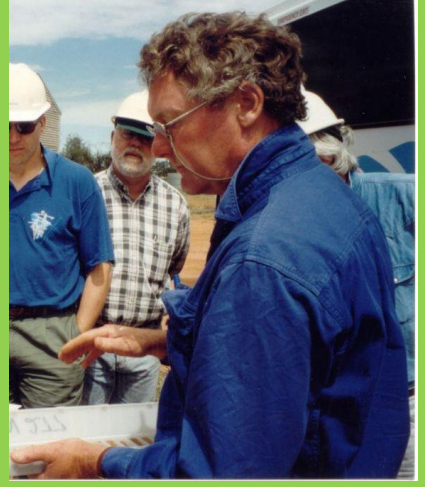
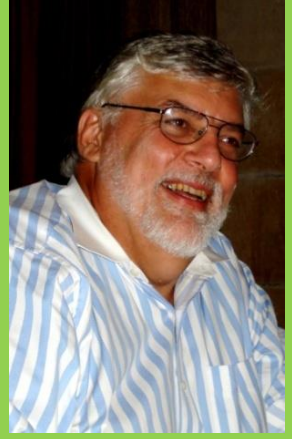


SMEDG Presentation

Thursday, November 27, 2014

Exploration Mines and Money

Tony Hope


MALAYSIA
INDONESIA
PNG
Equator
Lihir
Bougainville
Ok Tedi
PORT MORESBY
DARWIN
NT
QLD
Tropic of Capricorn
Mt Morgan
Murphyores
WA
AUSTRALIA
BRISBANE
SA
NSW
Browns Creek
PERTH
Ginkgo
ADELAIDE
SYDNEY
Arumpo
CANBERRA
VIC
MELBOURNE
TAS
HOBART
NEW ZEALAND
0 500 1000 1500 2000
km
120°E
140°E
160°E

Mount Morgan Copper-Gold Mine
Queensland 1882-1981

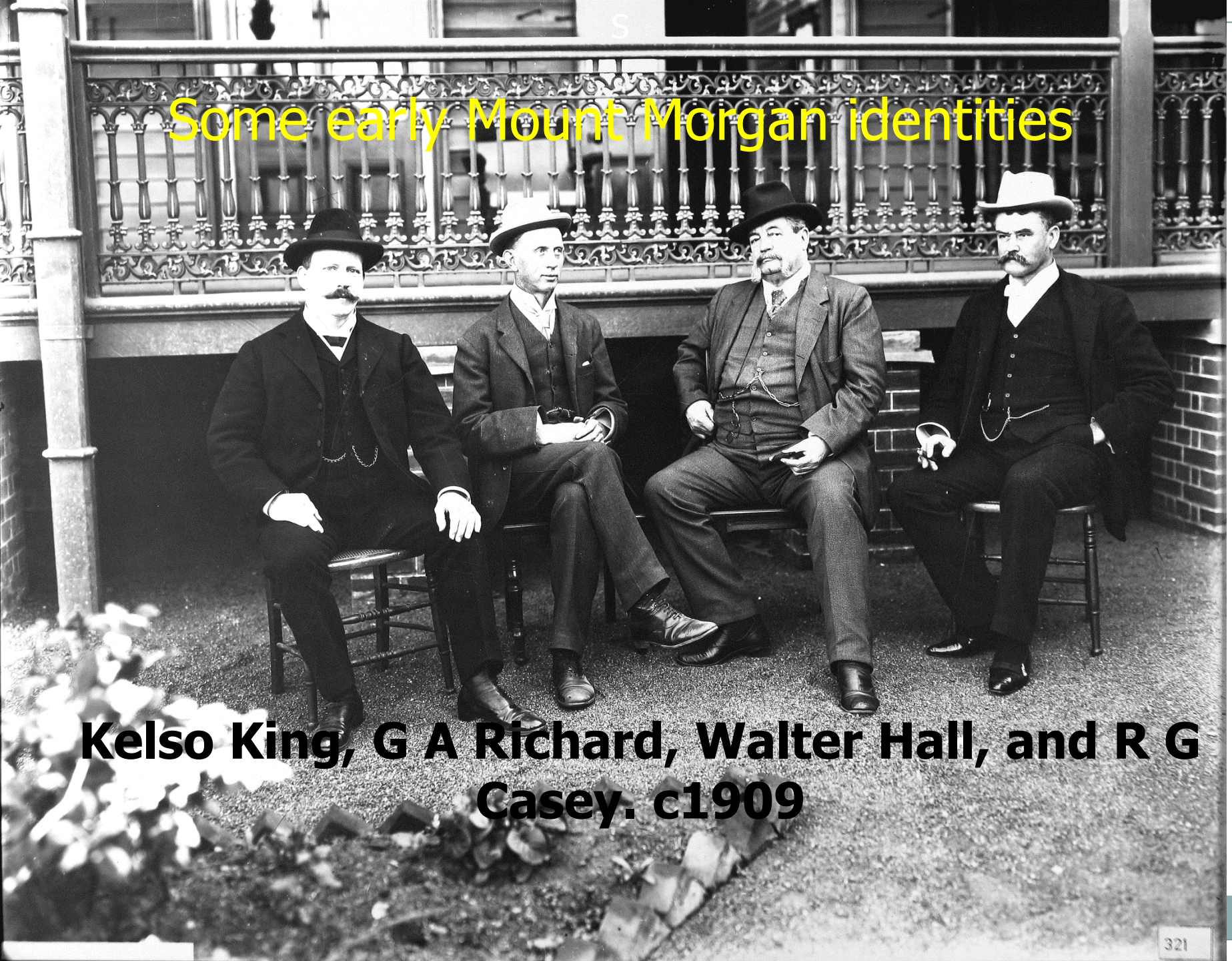
50 million tonnes ore treated at average grade of 5.9 g/t gold and 0.7% copper

c1888. Mount Morgan Gold Mine Queensland
The mine founded in 1882 was the largest gold mine in the southern hemisphere.

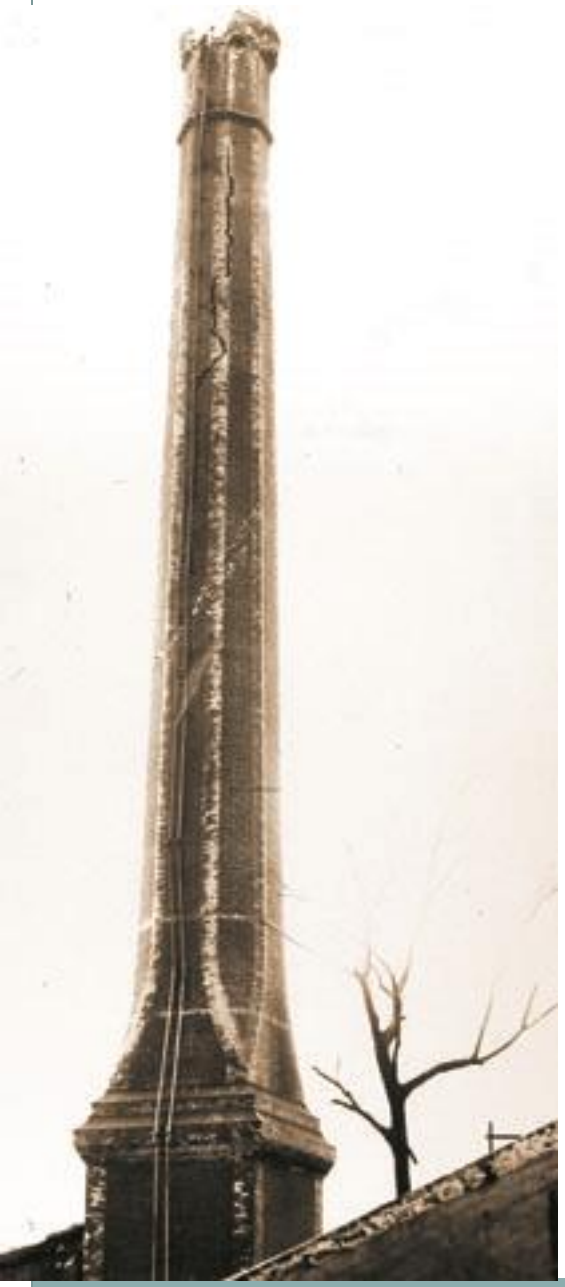

1974
2008

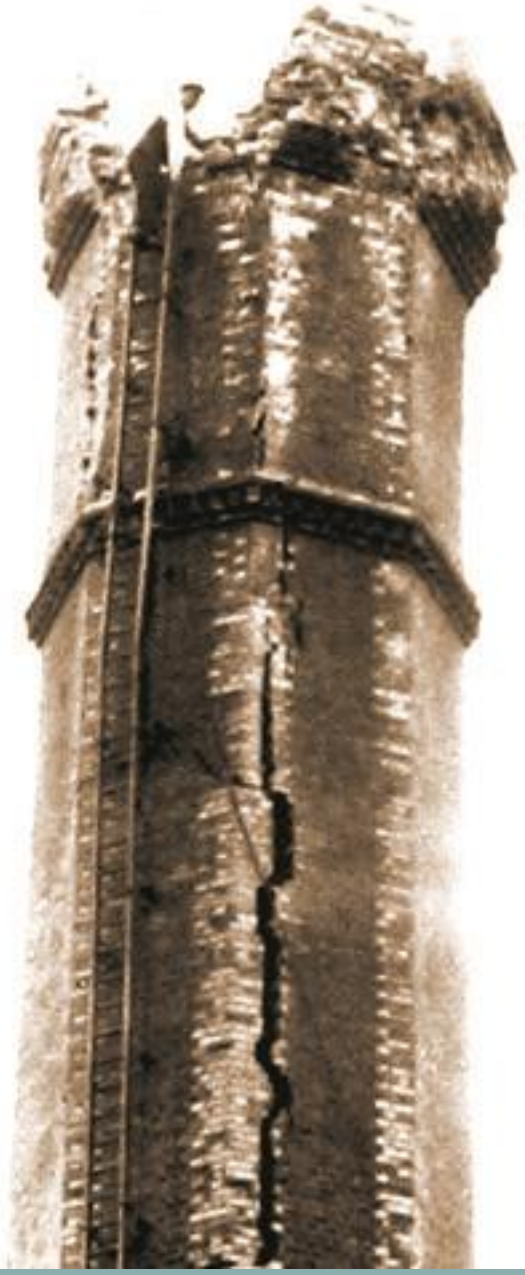

1974

Some early Mount Morgan identities



Kelso King, G A Richard, Walter Hall, and R G Casey. c1909



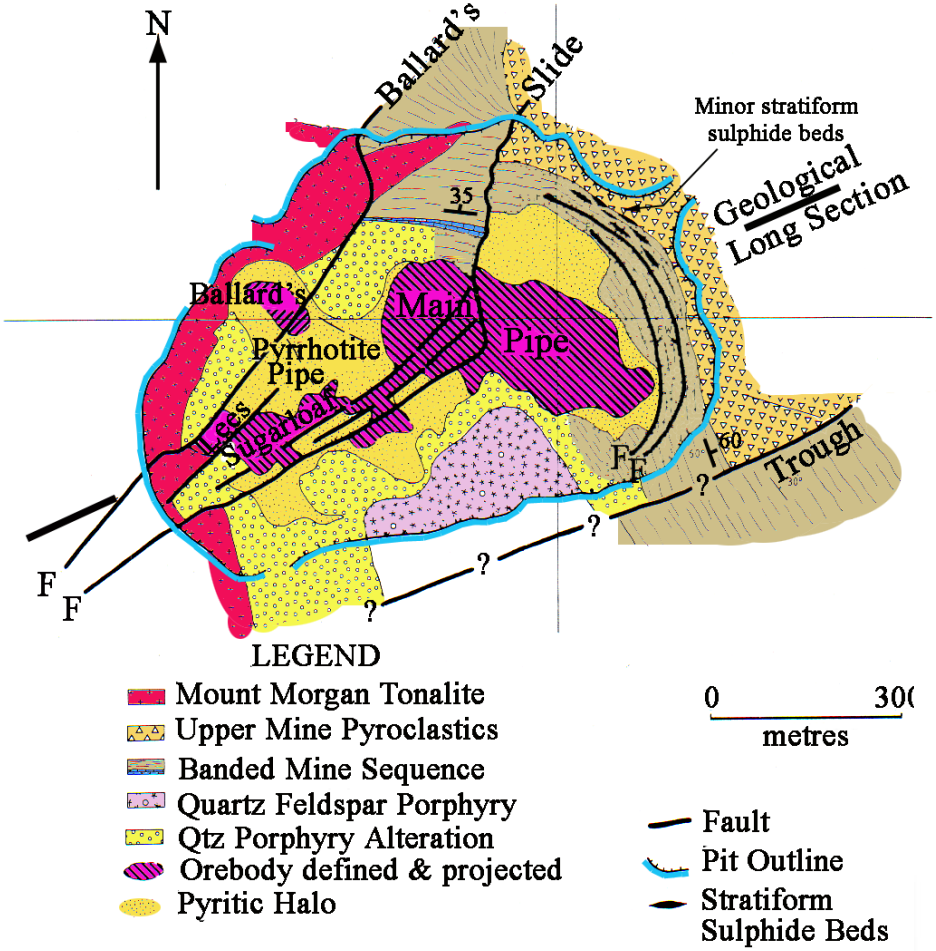


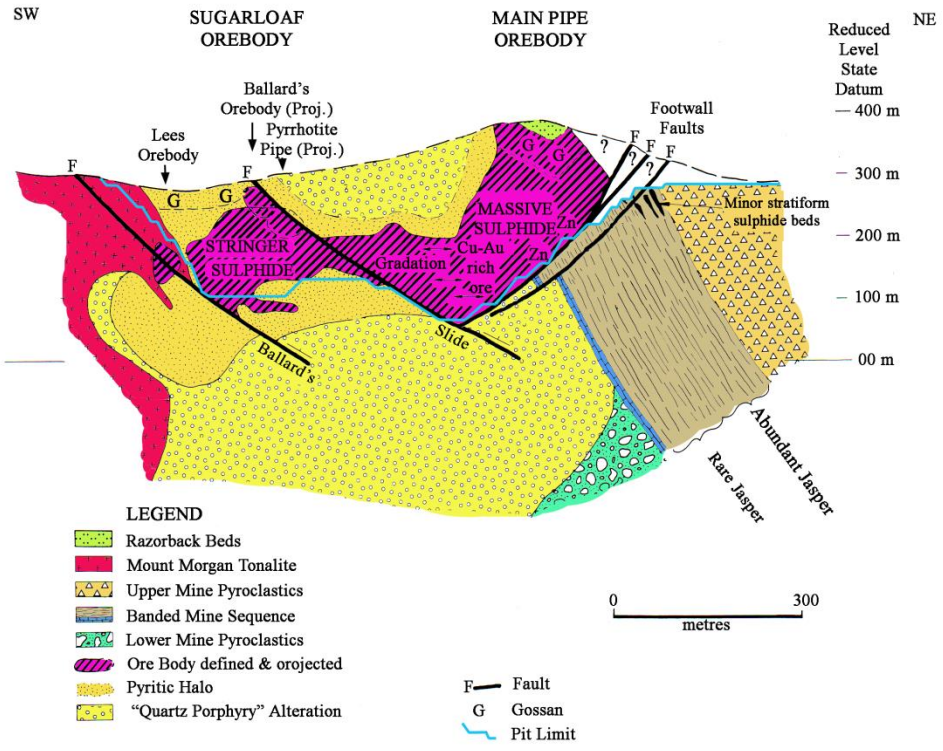
Comparative rock samples from Mount Morgan and Rotorua, c late 1880's

Massive sulphide with quartz veining

Quartz-pyrite

Mount Morgan geological plan and section
Alex Taube 1990





William D'Arcy
father of oil in Persia (Iran).

May 26, 1908: Mideast Oil Discovered — There Will Be Blood

By Randy Alfred

Mount Morgan c 1904

No. 2 steam shovel on Grasstree level, 1906


Gold ingots-183 kg each
worth AUD $9 million per ingot at
2012 prices.

Australasian Institute of Mining & Metallurgy (Inc.)

Photo taken at Swimming Baths, Mt. Morgan
Tuesday Morning, 28.8.1952.

First Ordinary Meeting 1952, Mount Morgan

FRONT ROW—left to right—O. A. Wilson, Miss G. Meyers, R. R. Neal, Mrs R. R. Neal, W. J. Cuming, Mrs W. J. Cuming, N. S. Kirby, Mrs N. S. Kirby, J. J. Whitelaw, Mrs J. J. Whitelaw, Mrs J. W. Westaway, Mrs L.B. Haney, Mrs A.D. Mackay, Mrs C. Blyth, K. B. Gross, Mrs K.B. Gross, Mrs D.I. Izatt, Mrs G. Sheil, J. Kruttschnitt, Mrs Kruttschnitt, G. Sheil, Miss B. E. Jacka, G.B. O'Malley, I.W. Morley, Mrs S. S. Pullar, Mrs R. B. Lawrie, Mrs J. J. Topping, Mrs J. M. Horsburgh, Mrs B. W. Lennon, Mrs J.G.Hart, Mrs A.E. Dainton, A. A. McLeod, K. A. Rowell, L. E. Elvey, Mrs P. L. Adams, P. L. Adams.

Second Row—Dr. J. C. Nixon, Mrs J. C. Nixon, R. A. Holliday, D. Gallager, L. I. Goff, C. Reynolds, Mrs M. Glen, M. Glen, H. A. Steane, B. W. Lennon, J.A. B. Forster, H.R. Brown, D.F. Branagan, P.O. Alston, Dr. J.A. Dunn, A. E. Dainton, E.L. Hardy, R.A. Palmer, J. B. Evans, J. J. Kelly, A.L. Lloyd, J.G. Hart, R.E. Le Messurier, A. R. Curry, G. F. Clark, W. Mc. A. Manson, J. K. Dreverman, N. A. Wilson, L. Golomb, S. A. Mackay, C. E. Caldwell-Wearne, R. Davey, C. C. Morton, Dr. O. A. Jones, J. J. Topping.

