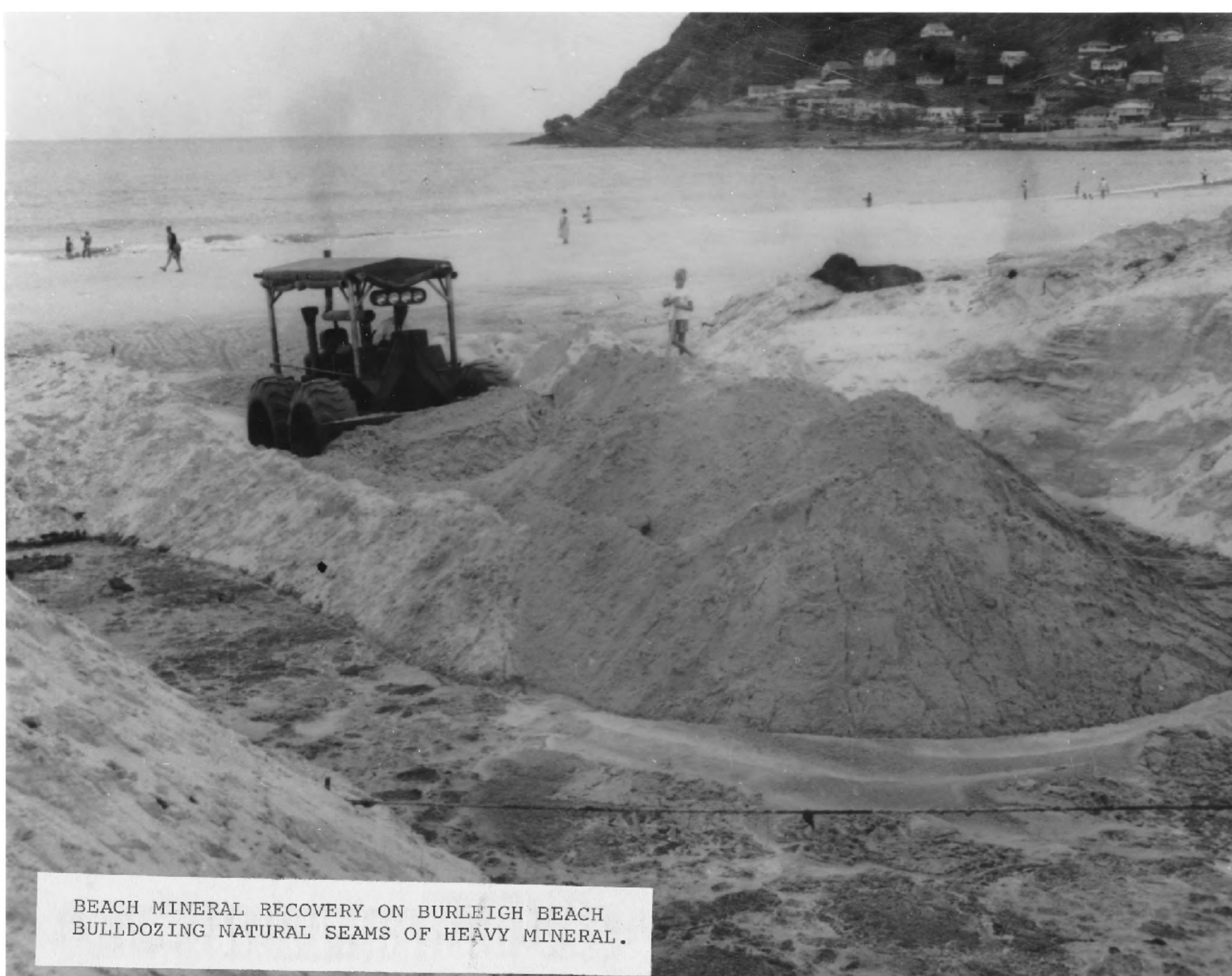




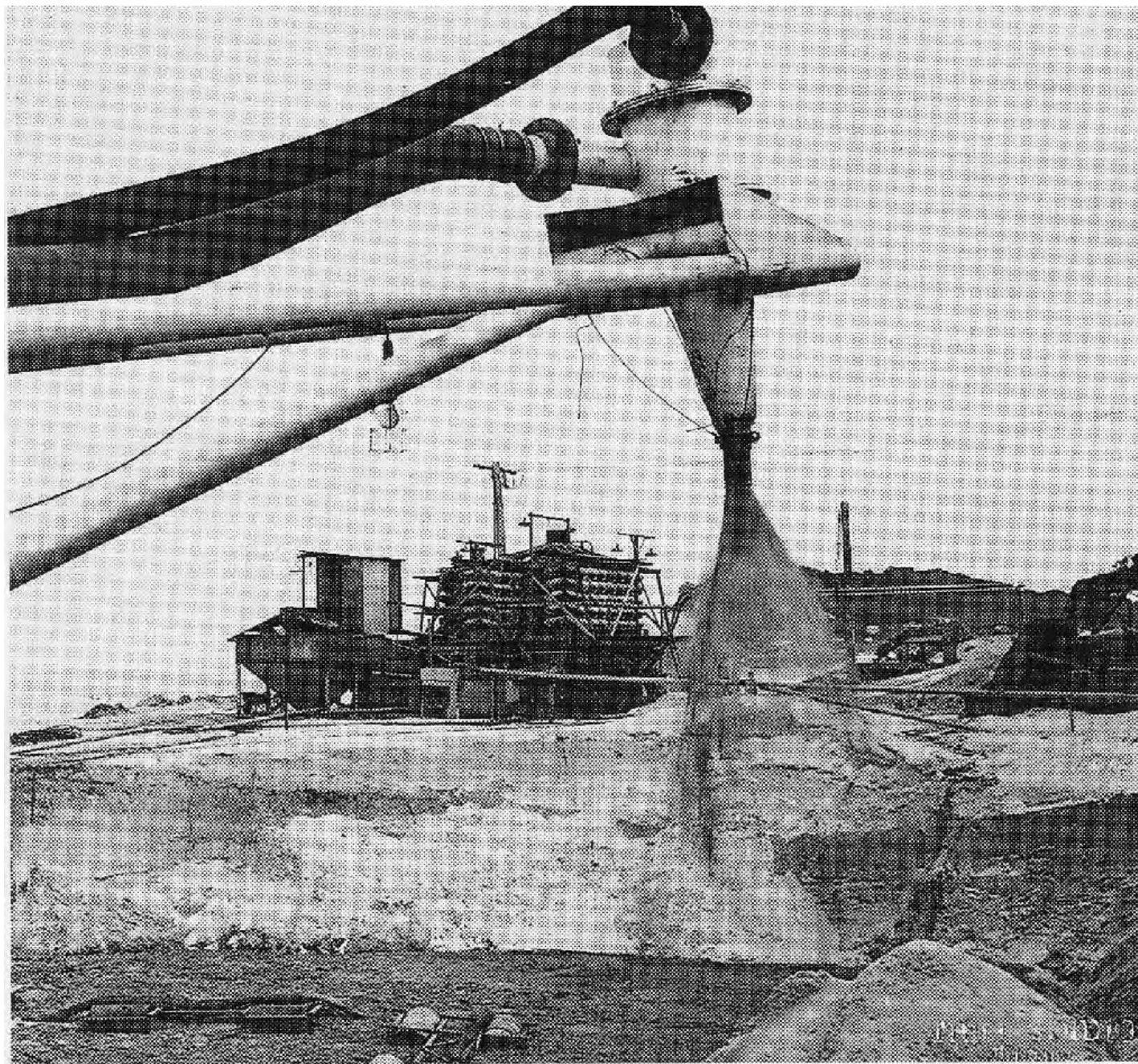
Recovering mineral sands northern NSW, late 1930s.



DRAGLINE BEACH OPERATIONS 1949