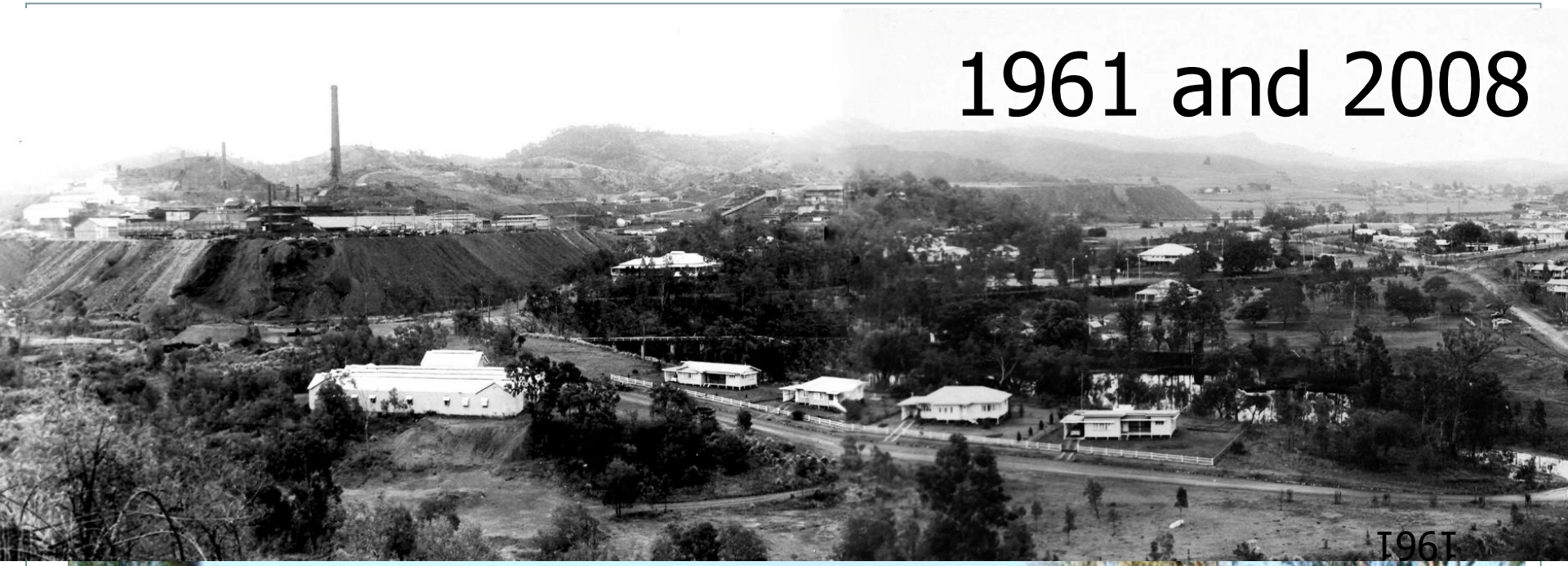
Third Row—K.S. Blaskett, G. W. Heyes, J. M. Silver, A. White, G. H. Jennings, Mrs P. M. Wreford, P. M. Wreford, P. M. J. Gray, R. I. Rankin, J. F. Ivanac, G. F. Whitten, L. G. Hetherington, J. R. Trezise, H. W. Whitford, L. W. Parkin, H. E. Jensen, A. D. Mackay, L. S. McEachern, C. Blyth, L. S. Jones, J. Ferguson, L. L. Johns, J.T. Woodcock, A. C. A. Seen, R. F. Bennett, C. T. Crawford, R.O.K.T. Moodie, O. Andersen, F. L. Bett, N. M. Worner, R. A. White, E. L. Richard, B. Gibson, R. B. Mills, R. A. Palmer, Miss T. Christie, H. A. Donegan, J. W. Westaway, D. I. Izatt.

Fourth Row.—J. Greer, P. Lloyd, C. Kaiser, R. A. Brown, C. Rowley, E. Williams, C. H. Warman, K. Chapman, O. D. Paterson, A. E. Kruger, G. Pitcher, A. W. Cameron, D. H. Watson, B. Hopkins, C. C. Maynard, G. H. Matheson, L. B. Fry, M. G. McAuley, K. C. Williams, R. F. Kable, D. G. Walker, G. M. Willis, R. A. Eaton, B. M. Beattie, C. W. Hoffmann, R. V. Jorgeson, J. Waring, N. J. Keys, F. K. Aylmer, I. R. McLeod, R. G. Hallowell, B. G. Hiskens, Miss J. Jefferson, K. A. Lamin, W. J. Murray, N. Underwood, Dr. A. B. Edwards.

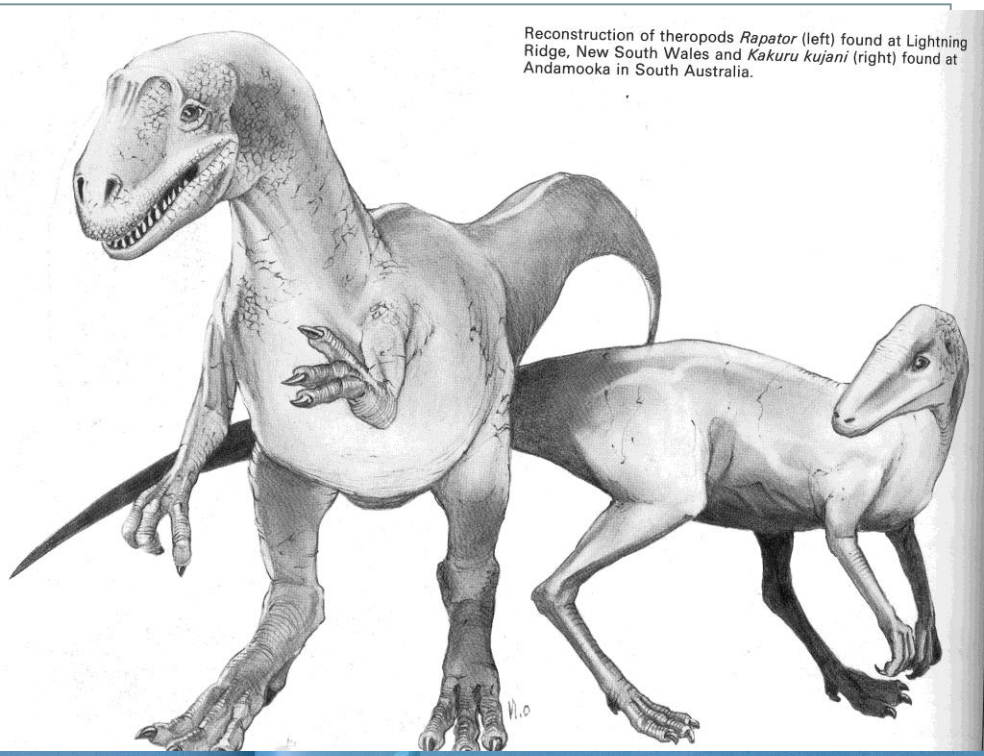
Fifth Row—A. G. Hay, C. R. Foster, R. B. Shiel, R. B. Lawrie, B. G. Patterson, R. F. Allen, J. M. Rose, S. G. Salamy, J. K. Mercer, H. Niemann, J. F. Rigby, B. Hamilton, D. F. Heinjus, J. A. Uscinski, E. Barnes, J. N. Nilsen, H. L. Williamson, D. E. Cartwright, G. P. Newton, R. J. Hilditch, C. J. Hamdorf, S. R. C. Jewell-Thomas, Miss M. E. Evans, Miss J. M. Fisher, R. A. Coutts, K. L. Ridley, Miss M. Anderson, J. D. Greenwood, J. L. Black.

Back Row Standing—V. J. McSweeny, I. McPherson, A. E. Wyatt, L. B. Haney, A. Ponniah, D. R. Moyses, E. W. Schroder, P. B. Moffitt, B. G. Polkinghorne, J. R. May, F. Cunningham, B. E. Trone, S. K. Pennycuick, H. R. E. Staines, F. G. Whitcher, J. N. Haughton, B. M. Mathias, D. C. Short, P. D. Barlow, R. J. Gluyas, Miss A. M. Moss, Mrs J. S. Purves, J. S. Purves, Mrs C. H. Martin, C. H. Martin, G. Hillier, Dr. N. R. Srinivasan, S. S. Pullar.

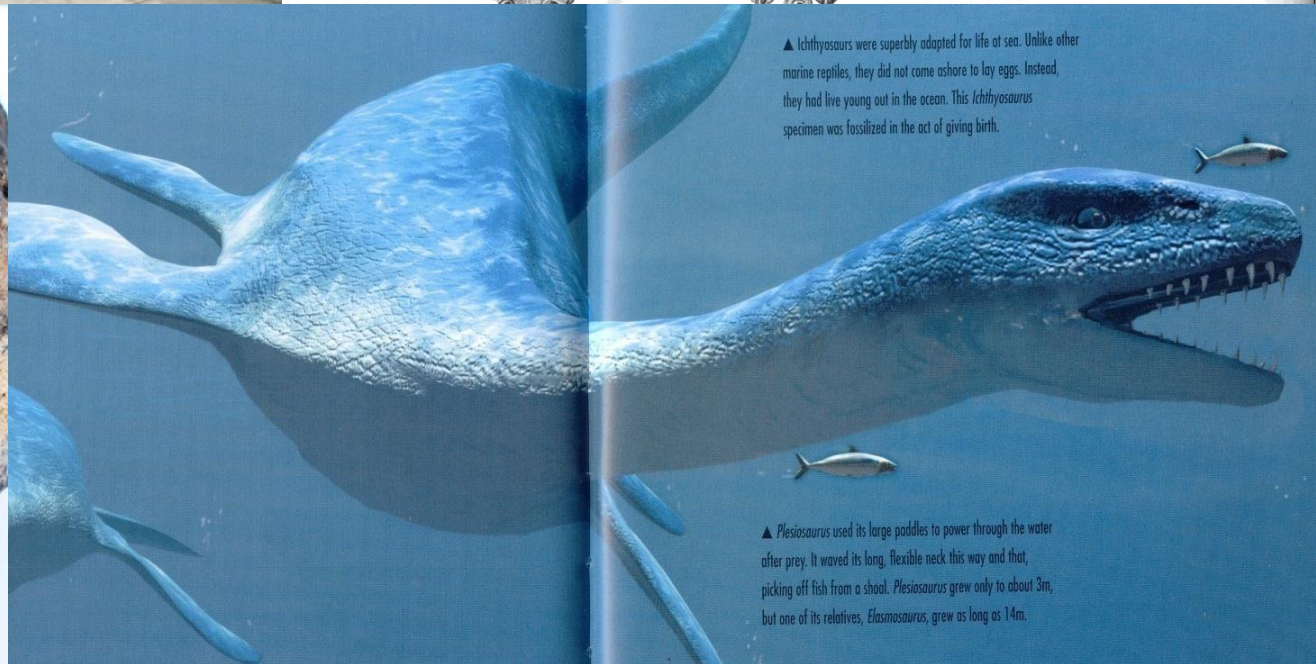
1961 and 2008



Mount Morgan fireclay mine and dinosaur foot print



Reconstruction of theropods *Rapator* (left) found at Lightning Ridge, New South Wales and *Kakuru kujani* (right) found at Andamooka in South Australia.

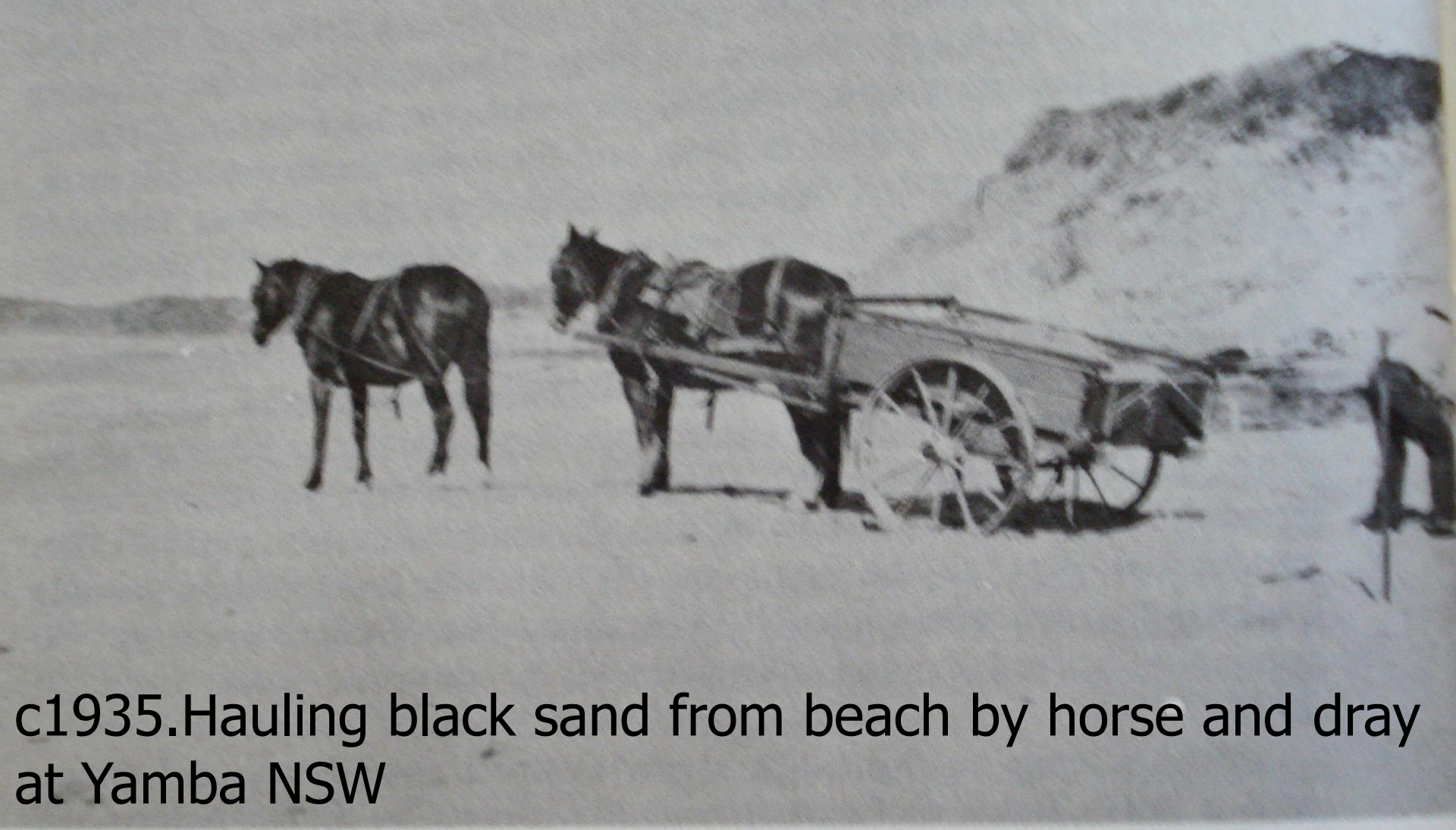


▲ Ichthyosaurs were superbly adapted for life at sea. Unlike other marine reptiles, they did not come ashore to lay eggs. Instead, they had live young out in the ocean. This *Ichthyosaurus* specimen was fossilized in the act of giving birth.

▲ *Plesiosaurus* used its large paddles to power through the water after prey. It waved its long, flexible neck this way and that, picking off fish from a shoal. *Plesiosaurus* grew only to about 3m, but one of its relatives, *Elasmosaurus*, grew as long as 14m.

Murphyores heavy mineral exploration Queensland 1963 to 1965.

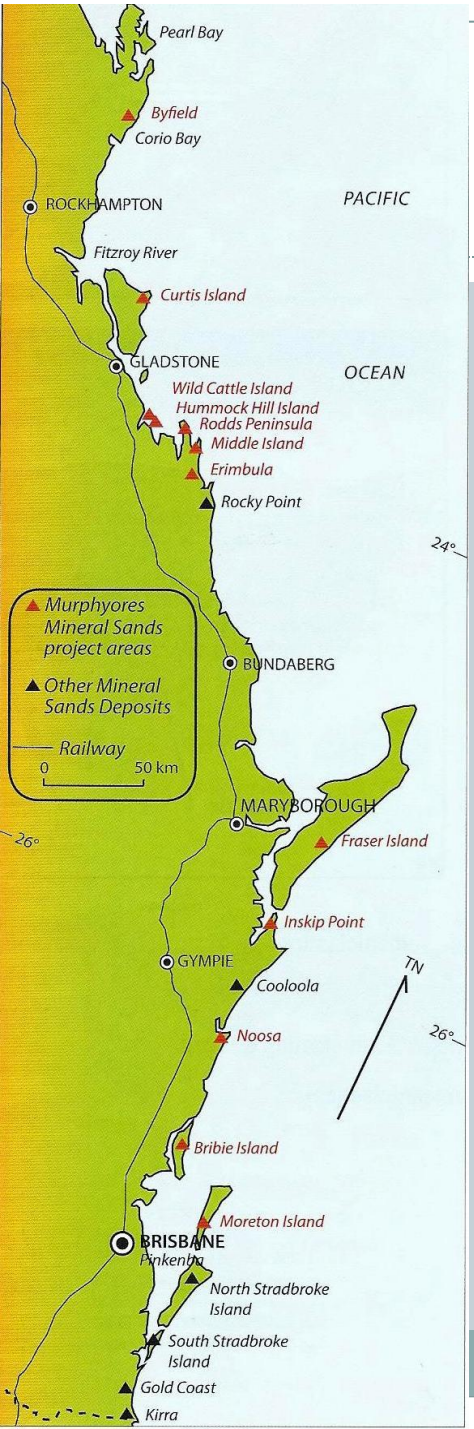
- The HM comprises ilmenite, leucoxene, rutile, zircon and monazite



c1935.Hauling black sand from beach by horse and dray at Yamba NSW

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

Murphyores' exploration sites Eastern Queensland



ABOVE: Hand augering on Fraser Island main Beach. 1964.

RIGHT: Sludging Eurimbula south of Gladstone 1963

Fraser Island 1979. Rehabilitated part of mining area

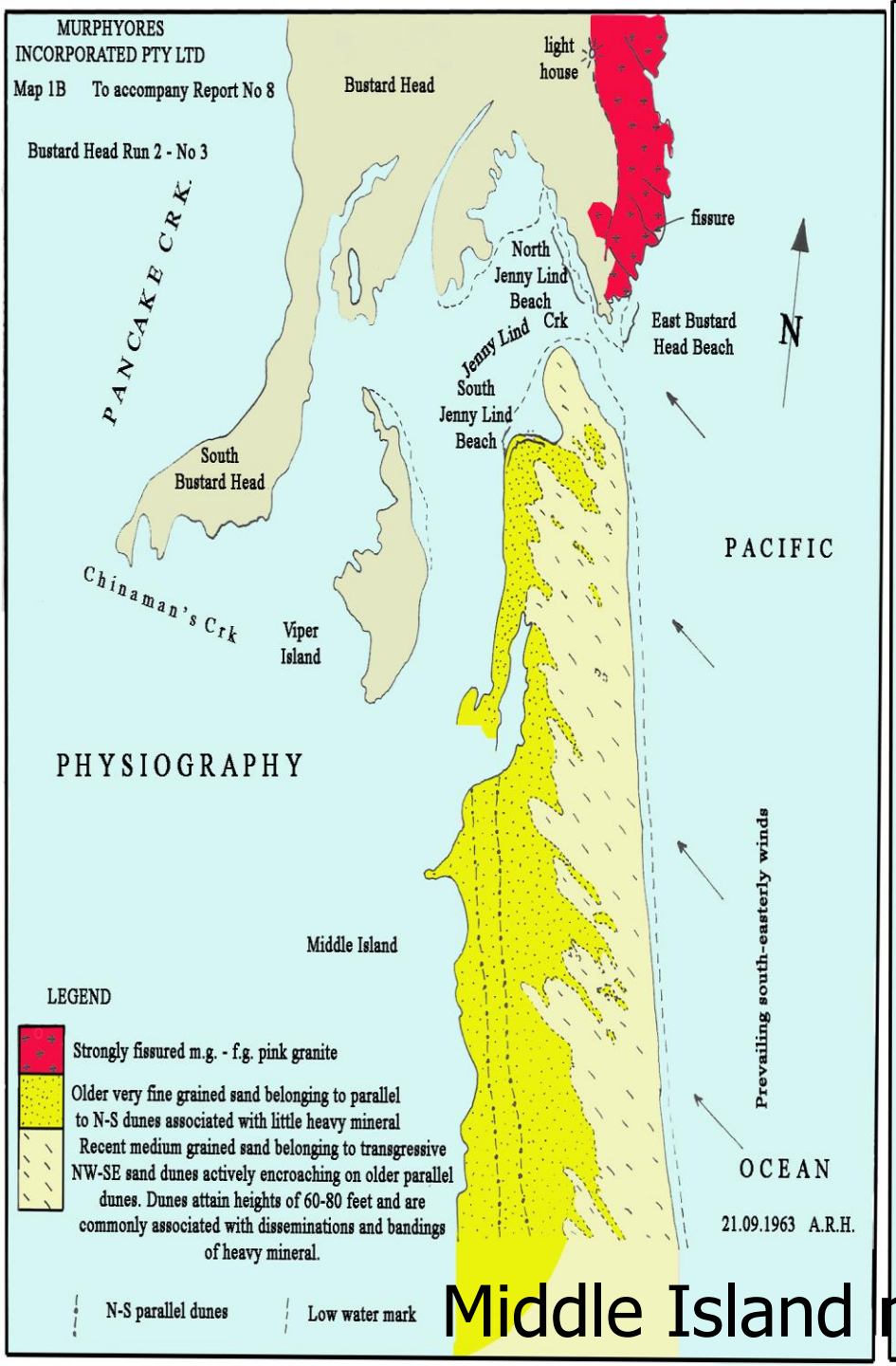
Illust. 46. Fraser Island, mid-1979. One of the older rehabilitated parts of the DM area. (By courtesy Murphyores Incorporated Pty Ltd, R. L. Anthony – photographer)

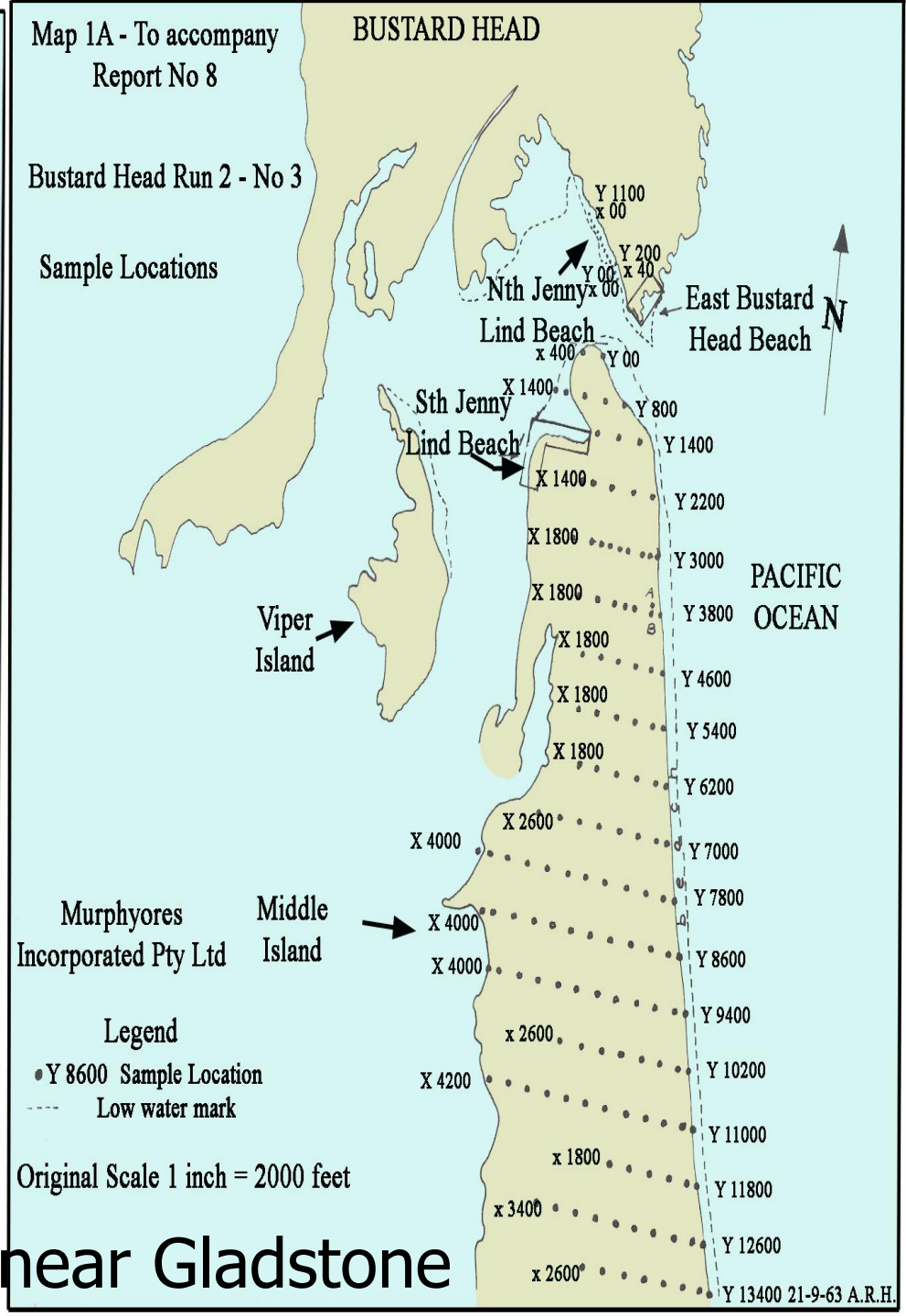
Murphy Star.
Ex fishing boat used for prospecting

Moreton Island. Wind blown sand dunes. 1963

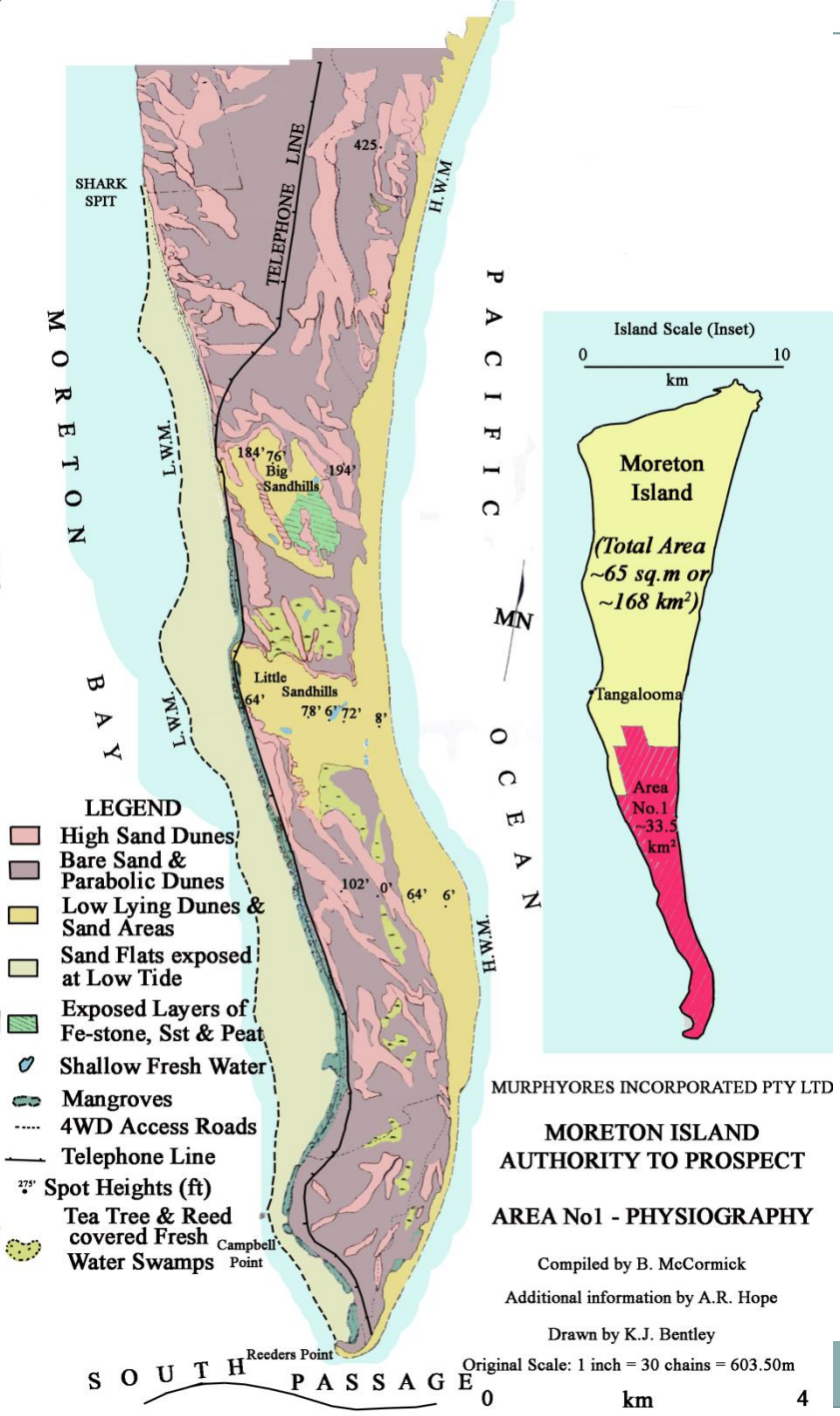
1963. Middle island from Bustard Head (named by Captain Cook).

Field camp Moreton Island 1963





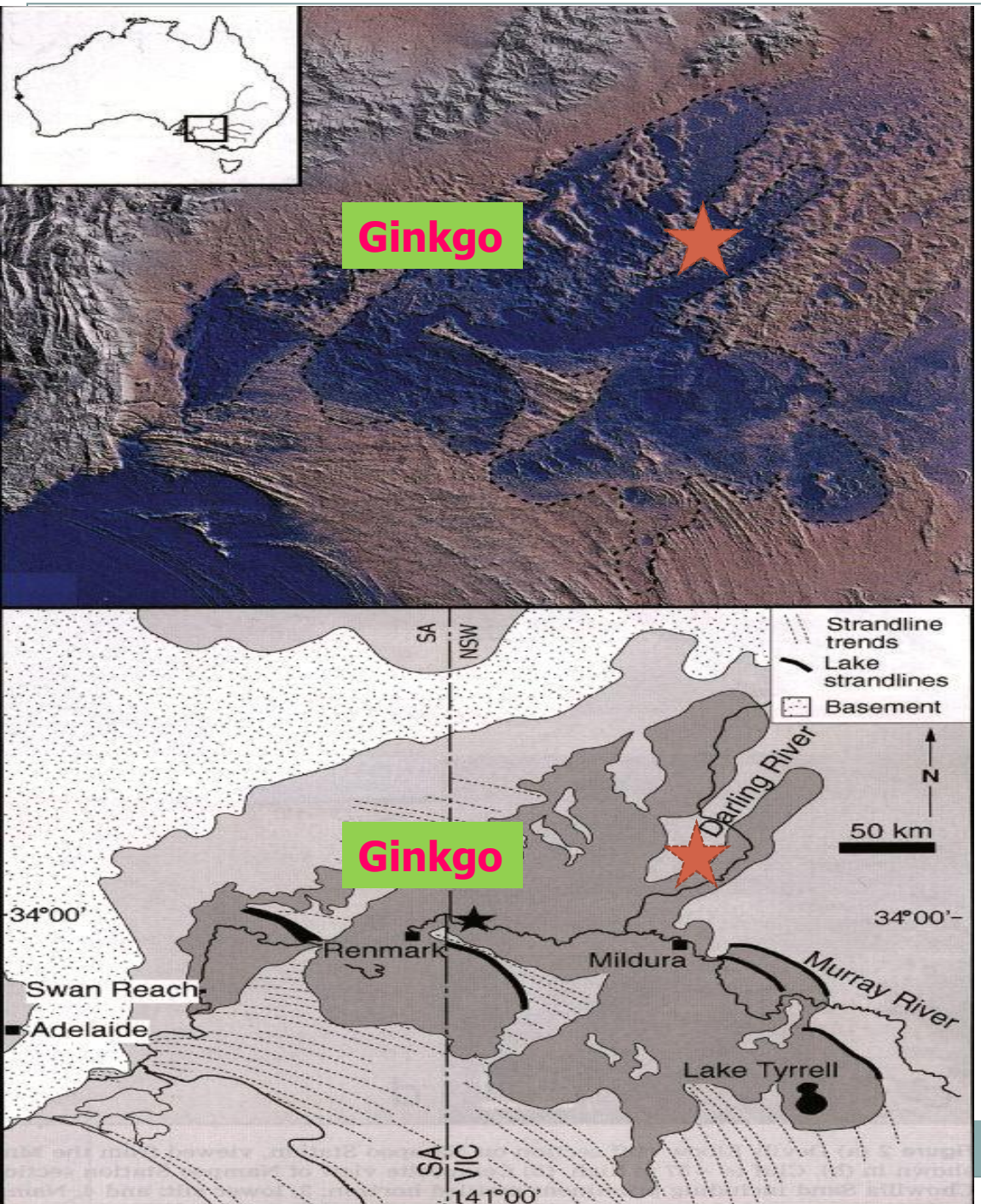
Middle Island near Gladstone



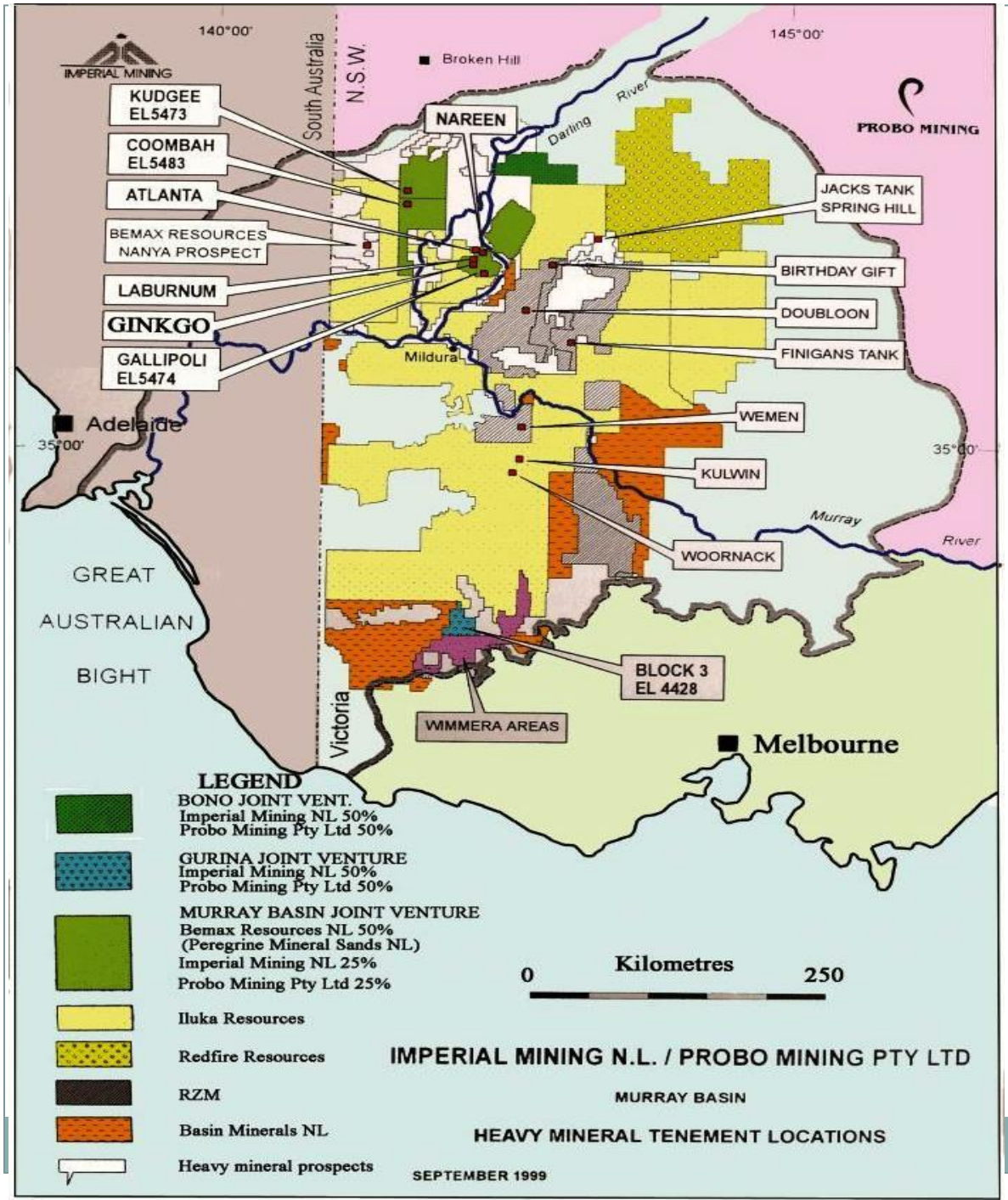
Moreton Island from the air. 2011

Ginkgo Heavy Mineral Mine
New South Wales 2005 to present

- 161 million tonnes at 2.68% HM
- The HM comprises 46% ilmenite, 8% leucoxene, 13% rutile and 10% zircon



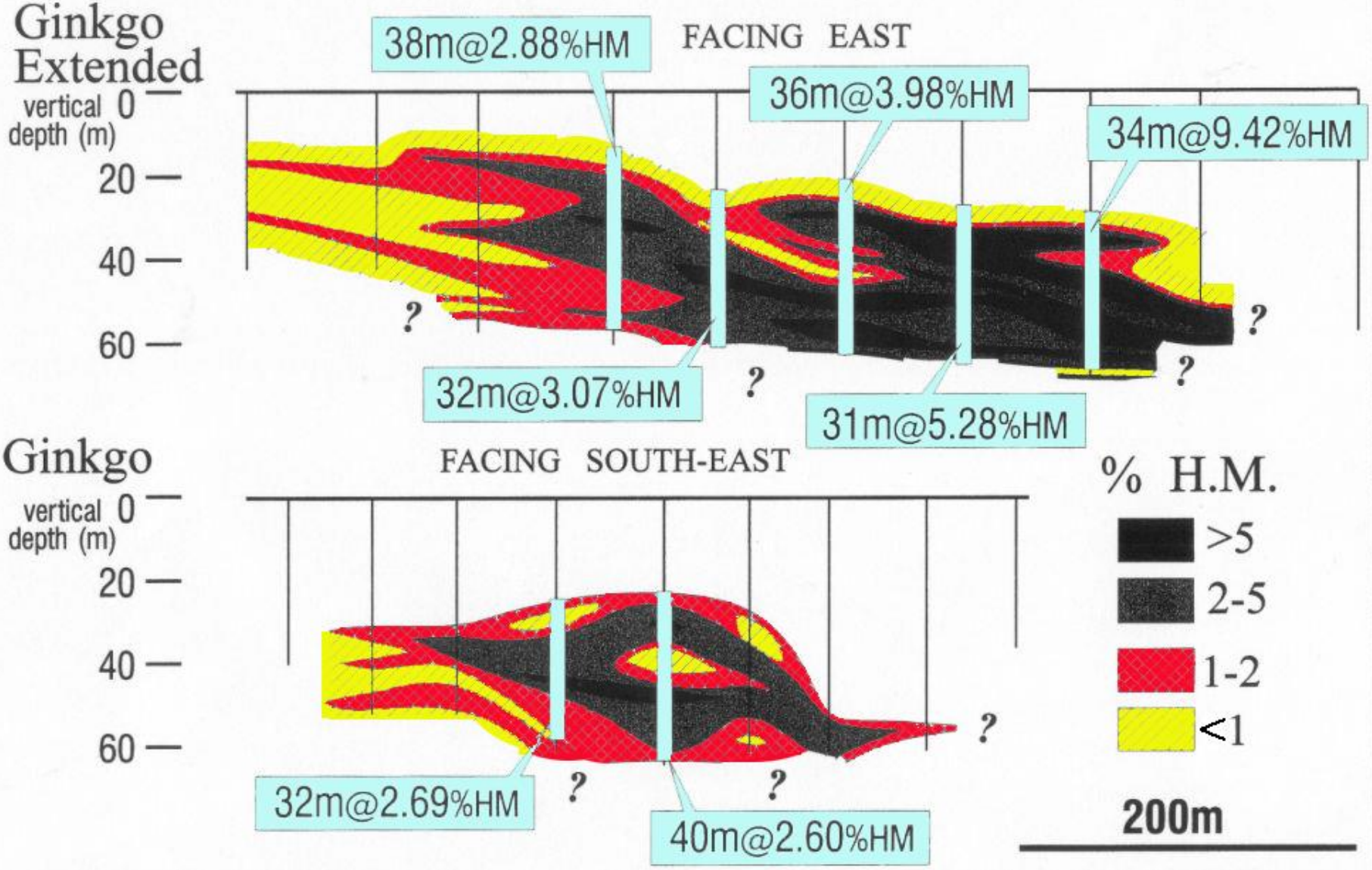
Murray Basin from Landsat imagery showing strand lines tens of kilometres long, an ancient lake and location of Ginkgo deposit