ERA DIRECT RECOVERY FROM NATURAL SEAMS



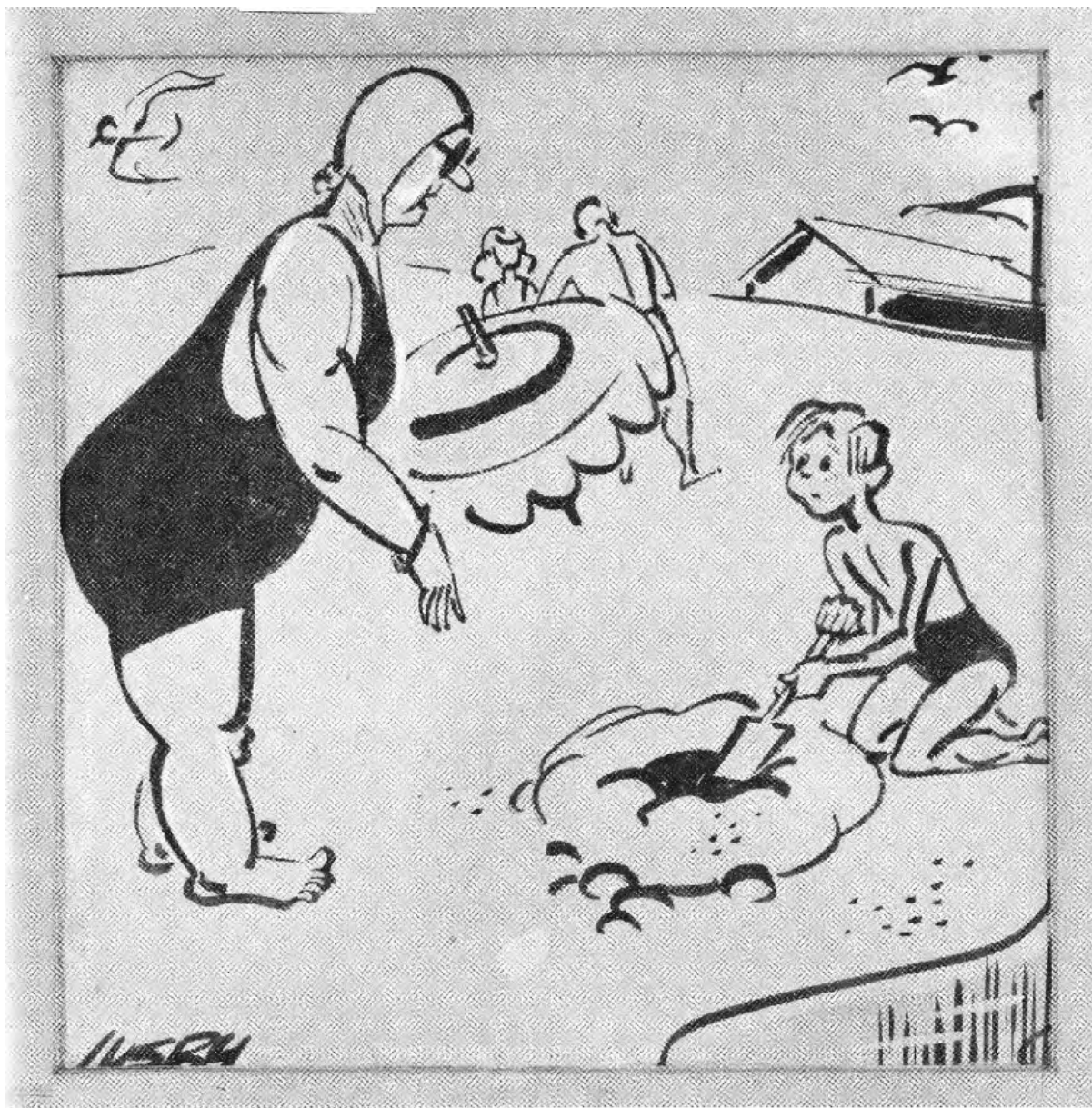
BEACH MINERAL RECOVERY ON BURLEIGH BEACH
BULLDOZING NATURAL SEAMS OF HEAVY MINERAL.



Spiral plant at Burleigh Heads, 1944.



SPIRAL PLANT RECOVERY ON THE
BEACH FRONT NORTH BURLEIGH 1954.



Illust. 25. "Only digging for mineral sand indeed! D'you want to cause erosion!"
(Lusby, *Courier Mail* (Brisbane), 17 November 1950. Original owned by author.)

The War Years

- By 1943 TAMCO parent company in USA had become National Lead Co and was buying mixed cons from both TAMCO and MDS. A long association began.
- In 1943, MDS installed a dryer and a second hand magnet to produce a cons containing 45-50% rutile and 45 – 50% zircon and a monazite product for its cerium content. This plant was located in Brighton Parade where the Rivage Royal building now stands.
- By late 1945, MDS was installing electrostatic separators to produce clean rutile and zircon concentrates and had become a major producer.
- Rutile Sands enlarged its plant at Currumbin and worked the beaches between Coolangatta and Tallebudgera Creek
- At the same time, Southport Minerals were mining beaches at Broadbeach and had erected a small tabling plant in an old quarry, corner of Ferry Road and Pinter Drive.
- Meanwhile, TAMCO at Cudgen had ramped up its production for the war effort and produced on average 28,700 tonnes/year of mixed cons from 1940 to 1943. In late 1943, TAMCO installed electrostatic and magnetic separators from USA and started producing rutile and zircon products.
- The Murphys (Tweed River Syndicate) started a small operation at Cudgen in 1943 and produced 4,500 tonnes of mixed cons by 1945. Grades in situ were reputed to be 60 – 80% heavy minerals.