IMPERIAL MINING
140°00'
145°00'
35°00'
South Australia
N.S.W.
Broken Hill
Darling River
NAREEN
PROBO MINING
KUDGEE EL5473
COOMBAH EL5483
ATLANTA
BEMAX RESOURCES NANYA PROSPECT
LABURNUM
GINKGO
GALLIPOLI EL5474
JACKS TANK SPRING HILL
BIRTHDAY GIFT
DOUBLOON
FINIGANS TANK
Mildura
Adelaide
WEMEN
KULWIN
Murray River
WOORNACK
GREAT AUSTRALIAN BIGHT
BLOCK 3 EL 4428
WIMMERA AREAS
Victoria
Melbourne
LEGEND
BONO JOINT VENT.
Imperial Mining NL 50%
Probo Mining Pty Ltd 50%
GURINA JOINT VENTURE
Imperial Mining NL 50%
Probo Mining Pty Ltd 50%
MURRAY BASIN JOINT VENTURE
Bemax Resources NL 50%
(Peregrine Mineral Sands NL)
Imperial Mining NL 25%
Probo Mining Pty Ltd 25%
Iluka Resources
Redfire Resources
RZM
Basin Minerals NL
Heavy mineral prospects
0
Kilometres
250
IMPERIAL MINING N.L. / PROBO MINING PTY LTD
MURRAY BASIN
HEAVY MINERAL TENEMENT LOCATIONS
SEPTEMBER 1999

Ginkgo heavy mineral mine in the Murray Basin, NSW. 2006

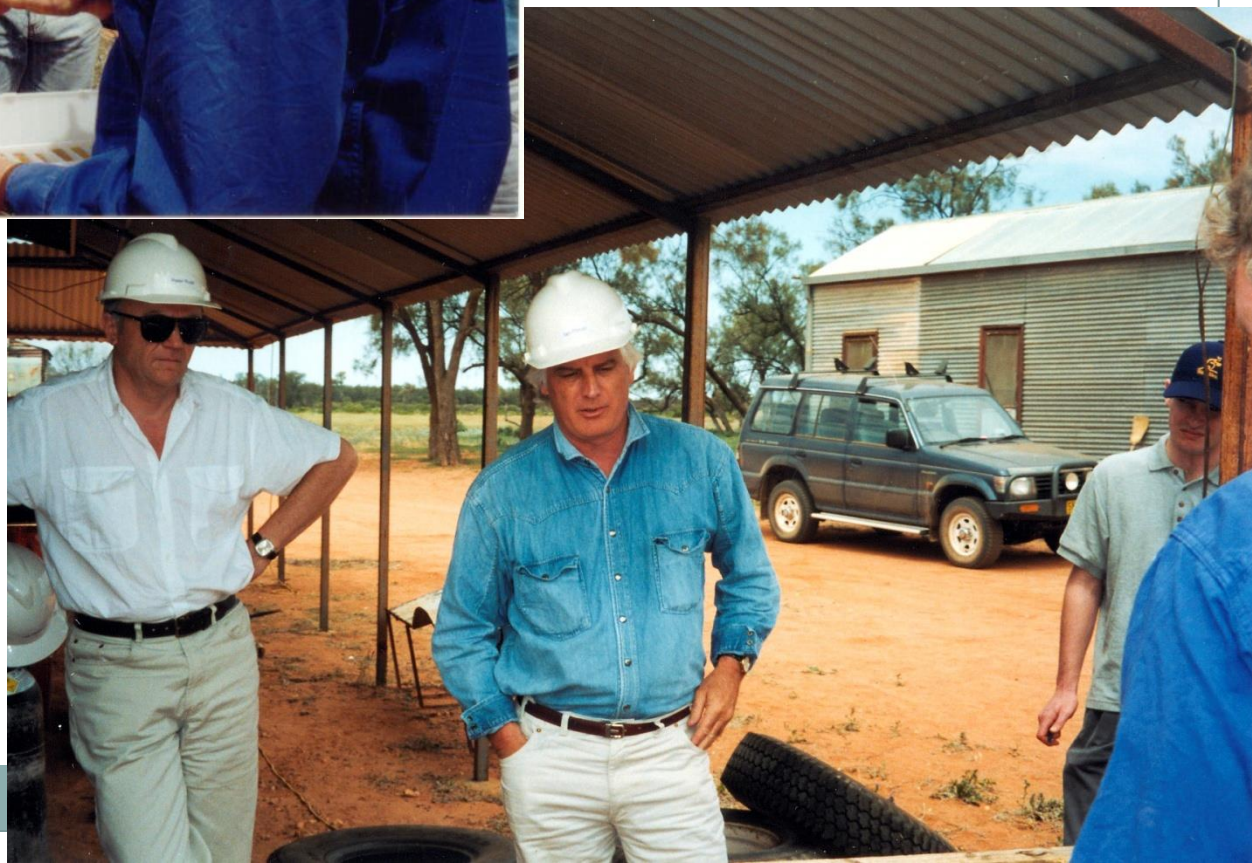
GINKGO PROSPECT Sections

BEMAX RESOURCES NL
A.C.N. 009 247 858



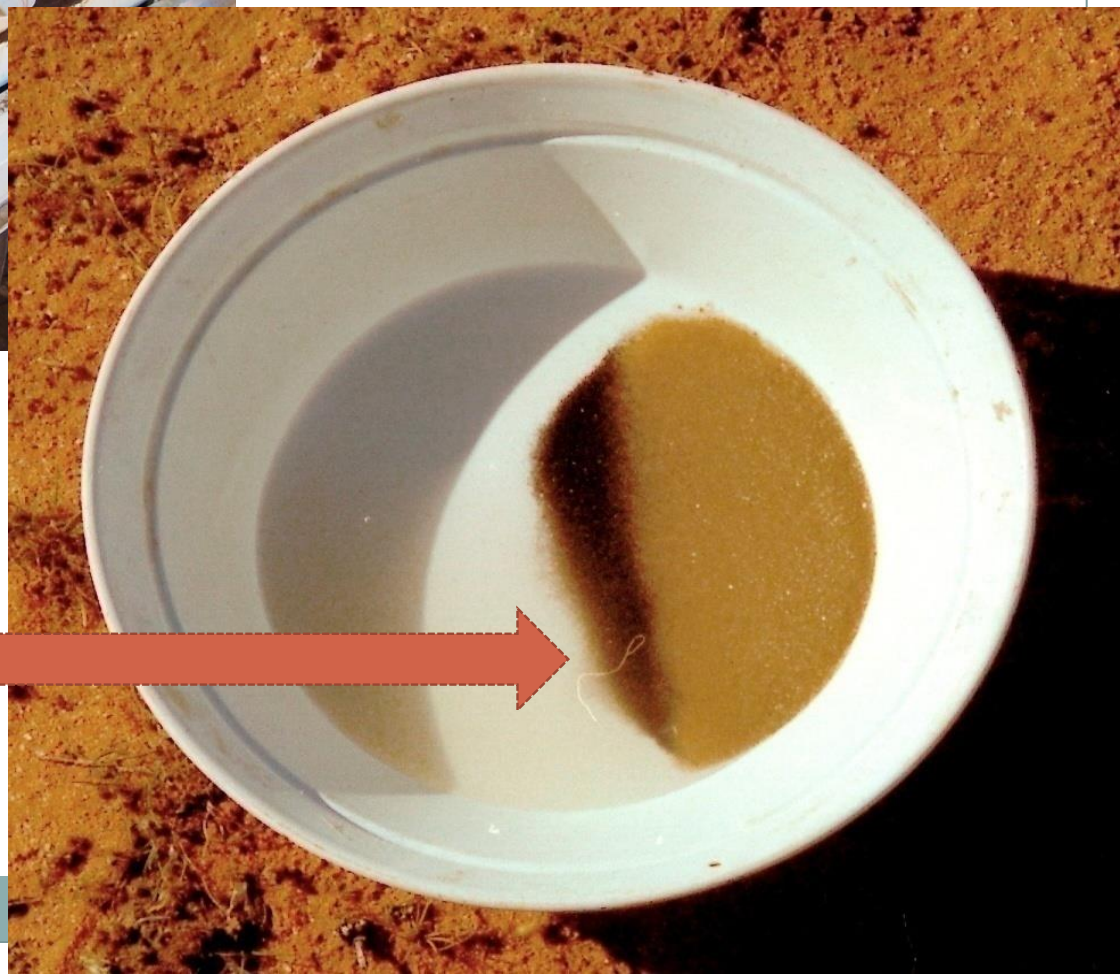
KKG/bw2992a/14April99

Geologist Ian Browne and visitors, 1998



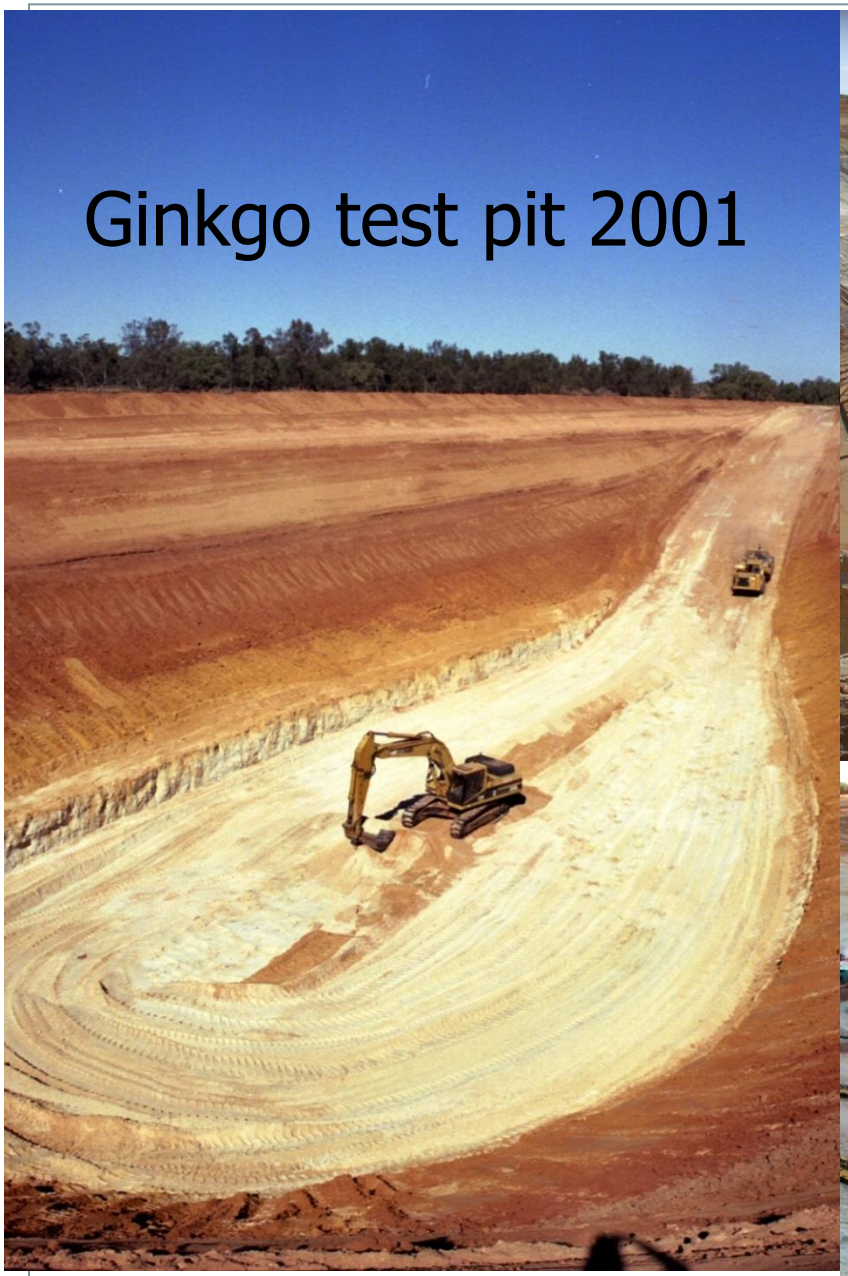
Prof. Ian Plimer

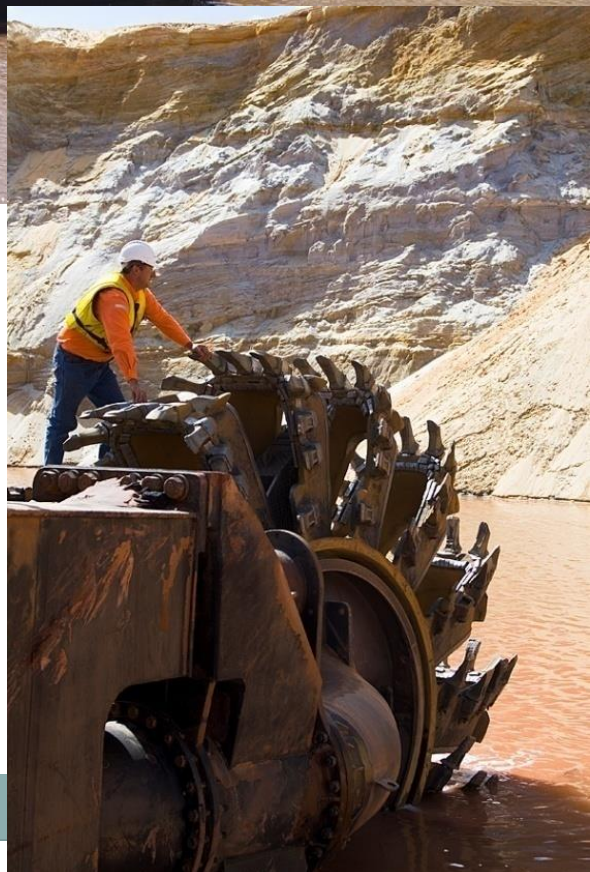
Exploration field team 1999 outlining Ginkgo deposit.



HM panned from RC drill hole sample.
L to R. Zircon, ilmenite/rutile, ancient beach sand.

Ginkgo test pit 2001



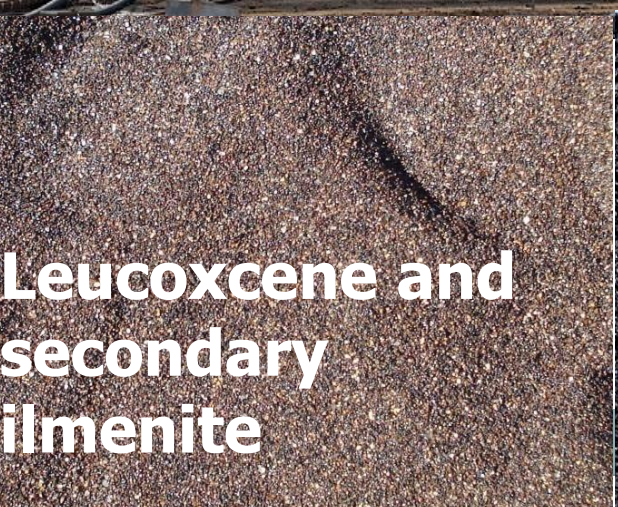


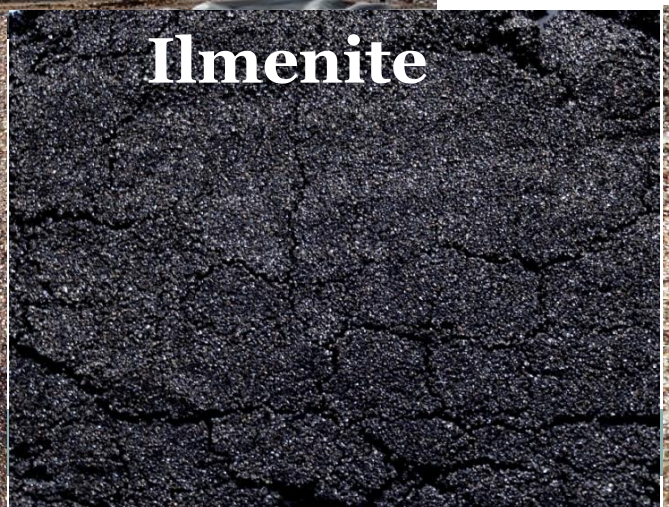
Spud dredge with cutter raised 2009

Ginkgo strandline from dredge pond 2008

Ginkgo mine manager and dredge operator

Ilmenite heap Gingko mine site





Road train used to transport HM from Ginkgo Mine to Broken Hill treatment plant.

Newly constructed treatment plant at Broken Hill, 2006.

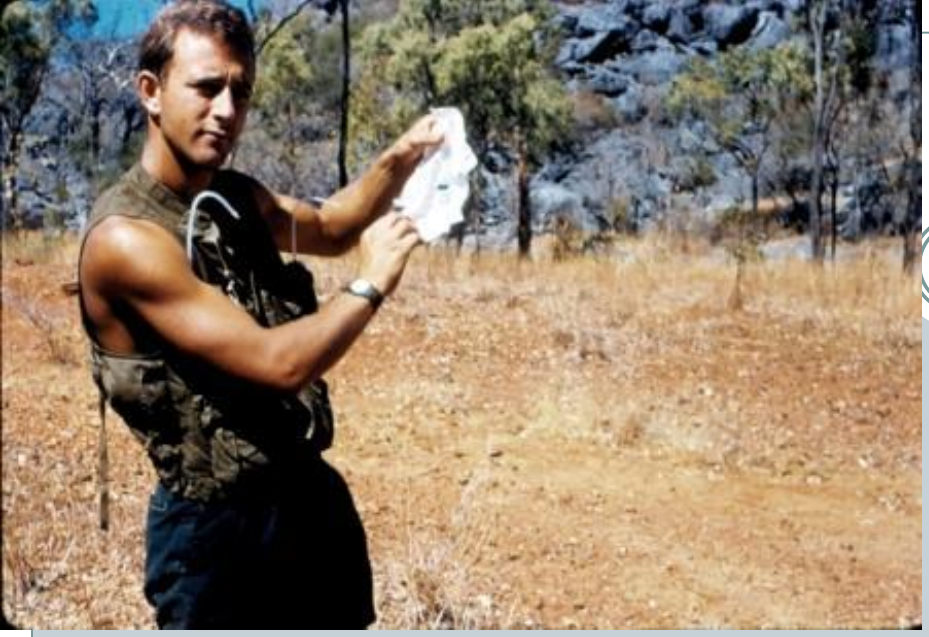
Panguna Copper–Gold mine Bougainville Papua New Guinea.1972 to 1989

- Produced 3.1 million tonnes copper, 10 million ounces gold and over 25 million ounces silver.

- Original reserves in 1968 were 230 Mt at 0.63% copper and 0.98 g/t gold.


MALAYSIA
INDONESIA
Equator
PNG
Lihir
Bougainville
Ok Tedi
PORT MORESBY
DARWIN
NT
QLD
Tropic of Capricorn
WA
Mt Morgan
Murphyores
AUSTRALIA
BRISBANE
SA
NSW
Browns Creek
PERTH
Ginkgo
SYDNEY
ADELAIDE
Arumpo
CANBERRA
VIC
MELBOURNE
TAS
HOBART
NEW ZEALAND
0 500 1000 1500 2000
km
120°E
140°E
160°E

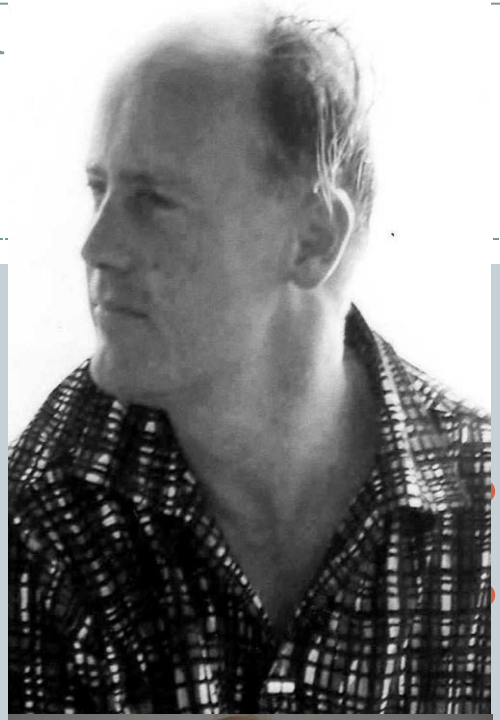
- Author's drainage sediment field gear. 1963

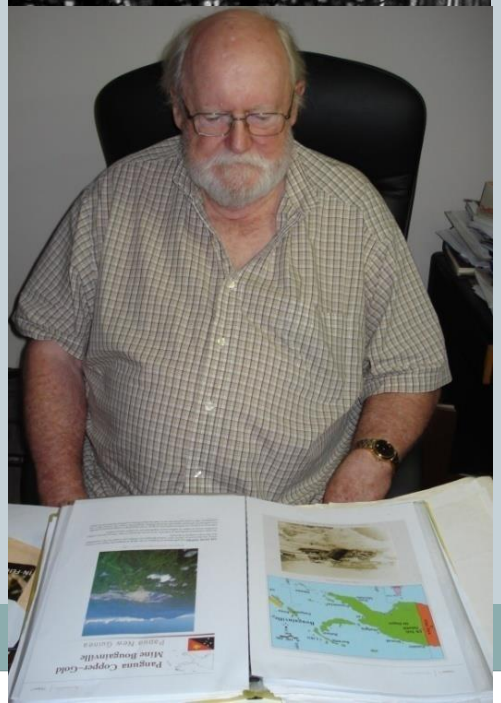


Consolidated Zinc exploration field team 1961 and 1962

Bulman Arnhem Land NT 1961


Bougainville and Mt Bagana



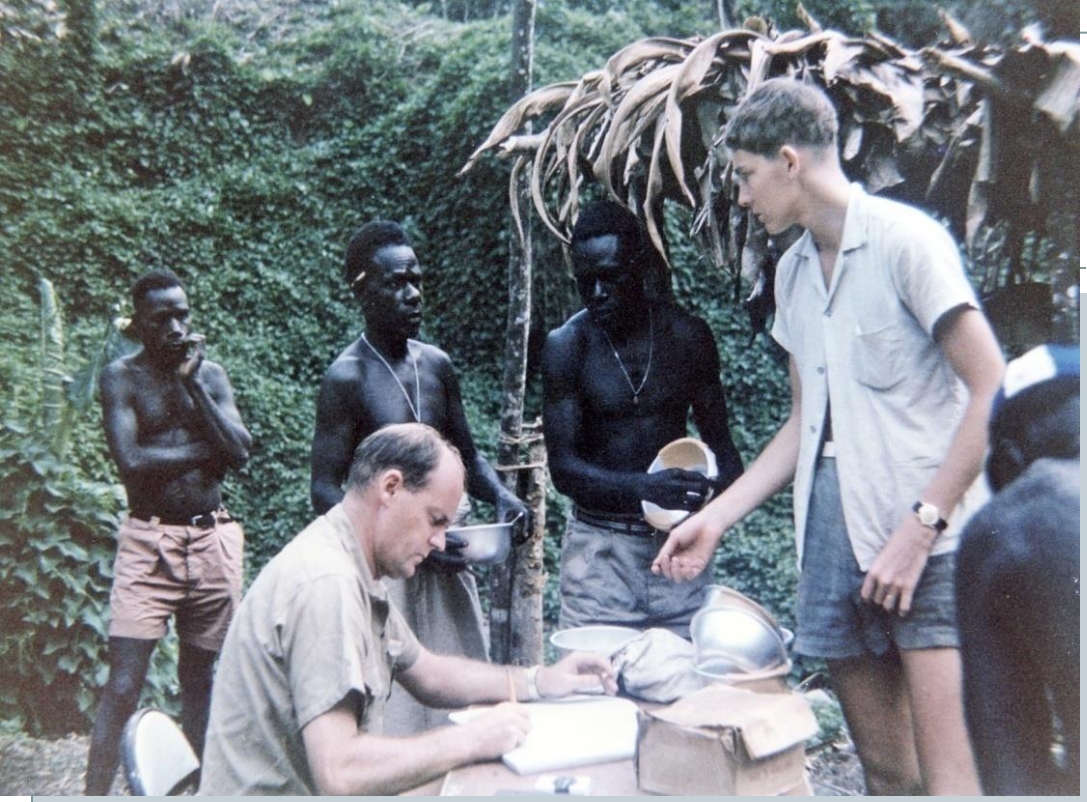


Ken Phillips

early1970's

2012


Geologist Phil
Macnamara



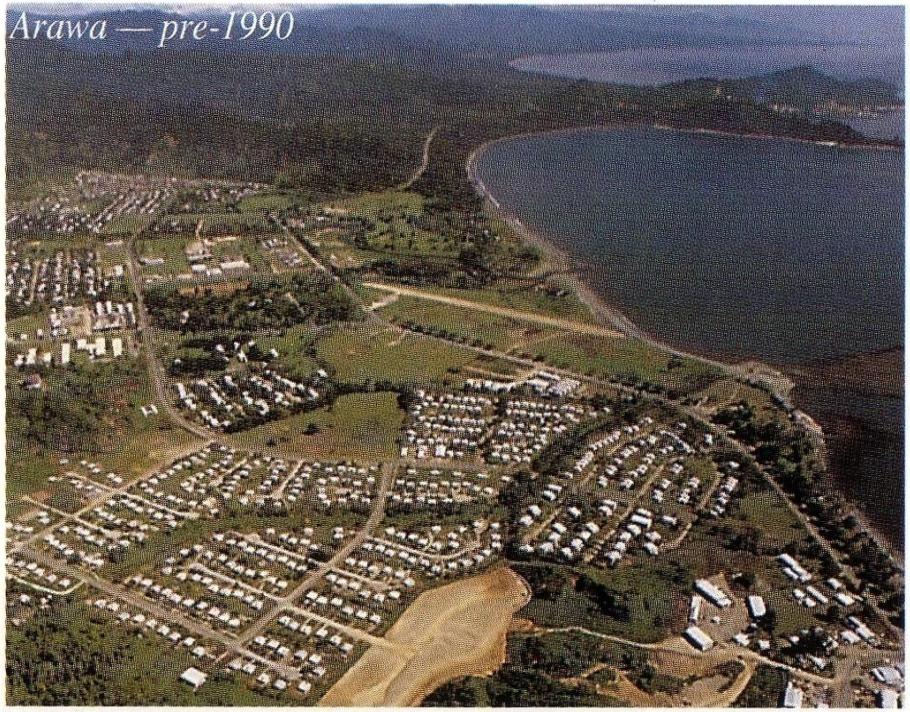
Top. Ken Phillips and Rex Brooks providing rations and pay to locals. 1964.

Surveyor Fred Pratt on helipad. 1965.

Flooding at Bougainville site. c1970

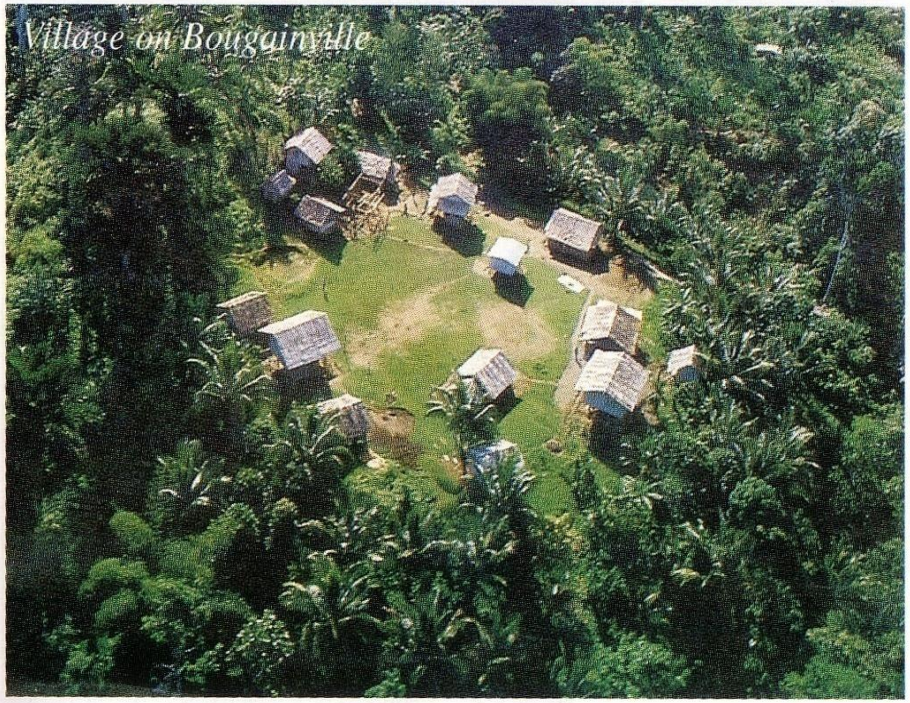

Aerial view of developing open pit. c1972.

Overburden removal. 1971.

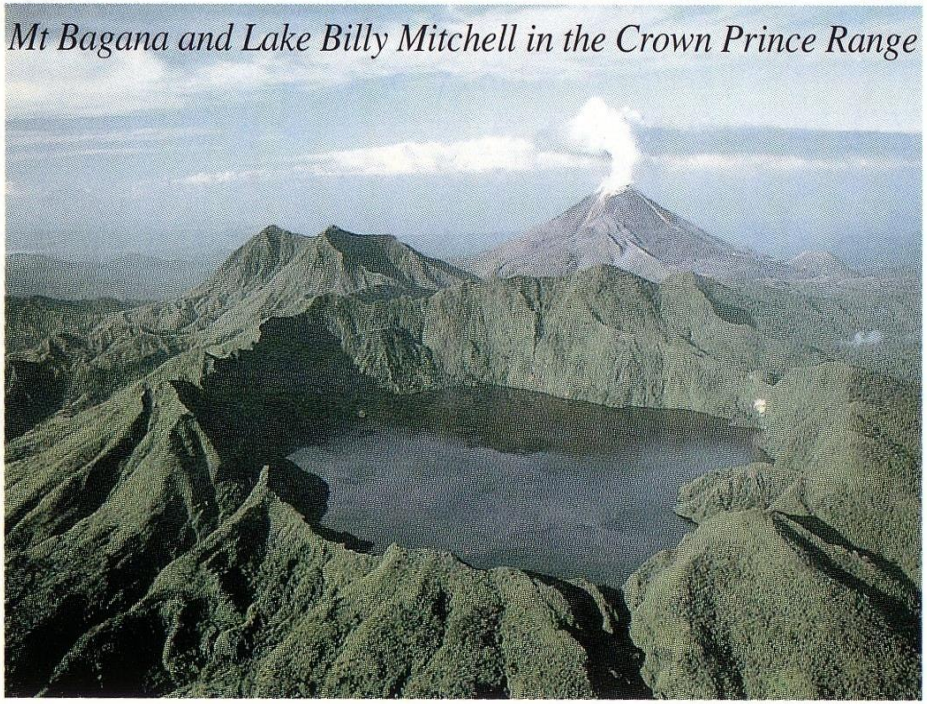


Arawa — pre-1990

Panguna — pre-1990

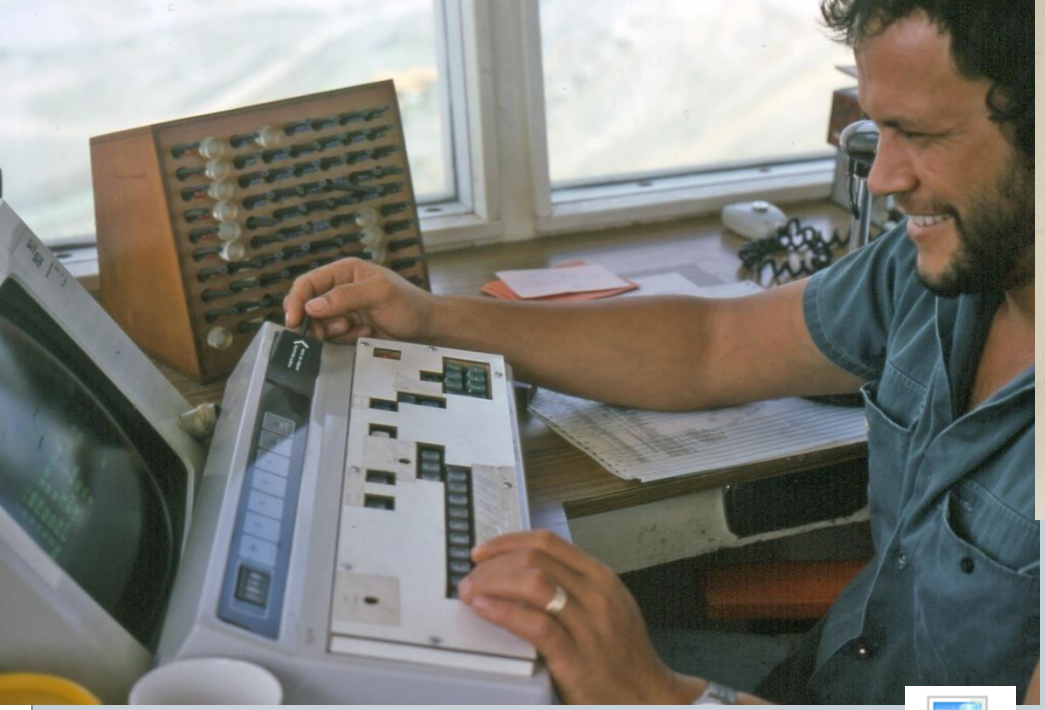


Village on Bougainville



Mt Bagana and Lake Billy Mitchell in the Crown Prince Range

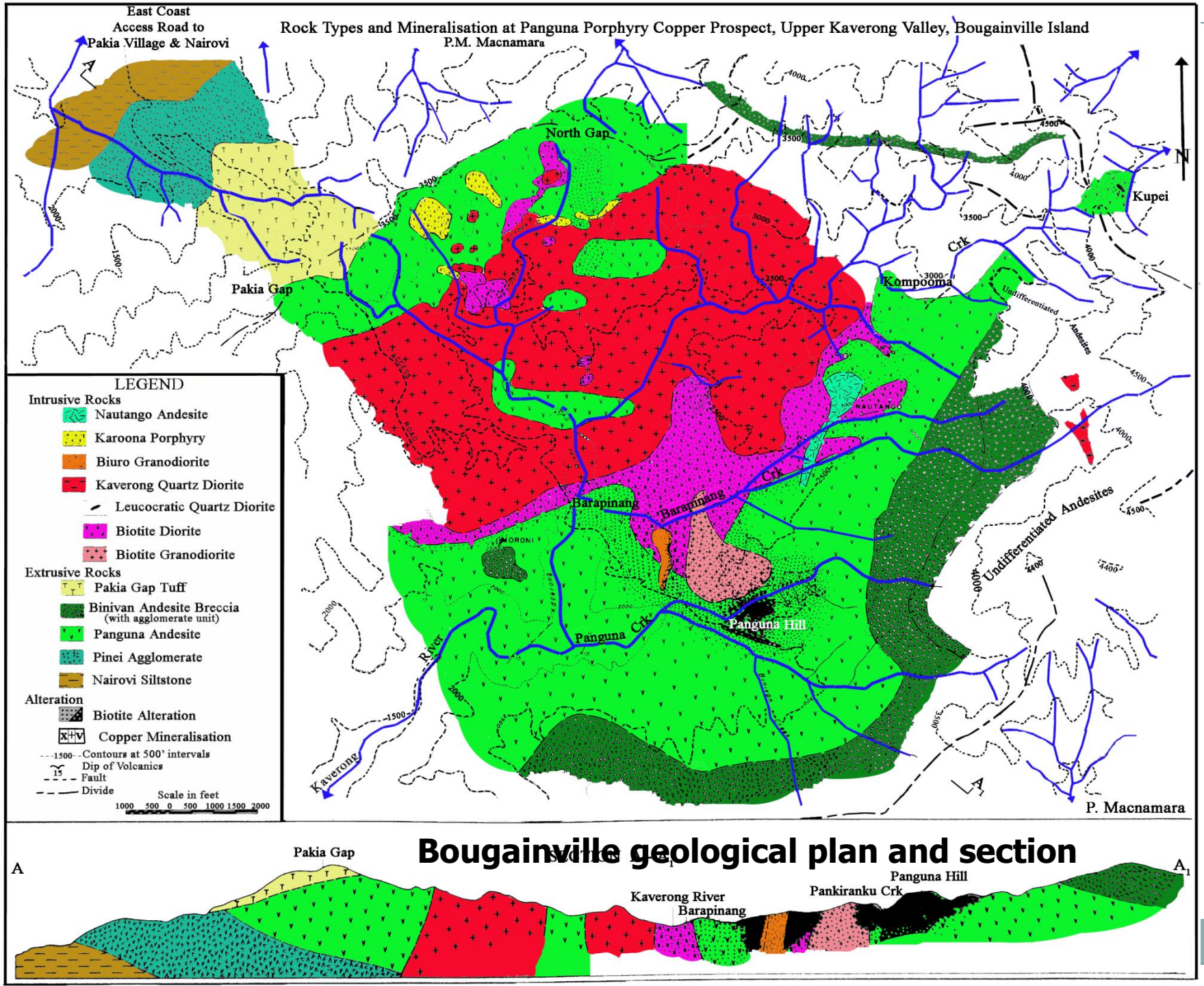
- Open pit 1986



Peter Hobday top. 2010.