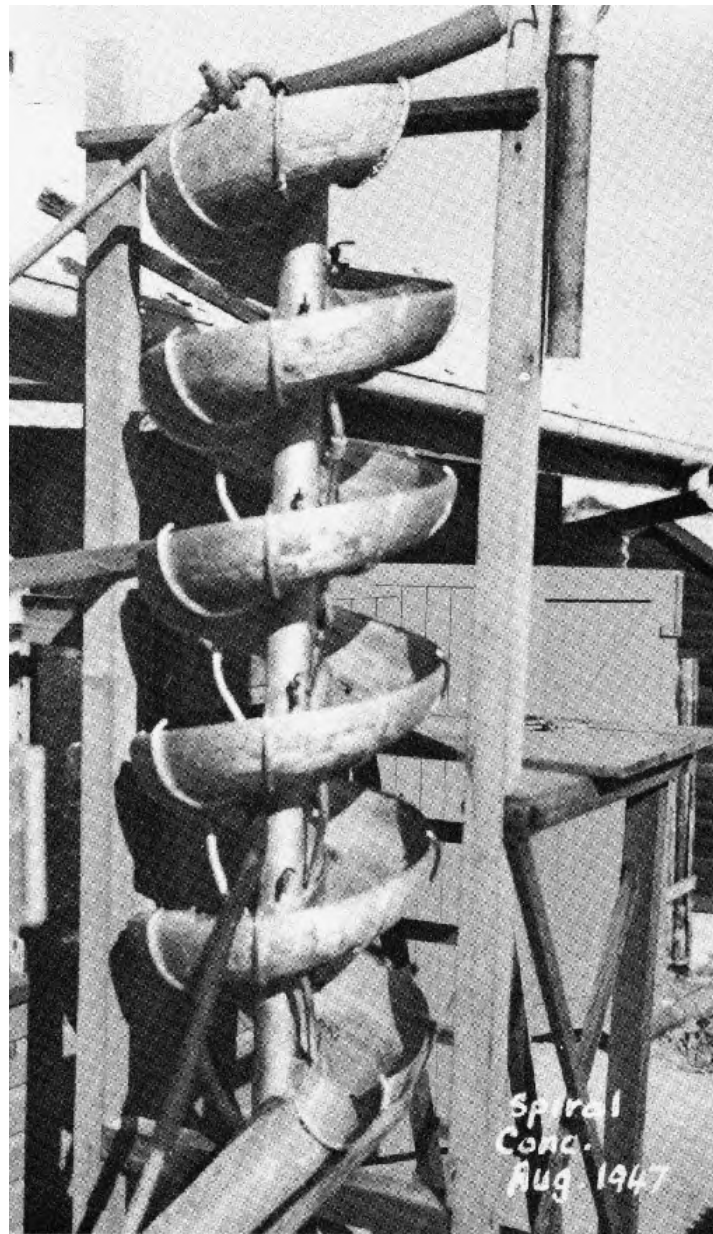
Aerial view of Southport 1969

The Innovators – Joe Pinter

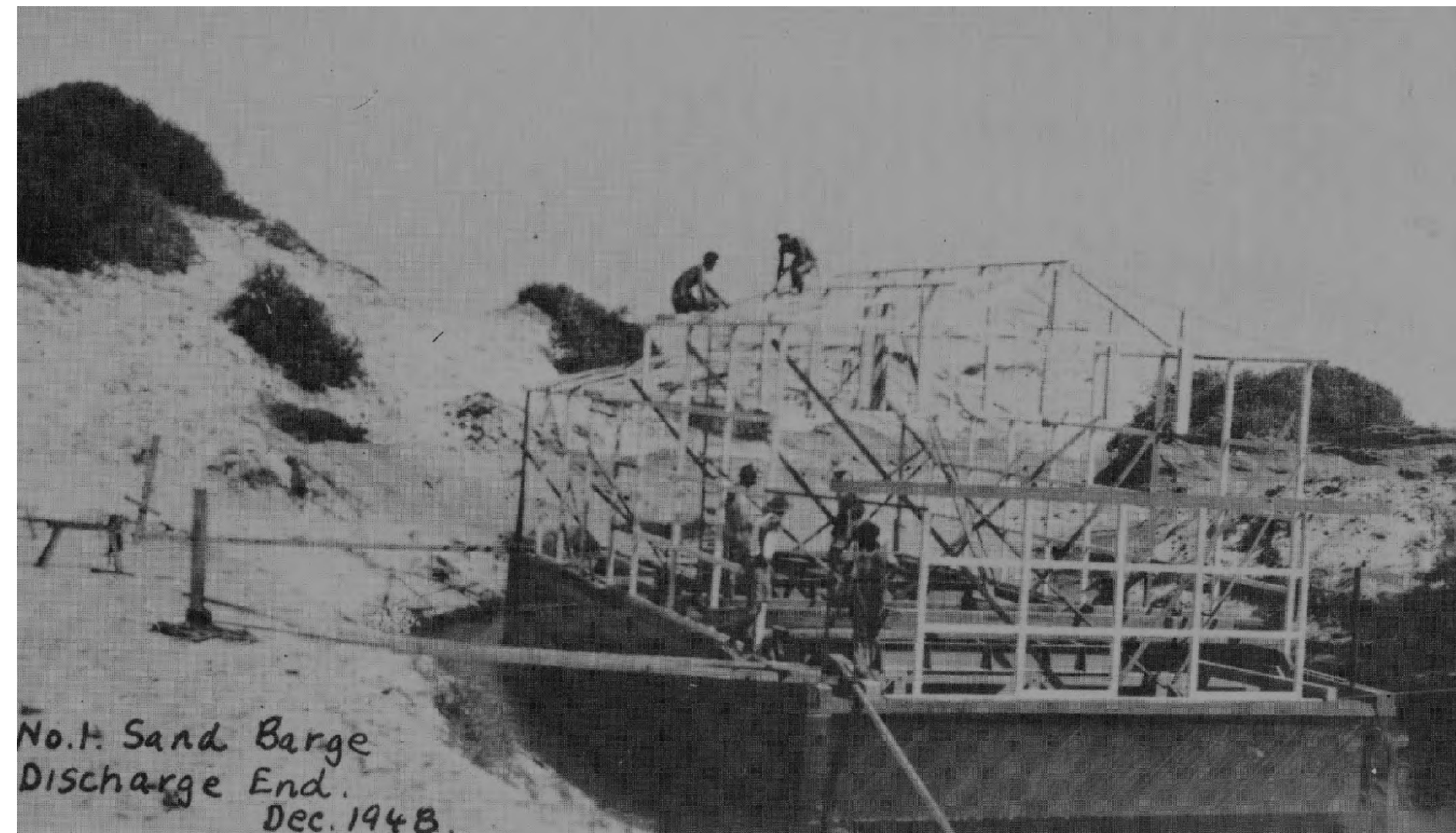
- The 1940s saw two of the great innovators of the industry come on the scene, Joe Pinter and Ernst Reichart.
- Pinter was born in Hungary and earned an electrical engineering degree in Berlin. He and his wife emigrated to Melbourne in 1939.
- He set up a welding equipment supply company in Melbourne. To obtain rutile for his welding rods, he bought mixed rutile-ilmenite cons from Zircon-Rutile Ltd and endeavoured to separate them. To do so he made his own magnetic separator. He also installed a dryer and started producing rutile product.
- Some was sent to the UK for the war effort and 600 tonnes were produced during 1941-43. This was the first commercial production of rutile product in Australia.
- In 1943, Pinter looked for a captive source of supply and visited the Gold Coast to do a deal with Southport Minerals to ship cons to Melbourne. This required Pinter to develop his electrostatic separator since the mixed cons also contained zircon.
- In 1946, Pinter brought his equipment and expertise to Southport Minerals as a contribution to the syndicate which became Associated Minerals in 1953 (now Iluka Minerals)

The Innovators – Ernst Reichert

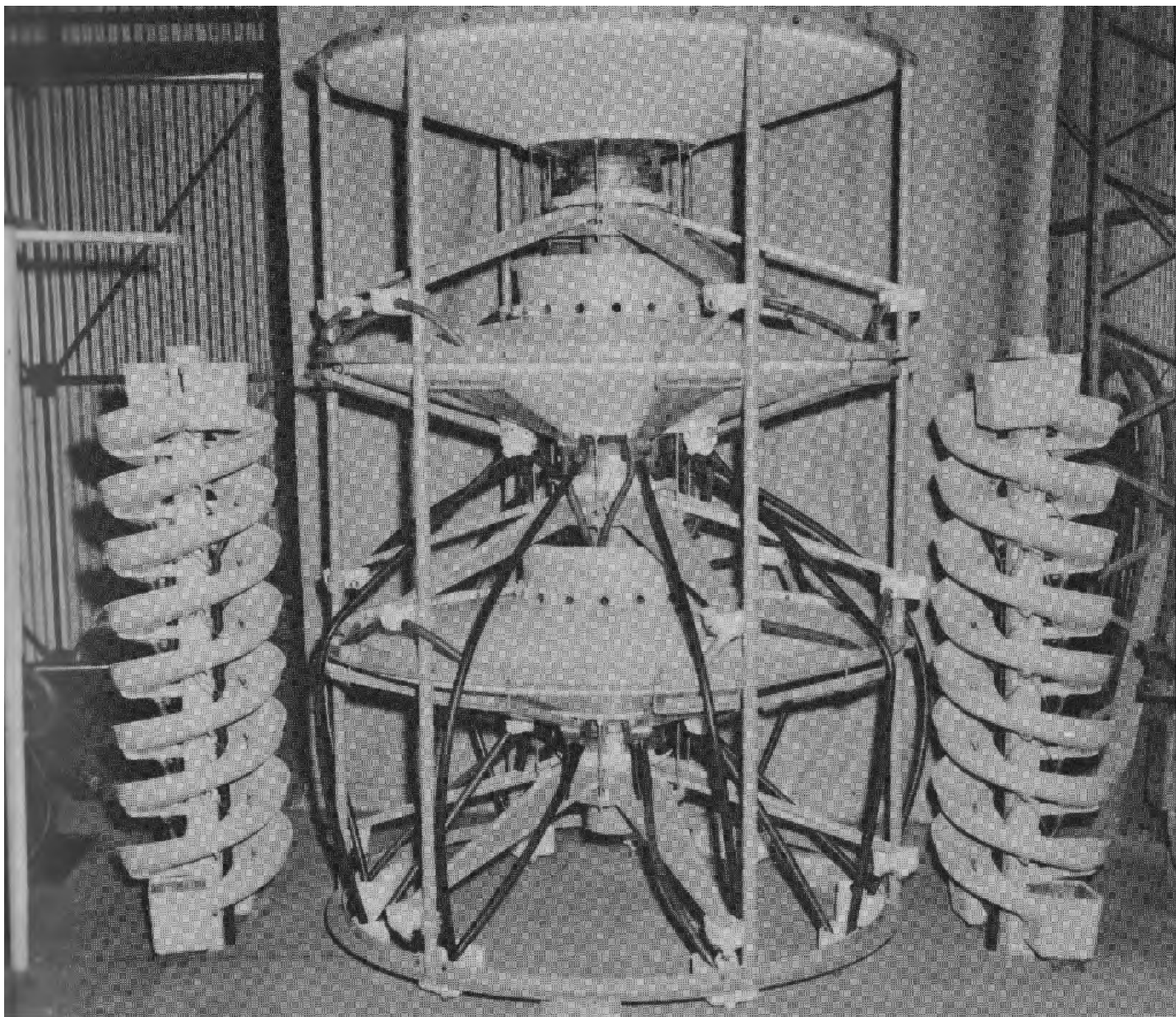
- Reichert was born in Germany and also became an electrical engineer who was working for Siemens in the Middle East when war broke out and was interned in South Australia for the duration. Here he started experimenting with electrostatic separation.
- Upon release, he went to the CSIRO who referred him to MDS and was soon employed.
- At the time, spiral separators used in mining plants were made from cast iron segments bolted together and imported from the USA. He made segments locally out of concrete which was cheaper and quicker to get.
- However, when floating plants were introduced, concrete spirals were a liability and he pioneered the manufacture of one piece spirals out of fibreglass.
- These floating plants lead to the birth of the Reichart Cone Concentrator, (also fibreglass) with a throughput of 40 tph, 40 times that of a single spiral for much less unit area of floor space. Thus larger floating plants were practical.
- Then followed development of the 80 tph Cone Concentrator, multi-start spirals, multi-stage high tension separators, electrostatic separators, magnetic separators. All were superior units and eventually MDS started a business selling this equipment to other producers to become the standard equipment for the industry to this day.



Illust. 23. Concrete spirals, Byron Bay, 1947. (By courtesy F. S. Wright)

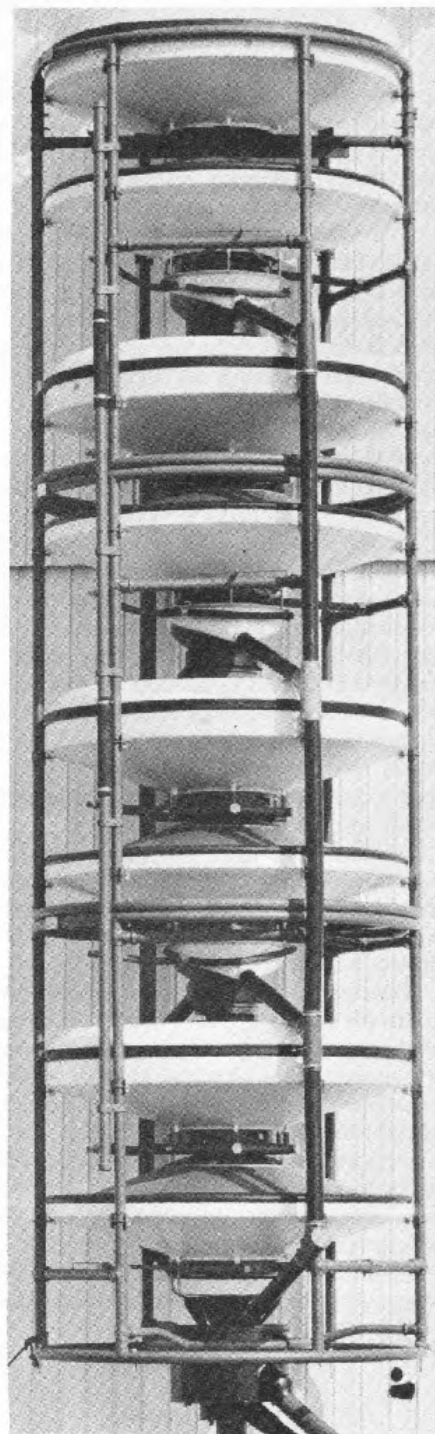


Early Floating Wet Spiral Plant



Illust. 20. Mark I Reichert cone concentrator with pair of Reichert twin volute fibre-glass spirals, circa 1960. (By courtesy Mineral Deposits Ltd)

Illust. 48. Type 4DSV Reichert concentrator. One of a series in current production, 1979. (By courtesy Mineral Deposits Ltd)