Pit control room. 1975.

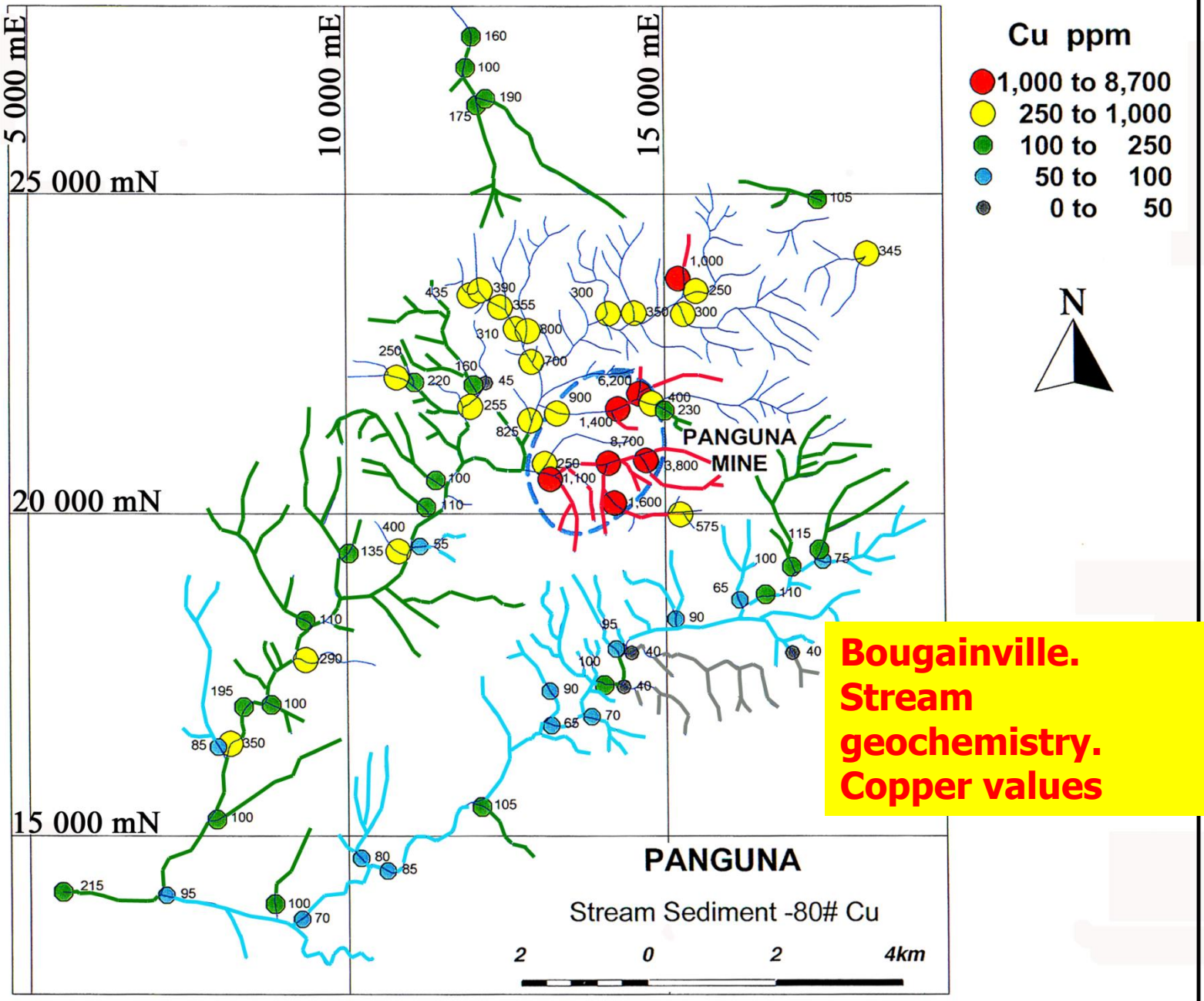
Bougainville field assistants Stuart Golu and Augustine Gomona. c 1967



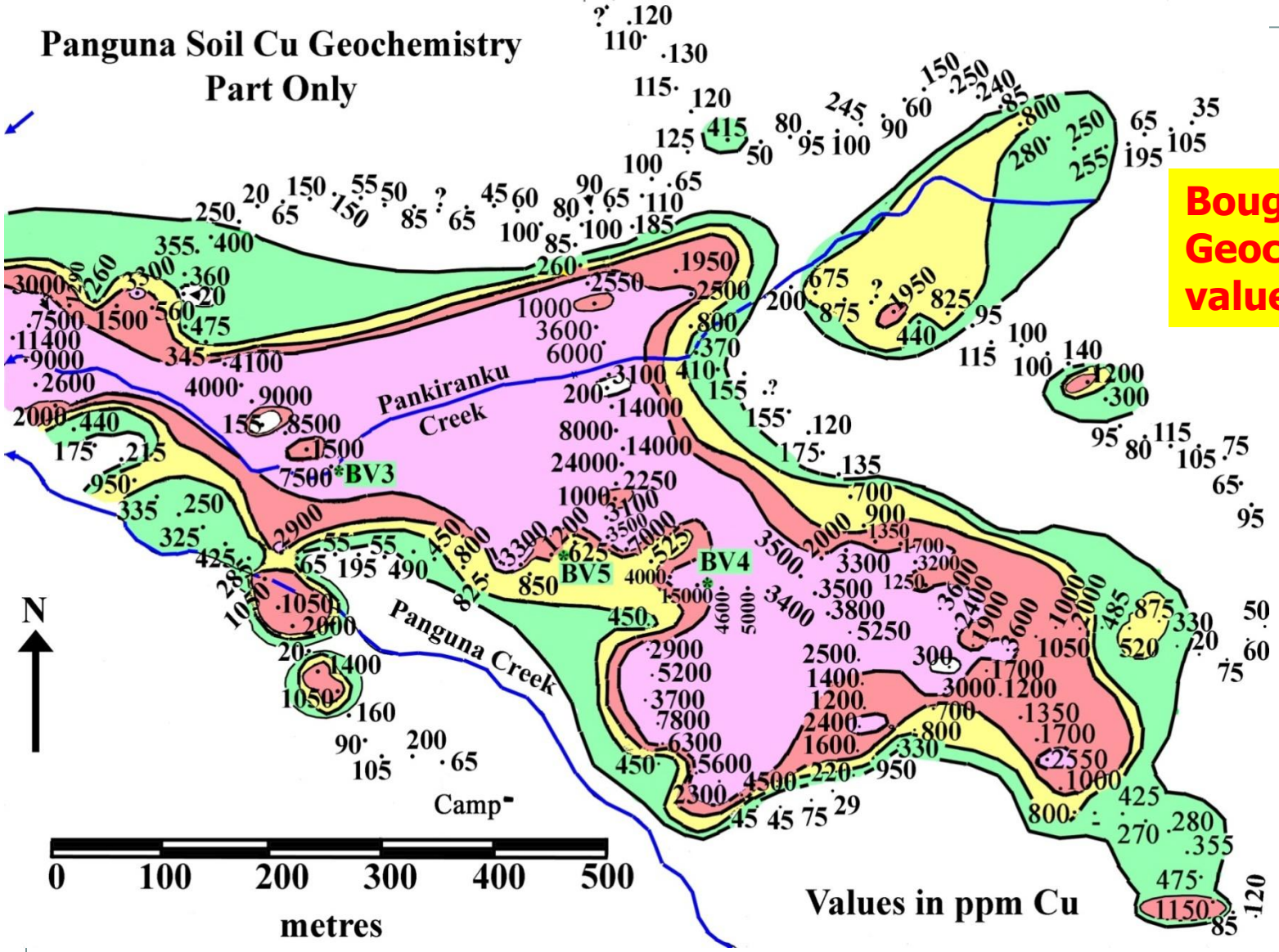
Bougainville geological plan and section

Above. Breccia pipe

Left. Bougainville intrusive containing quartz veinlets and limonite after pyrite and chalcopyrite. Photo R. Lord 1970.



Bougainville. Stream geochemistry. Copper values



Bougainville Geochemical soil values. Copper

Ok Tedi Copper–Gold mine

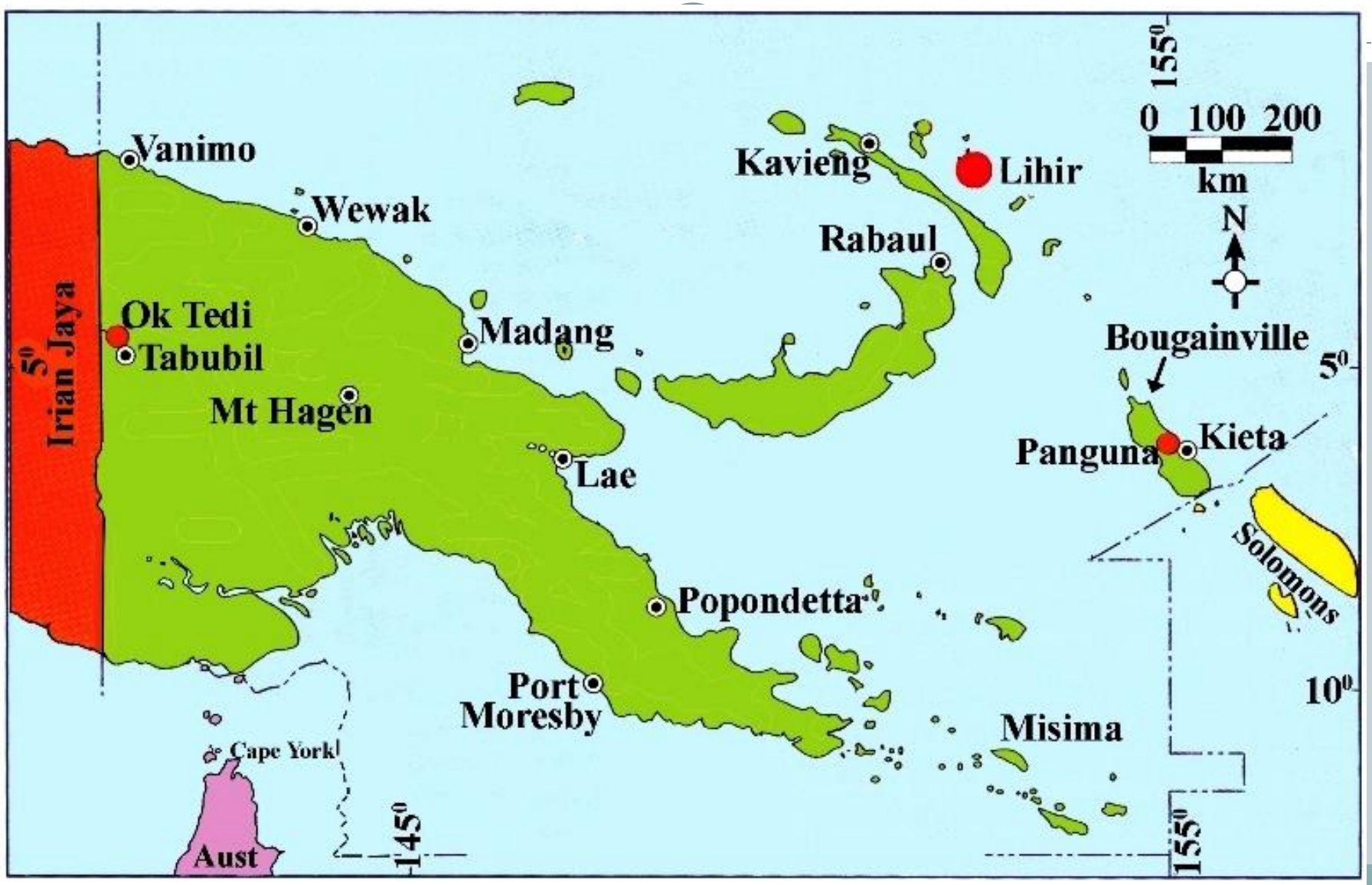
Papua New Guinea

1982 to present

- By end 2007 the mine had produced 3.6 million tonnes copper and 10.5 million ounces gold.

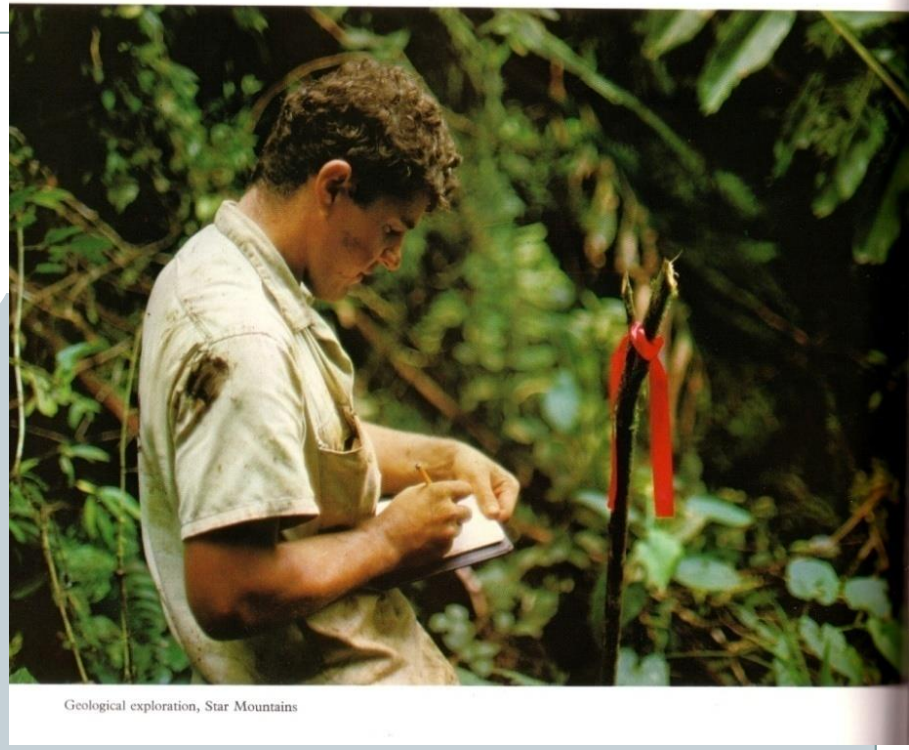
- Mineable reserves in May 1988 were 355 Mt at 0.67% copper and 0.61 g/t gold. In addition to leached cap ore of 2.7 Mt at 2.08 g/t gold.

Ok Tedi-copper/gold

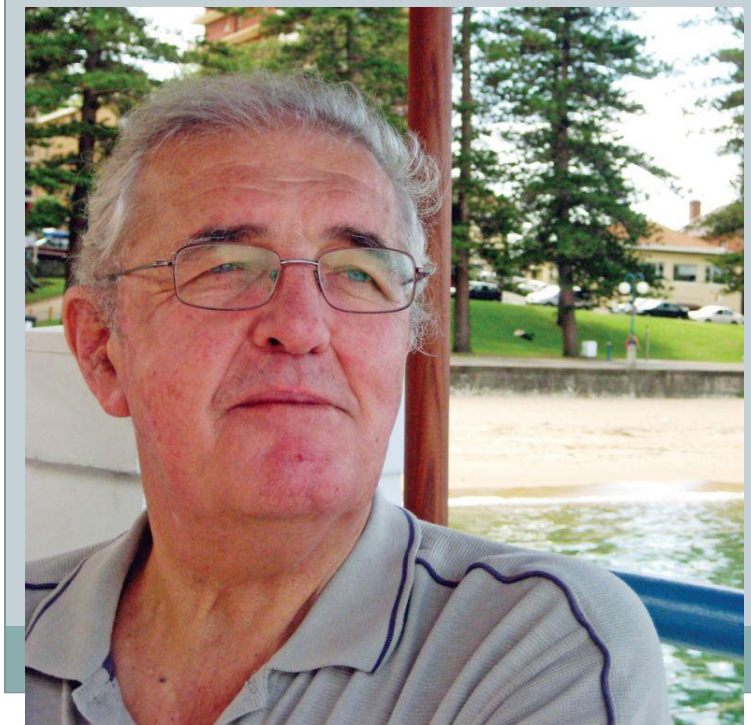


Kennecott geologist Gerry Rayner with ‘locals’ on the Strickland River, 1968.

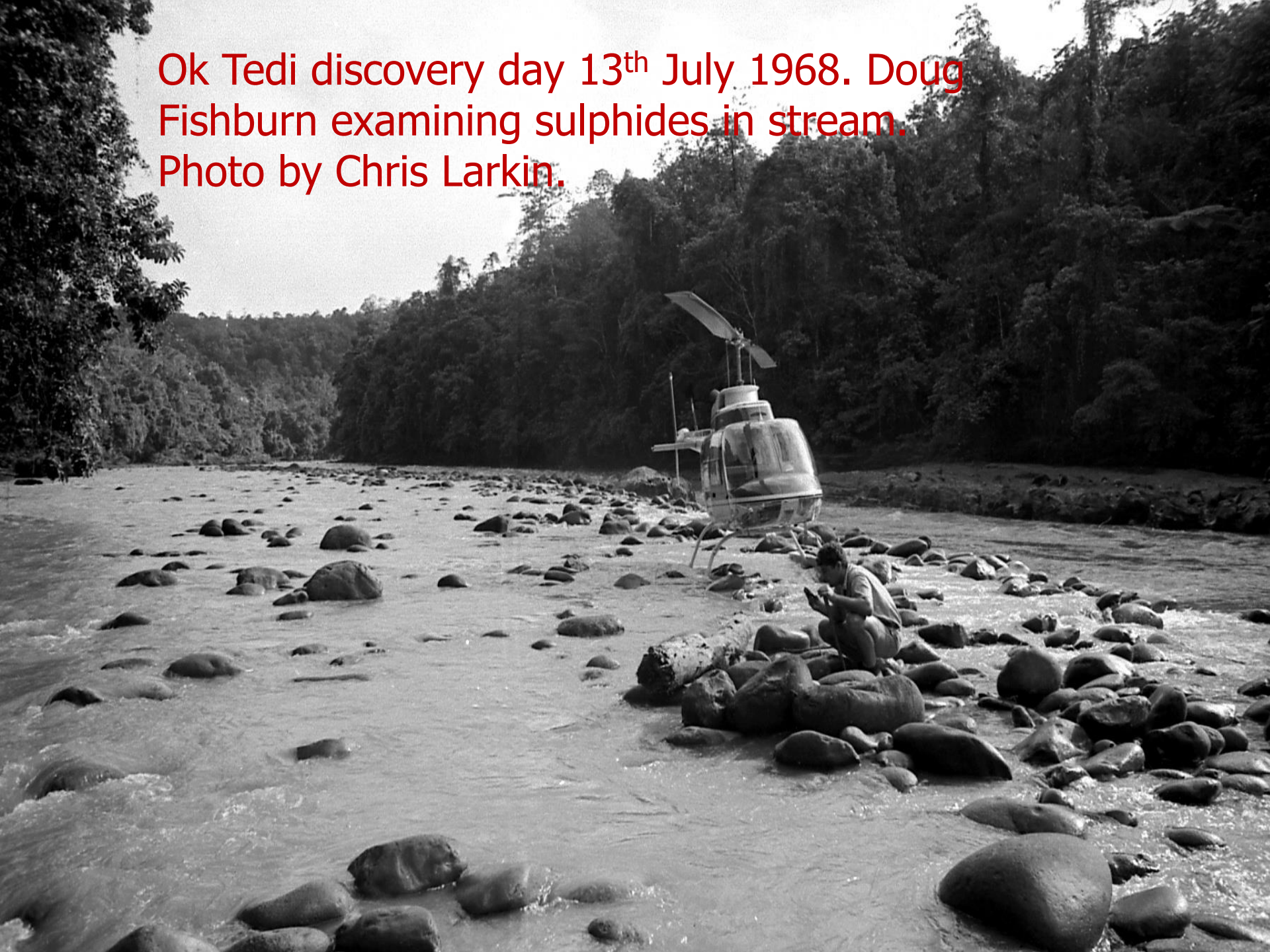
Old camp 1968. Shower and "self flushing" toilet



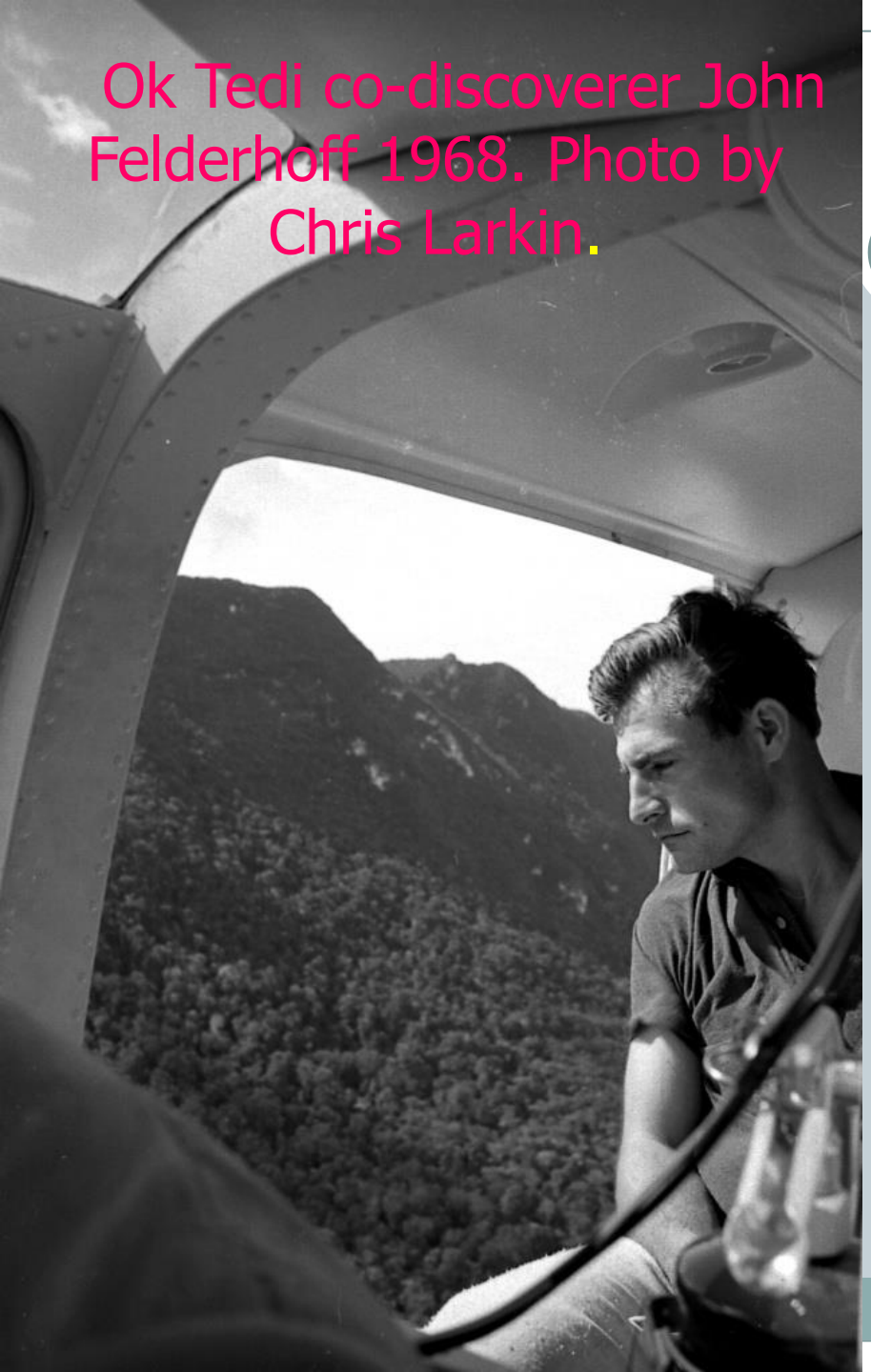
Geological exploration, Star Mountains



23 year old Geologist Doug Fishburn. Co-discoverer of Ok Tedi. 1968 and 2008.

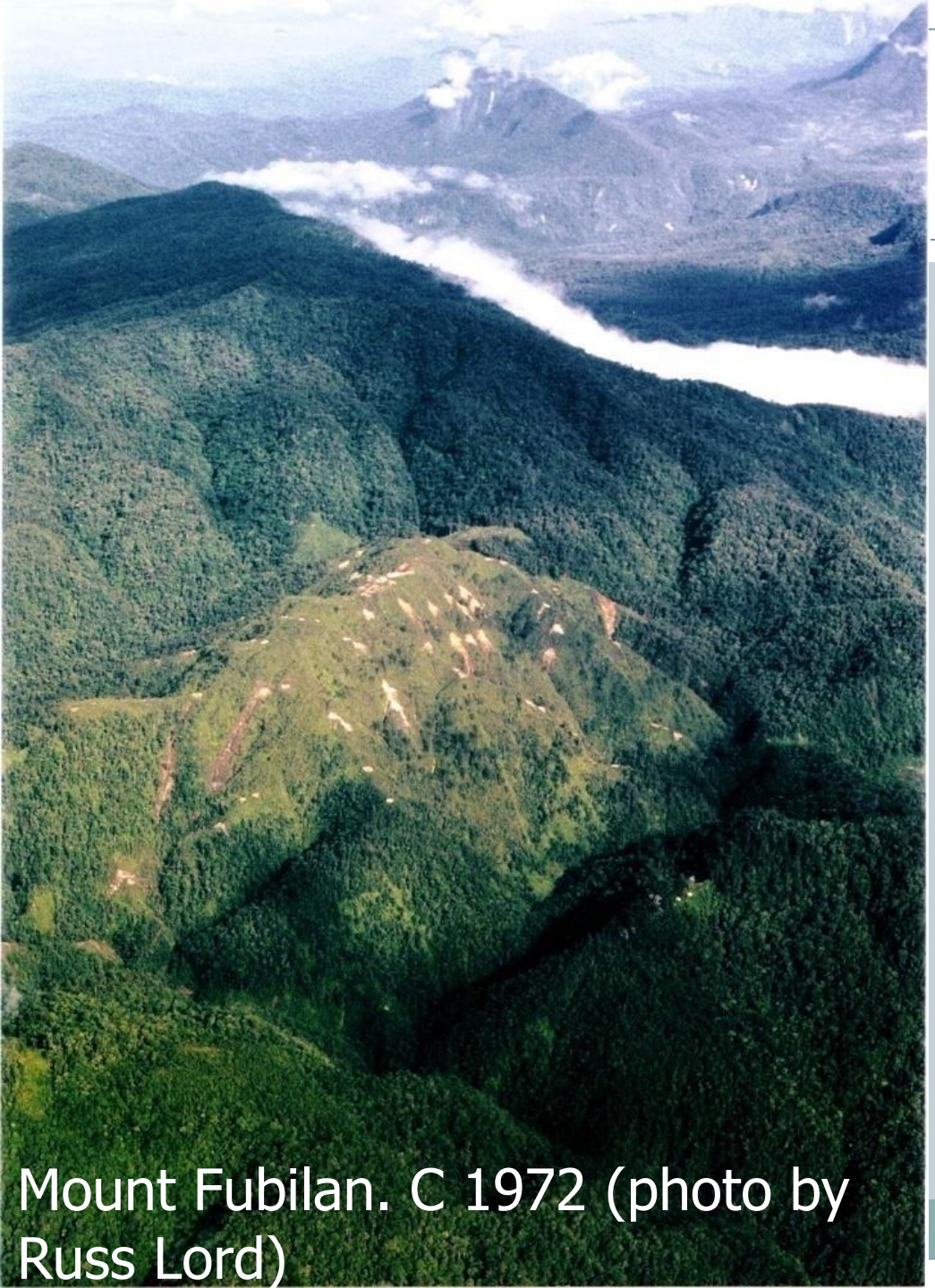


Ok Tedi discovery day 13th July 1968. Doug Fishburn examining sulphides in stream. Photo by Chris Larkin.



Ok Tedi co-discoverer John Felderhoff 1968. Photo by Chris Larkin.

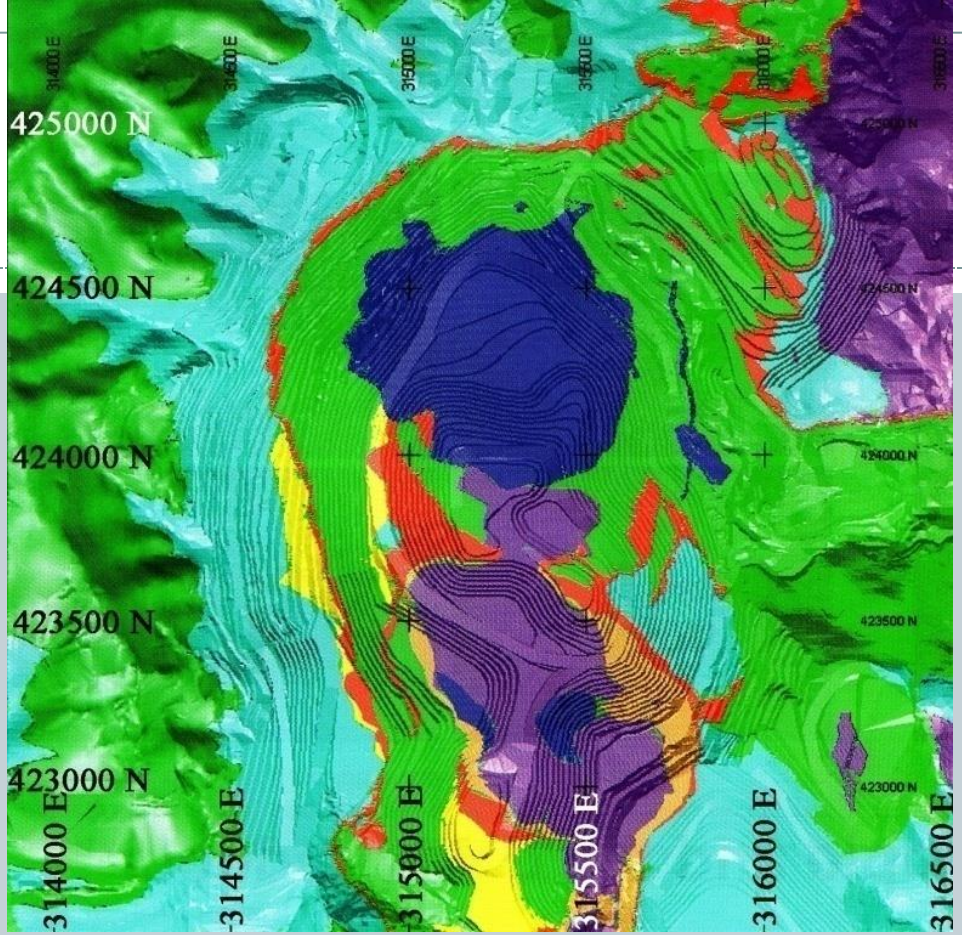
19 year old field assistant Chris Larkin

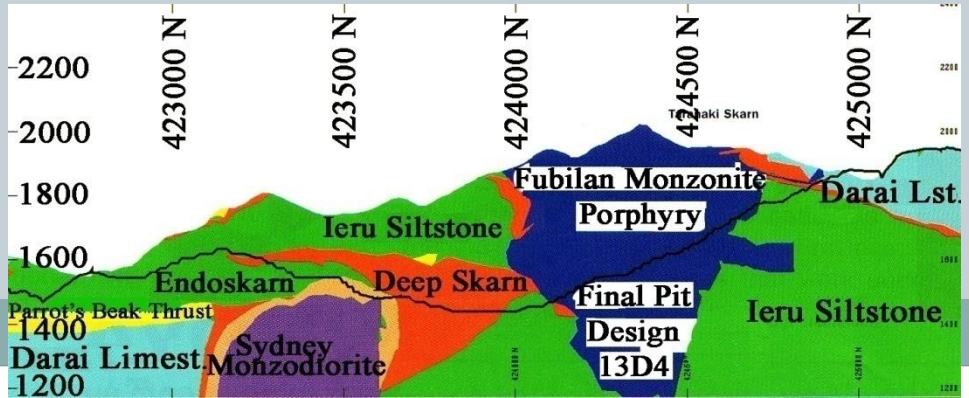


Mount Fubilan. C 1972 (photo by Russ Lord)

Diamond drill rig. 1969

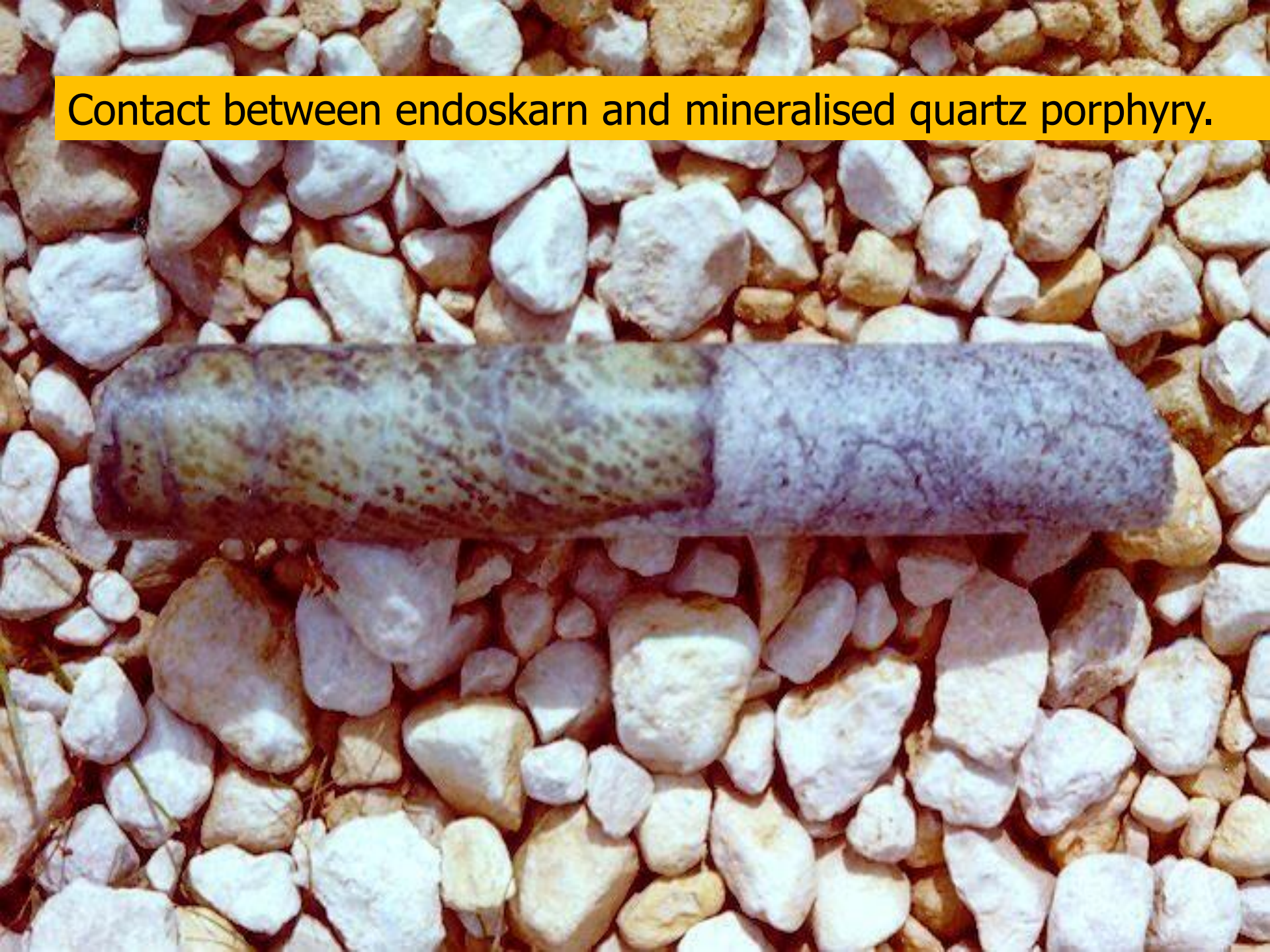
Ok Tedi geological plan and section, 2008. (Smith and Shephard)





Tabubil plateau 1971 and 2004


Ok Gilor in flood beside
old camp, 1968



Contact between endoskarn and mineralised quartz porphyry.

3D model of Ok Tedi drill holes, 1978.

High grade copper zone, c 1977.


Ok Tedi mine complex. 2008
Tabubil
Ok Tedi River
Mill
Moscow Ridge
Office and shops
Waste Dump
Paris Ridge
Fubilan Pit

Gold medallion struck from the first gold pour at Ok Tedi, 1984.