1950s – The Boom Times

- In 1950, three events changed the industry
 - the Korean War started
 - Federal Government removed the minimum export price regulation
 - Mines Department instituted rehabilitation requirements on mined area
- The rutile price went from \$47/t in 1950 to \$100/t in '51, \$140/t in '55
- Mining grades declined from 30-70% HM in 40s to 10-15% in '51 to ~5% in '55
- All the major producers expanded, but the beach leases were almost mined out
 - Associated Minerals moved mining to Sth Stradbroke and Cudgen
 - Mineral Deposits moved to Fingal and vacant Crown Land at Broadbeach and by 1955/6 had 6 mining plants, mainly working old strandline deposits behind the frontal dunes from the Spit to Coolangatta
 - Rutile Sands continued mining beaches south to Coolangatta and processing HM cons in its plant at Currumbin
- Both MDL and AMA processed HM Cons through their Drymills at Brighton Parade (MDL) and Ferry Road (AMA)
- Community opposition to beach mining continued to grow resulting in MDL handing back its beach leases between Main Beach and Broadbeach in 1954
- The industry mainly expanded at Cudgen with TAMCO, Associated Minerals, NSW Rutile (Murphys) and Cudgen RZ (Foysters) all operating there at the same time.

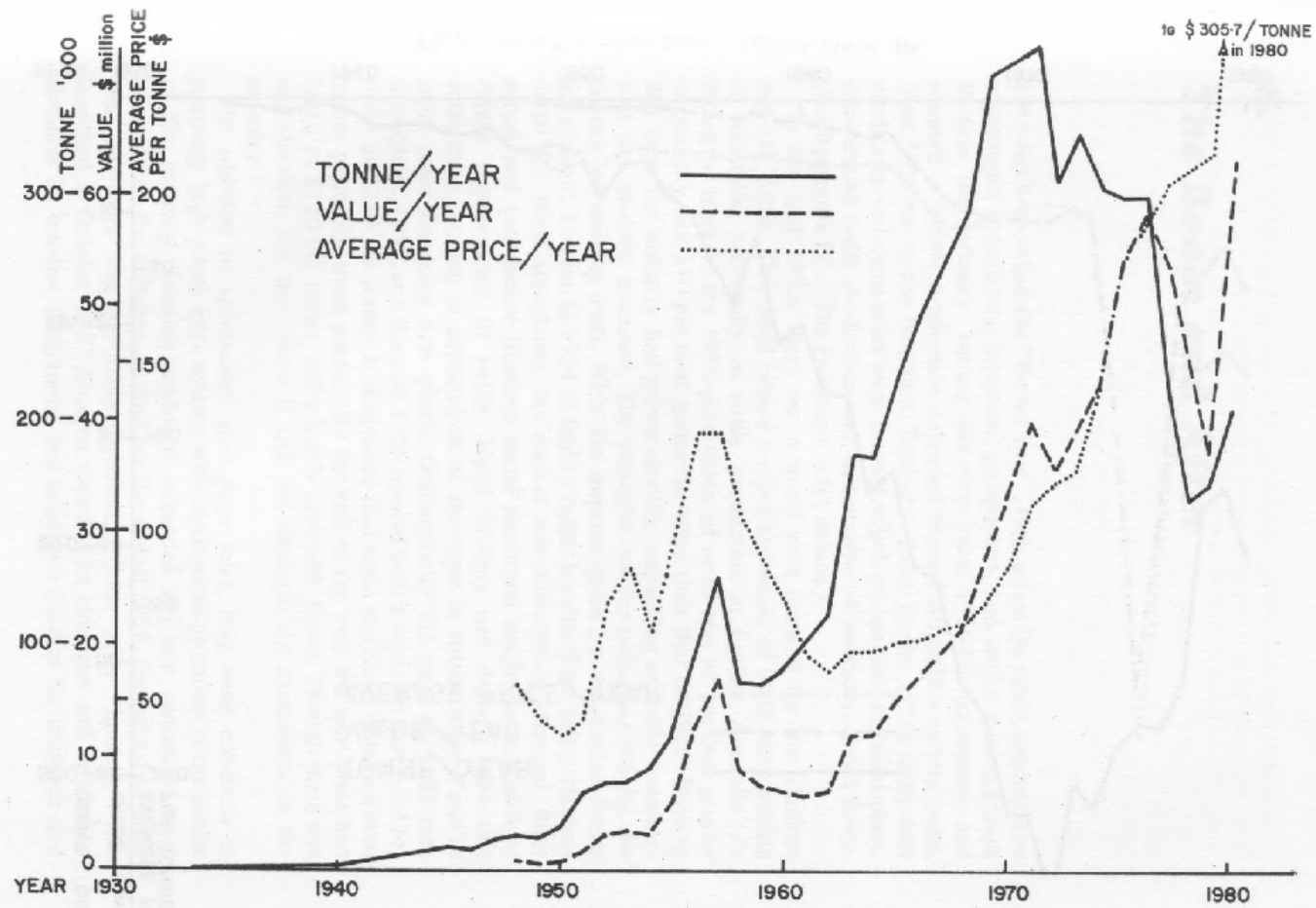


Fig. 4. Rutile Production, Eastern Australia (1934-80)



SPIRAL PLANTS AND RECLAMATION OF
BROADBEACH/MERMAID BEACH AREA 1956.



RECLAMATION AND REHABILITATION OF MINED AREA
BROADBEACH, GOLD COAST 1956.



THE SURFERS PARADISE/BROADBEACH MINED
AND UNMINED SECTIONS WITH INTERNATIONAL
HOTEL JUST COMPLETED 1959.



KINGSCLIFF SAND MINING 1954
SHOWING STRIP LEASE MINING
WITH CUDGEN R.Z. IN FOREGROUND.



MURPHYORES KINGSCLIFF PLANT 1955.

The Aftermath

- By 1958 the boom had busted, both production and prices declined.
- Mining on the Gold Coast started to wind down during the '60s
- By 1970, MDL had ceased mining and processing at Brighton Parade and had set up operations at Crescent Head and Hawke's Nest in NSW.
- By 1970, MDL had set up an equipment manufacturing and engineering division servicing other producers and moved this division and its head quarters to Ashmore Road in 1971, near where Harvey Norman is now.
- Meanwhile, AMA continued to process concentrates at its Ferry Road plant from its operations as far south as Laurieton. It finished mining on Sth Stradbroke in 1971.
- AMA, lead by Joe Pinter continued to grow through mergers and acquisitions to eventually morph into Iluka Minerals
- Currumbin Minerals bought out Rutile Sands in 1964 and continued to exist on beach scrapings until the late '80s and eventually moved its plant, due to community pressure, some kms inland at Currumbin where it still operates to-day.

MINING COMPANIES	YEARS OF MINING	TONNES OF HEAVY MINERAL MINED - ACCORDING TO TYPE OF MINERAL							TOTAL HEAVY MINERAL
		Il	R	Zr	Mz	Sn	Gt	Au	

(A) THE GOLD COAST FROM SOUTHPORT TO COOLANGATTA

.Associated Minerals	1945-1972	972	16 641	13 983					
.Rutile Sands Ltd	1943-1972	972	36 080	371 119					
.Mineral Deposits	1941-1967	972	40 321	37 218					
.Cudgen R-Z	1956-1958	1 760	784	1 478	544				
.Pacific Minerals	1950-1960		1 596	1 457					
.Rutile Mining Deve.Co	1957-1957		1 190	1 485					
.Currumbin Minerals	1971-1973		1 341	1 539					
.Dillingham's	1968-1970	1 979	1 634	3 843					
		<u>6 655</u>	<u>100 587</u>	<u>432 122</u>	<u>544</u>				

539 903

Note: Rutile Sands Ltd Zircon production is obviously a typo, probably should be 37 119, total zircon 98 122 and total HM 205 903

SOUTH STRADBROKE IS.

.Associated Minerals	1959-1963		28 357	21 212					
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49 569

CUDGEN AREA FROM HASTINGS PT TO TWEED HEADS
(includes Norries Head, Kingscliff, Fingal)

.Zircon-Rutile Pty Ltd	1936-1969	7 863	77 696	116 486	708				
.Rutile Mining Dev. Pty Ltd	1957-1958		3 048	3 781					
.Titanium Alloy Manu Co.	1951-1960	1 329	103 068	150 493	720				
.NSW Rutile Mining Co	1943-1970		225 866	246 290	118				
.Cudgen R-Z	1948-1971		109 141	85 111					
(Mining not continuous breaks	1953-1961 1964-1969)								
.Associated Minerals Consol.	1953-1967		229 231	227 761			820		
		<u>9 182</u>	<u>748 050</u>	<u>829 922</u>	<u>1 546</u>		<u>820</u>		

1 589 520

Source - BMR Canberra Report 1975

To-Day's Legacy

- Associated Minerals by mergers and acquisitions has morphed into Iluka Minerals.
- The Neumann Group has been able to establish a successful dredging division which has developed most of the canal estates on the Gold Coast. They have also manufactured and supplied dredges to various mining operations around the world.
- MDL is still going strong under different owners and operates a 6,500 tph mineral sands mining and processing plant in Senegal as well as having an interest in an ilmenite smelter in Norway.
- The manufacturing and engineering division of MDL has continued to prosper and lives on as Mineral Technologies, a division of Downer, at Elysium Drive, Carrara. It has a test facility on site capable of treating large samples and manufactures processing equipment as well as having a significant engineering design capacity.
- Equipment that is widely used around the world originated from the mineral sands industry and that is now produced by Mineral Technologies at Carrara includes,
 - Spirals in various configurations, high tension and electrostatic separators developed at MDL
 - High Intensity Wet Magnetic separators developed by Readings of Lismore
 - Washwater less spirals developed by Doug Wright at Banora Point
 - Rare Earth Wet and Dry Magnets developed by Readings and MDL
 - Kelsey centrifugal jig developed by Chris Kelsey



MDL's Southport headquarters on Queensland's Gold Coast 1969.



Mineral Technologies Facility at Carrara



Spirals in final stage of manufacture

Sample of recent projects by Mineral Technologies



Over 8,000 spirals supplied to Mount Wright Iron Ore mine in Canada



Engineering design and spiral supply to Arrium Iron Ore Project Sth Australia



Engineering design and supply of spirals to Cape Flattery Silica Sands



Testwork, flowsheet development, engineering design and equipment supply to MDL Mineral Sands Project in Senegal, the largest in the World with nominal capacity of 7,000 tph.



**900 tph Minerals
Sands Spiral Plant for
Cable Sands at
Jangardup, WA**





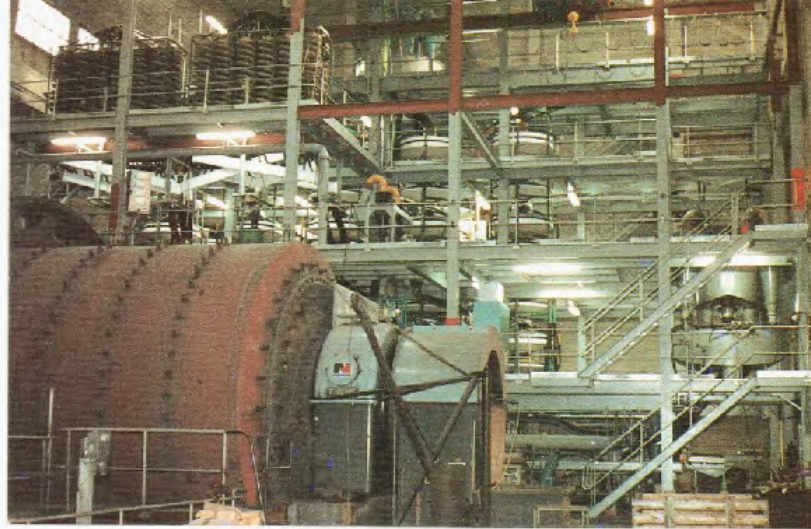
Titanomagnetite Mining Plant for NZ Steel, Taharoa, New Zealand