Lihir Gold mine

Papua New Guinea 1982 to present

- **60 million ounces gold.**

- **1991. Sulphide resource 421 MT at 2.77g/t gold and oxide resource 4.3 MT at 2.55 g/t gold**

Lihir-Gold


155°
0 100 200
km
N
Vanimo
Wewak
Kavieng
Lihir
Rabaul
Irian Jaya
Ok Tedi
Tabubil
Madang
Mt Hagen
Bougainville
5°
Panguna
Kieta
Lae
Solomons
Popondetta
10°
Port
Moresby
Misima
Cape York
Aust
145°
155°


N
AERIAL PHOTOGRAPH
OF
LIHIR ISLAND
GOLD DEPOSIT
One kilometre
Kapit Village
CALDERA RIM
Luise
Harbour
KAPIT AREA
COASTAL AREA
Putput Village
Camp
LIENETZ AREA
MINIFIE AREA
1986


Mali Is
1986
lihir gold mine
Sanambiet Island
© 2007 Europa Technologies
Image © 2007 DigitalGlobe
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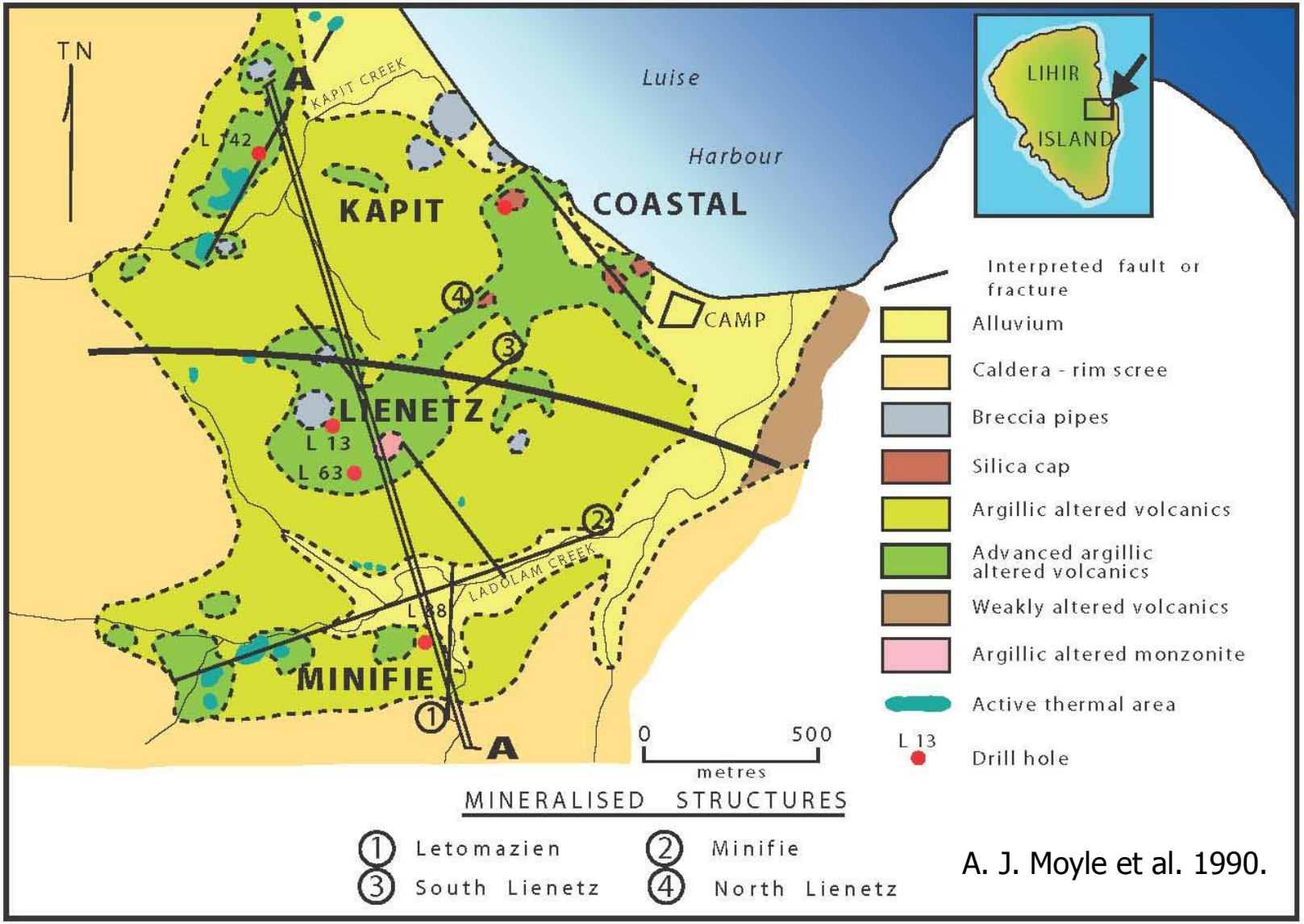
2007



A. J. Moyle et al. 1990.

c 1987

Louise Harbour before and during mining

c 2009

First campsite on Lihir 1983

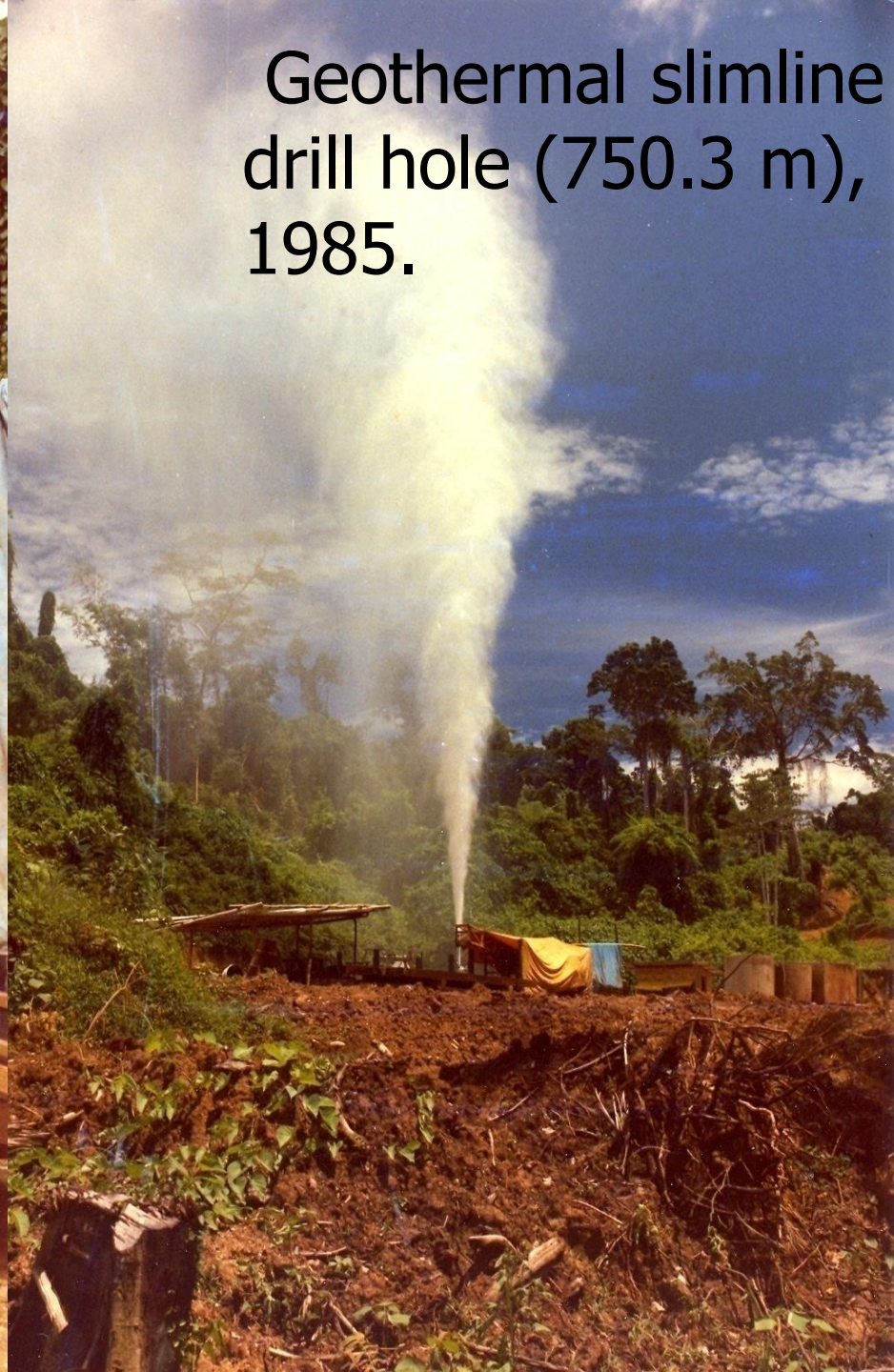
Aerial view of base camp, c1987

Kennecott Geologist Gavin Thomas panning gold at Lihir for Sir Julius Chan (PNG Prime Minister) and family. 1983

Discovery outcrop Lihir

L-R: Gavin Newman, Russell Madigan, Peter McNab, Ken Rehder. Kainantu, c1980s

Beginning of discharge

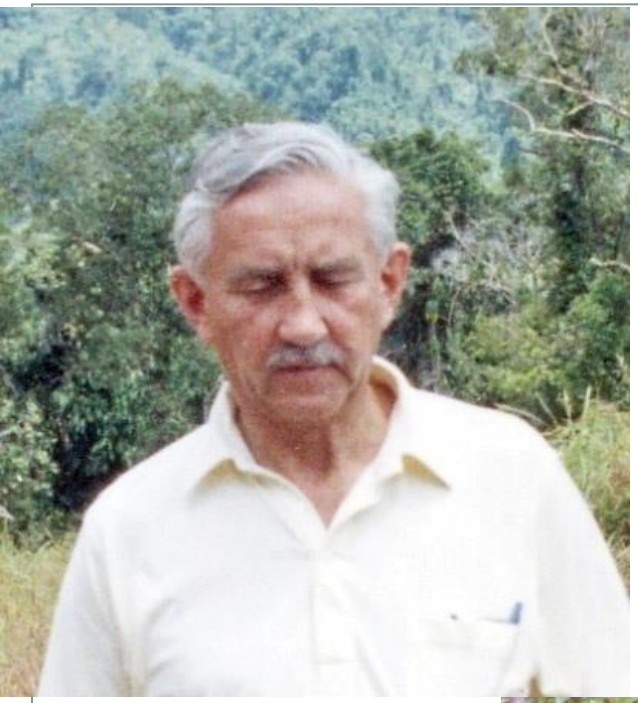


Geothermal slimline drill hole (750.3 m), 1985.

Geologist Sandy Moyle at hot spring used by locals for cooking c1984

One of many active geothermal sites, Kapit 1986

A typical family prior to mining on Lihir, 1986



Greg Corbett, Mike Turbott & Rod Davies, c1986

Kennecott President – Frank Joklik, 1988

Graeme Minifie, c1985

Track mounted reverse circulation air core drill, c1987

Atop a drilling rig, c1985

Aerial view of Lienetz and Minifie Pits, 2007

Londolovit town site, 2007

Local village (Putput), processing plant and mine, 2007

Lihir plant site

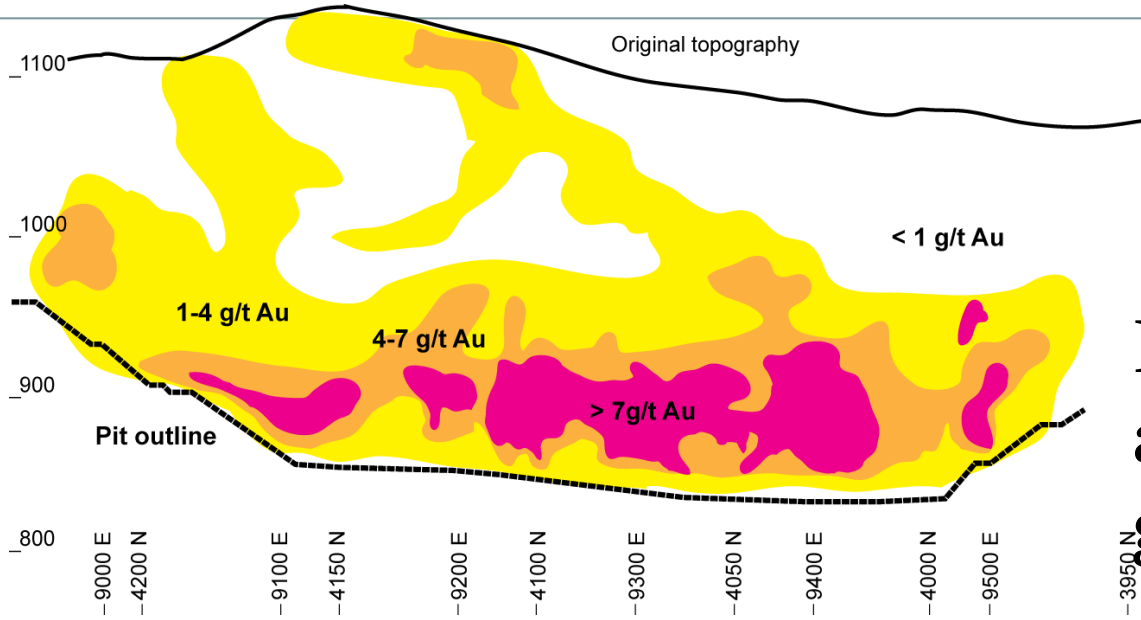
Lihir processing plant, 2007

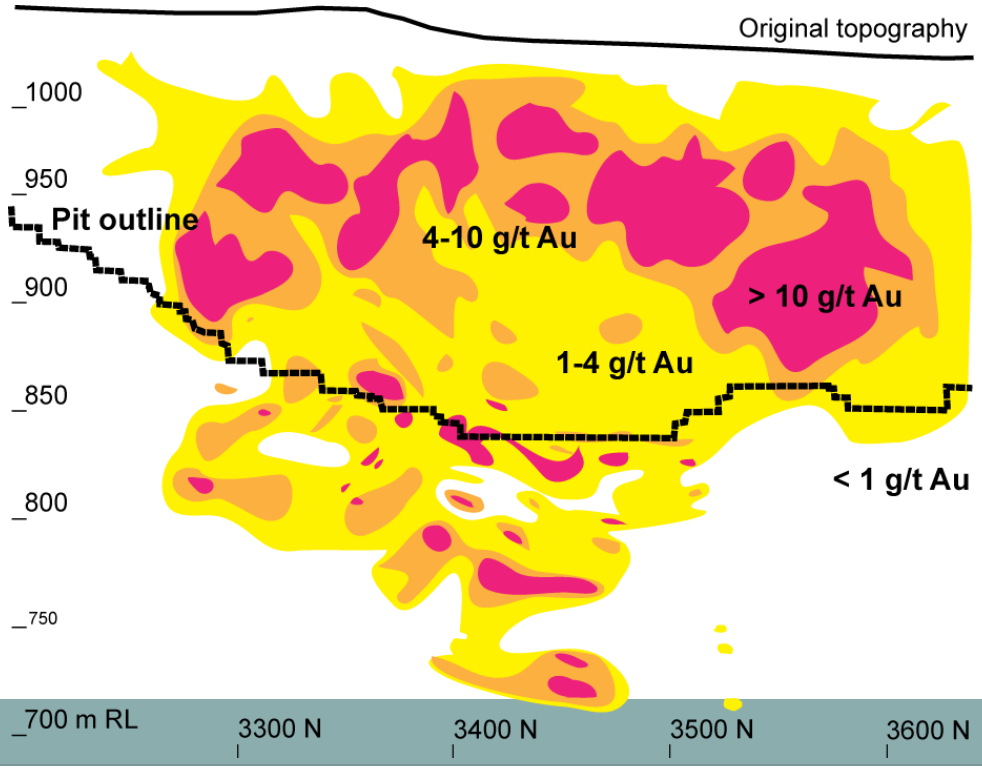

Alaia Rock
Luise Harbour
Lienetz Pit
Minifie Pit

Operating in area of geothermal activity, Lihir

Damage caused by the geothermal outburst of 30 April 2006

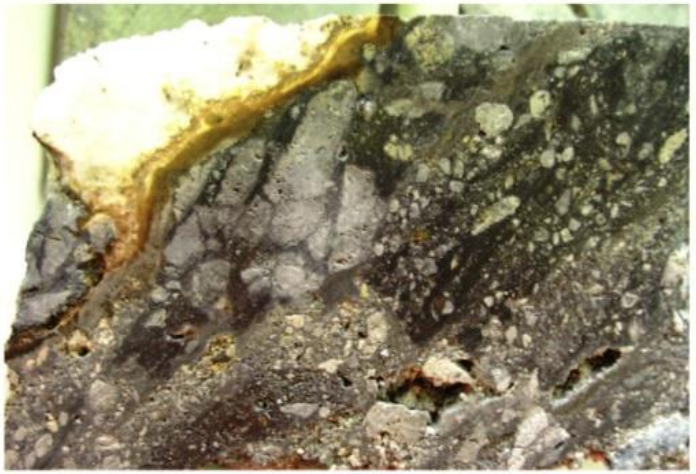
Geothermal outburst





Pit sections and gold grades, c2008

Anhydrite crystals



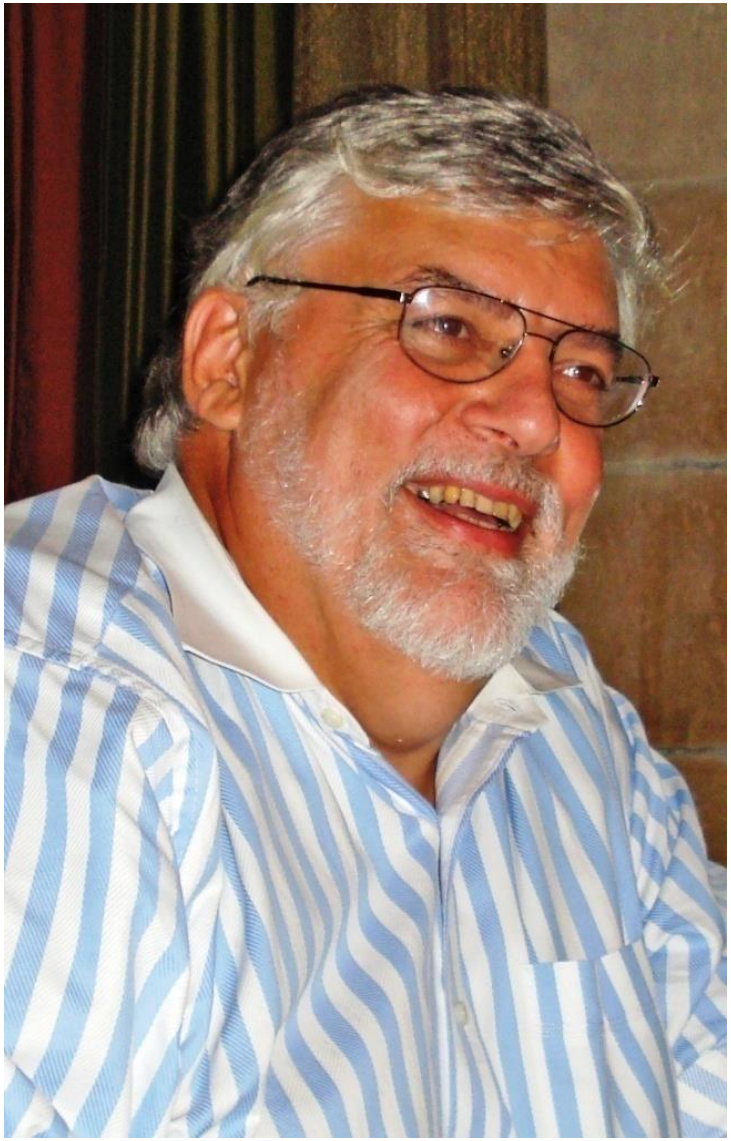
Crackle and fluidised breccia

? Tree clast in breccia

Diorite with pyrite selvages and potassic alteration

Drill hole L188, 129-134.5m showing intense potassic alteration, crackle breccia and quartz-filled structures associated with high gold grades, 1989

Lihir project reunion in Sydney, December 2010



Pioneers of the Lihir discovery – Michael Turbott and Gavin Thomas. Photos 2010.

Working on Lihir geology. PhD students at CODES, University of Tasmania, 2009.

THE END