Spiral plant treating coal
At Ravensworth North, NSW,
using spirals specifically
designed for upgrading coal
fines



**Fine Coal Spirals
being installed in
Coal Washery in
China**



A gravity circuit installed within the Milling complex of Titania A/S for the recovery of ilmenite from a hardrock ore. Mineral Deposits Limited was responsible for the metallurgical and engineering design of the gravity circuit.



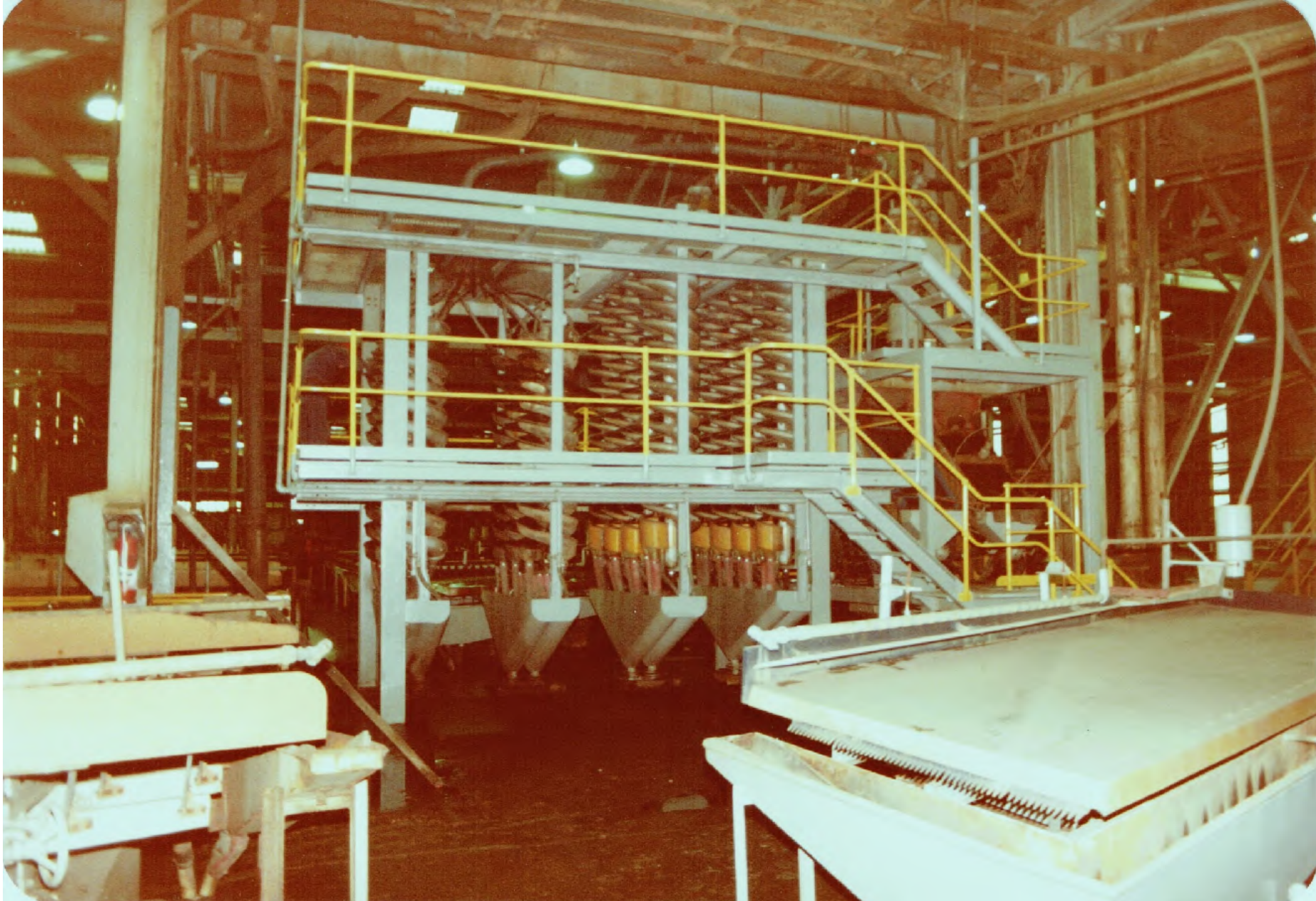
The circuit uses 2M cone concentrators and WW6-7 turn spirals for the recovery and upgrading of the ilmenite product.



Reichert Cones and Spirals in Kaltails Gold Plant, WA



**Reichert Spirals in
Tantalum circuit at
Gwalia Consolidated,
Greenbushes, WA**



Reichert Spirals installed in Tin Circuit, Renison, Tasmania

Acknowledgements

Most of the historical information in this presentation was derived from “Black Sands”, I W Morley, UQ Press, 1981.

Further information and photos were sourced from “A Brief History of Beach Mining from Byron Bay to Fraser Island” compiled by Robert Anthony, personal collection.

Newspaper articles were found in the online resources of the Gold Coast City Library.

Additional documentation was kindly provided by Craig Vadeikis of Mineral Technologies.

Some of the modern plant photos were sourced from Keith Stamp’s personal collection.

The 1969 Aerial Photo showing the location of MDL and AMA comes from Ed Newman’s personal collection.