PIONEERS AND MILESTONES OF INDONESIAN GEOLOGY

4-PETROLEUM AND MINING INDUSTRIES, WWII AND POST-1945 RESTART

J.T. VAN GORSEL

ITB Press

Pioneers and Milestones of Indonesian Geology (~1820-1960s)

4 - Petroleum and Mining Industries, WW II and Post-1945 Restart

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Cover Chapter XIV: An oil drilling rig of BPM at the Suban Djerigi oil field in South Sumatra around 1910. This is a 'Canadian-type' steam-driven cable tool rig, commonly used before the arrival of rotary drilling rigs in the 1920s (Jean Demmeni, Platen van Nederlandsch Oost- en West-Indië, Kleynenberg, 1911. Coll. KITLV 2448).

XIV. PETROLEUM INDUSTRY

The first shallow wells that flowed oil in the Netherlands Indies were drilled in Java and Sumatra in the early 1870s and 1880s, by entrepreneuring individuals like J. Reerink, A. Zijlker and A. Stoop. Until the nationalizations by the Indonesian government in the late 1950s and 1960s, the petroleum industry had been entirely the realm of private companies (although the Netherland Indies government had participated in the *Nederlandsch-Indische Aardolie Maatschappij* (NIAM), which was operated by the *Bataafsche Petroleum Maatschappij* (BPM; a Royal Dutch/Shell affiliate) in the 1930s).

Indonesia played a significant role in the development of the petroleum industry, as it was the birthplace of the large multinational *Royal Dutch/Shell* in the late 1800s. Many small oil independent oil companies came and went around 1900, but by 1940 all oil production in the Netherlands Indies came from only two companies: *Royal Dutch/Shell* (operating as *Bataafsche Petroleum Maatschappij/BPM*; 75%) and the American *Nederlandsche Koloniale Petroleum Maatschappij* (*NKPM*; later known as *Stanvac* or *SVPM;* 25%).

In the late 1800s, the Netherlands Indies were behind the more advanced European and American oil producing regions in petroleum technology. Some of the first drilling crews and equipment therefore came from the USA and Canada and also from Baku (Russia). The first petroleum geologists arrived in the Indies only around 1900 and most of them were hired from Switzerland and Germany. An extensive review of the early history of the petroleum industry in the Netherlands Indies is by Poley (2000).

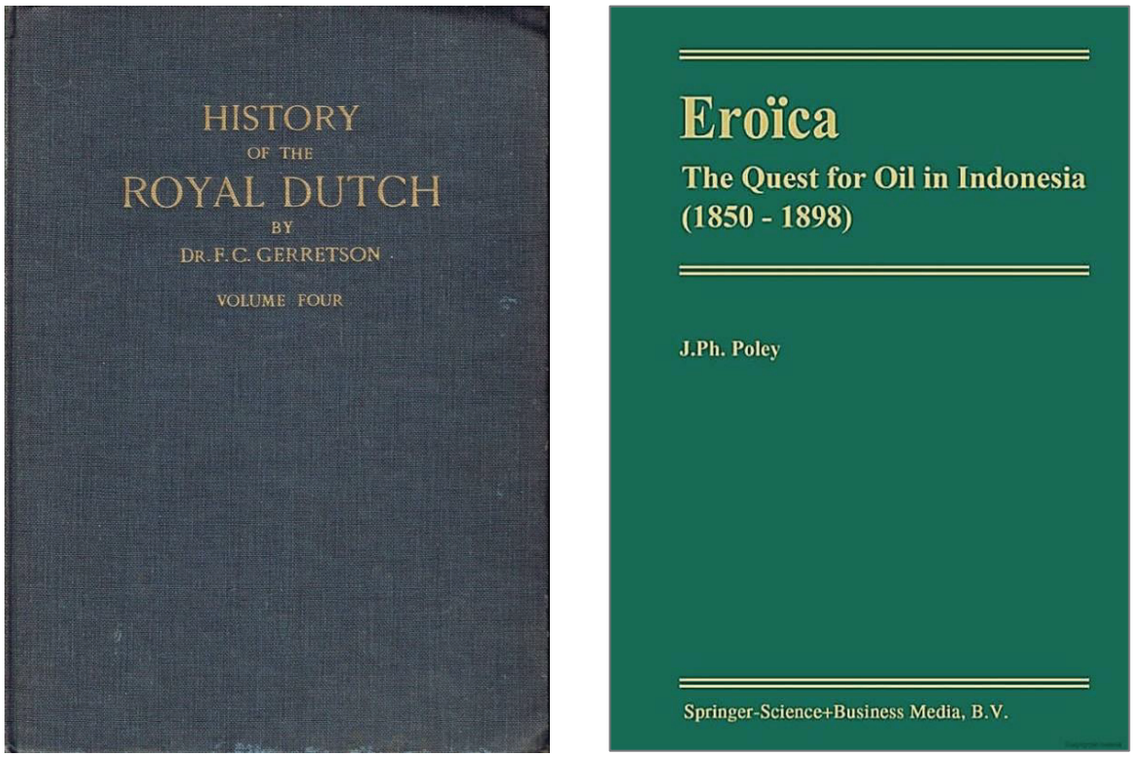


Fig. XIV.1. Two classic books on the early history of the oil industry in Indonesia. Left: History of the Koninklijke Olie/ Royal Dutch/Shell company (Gerretson, 1953-1957; English edition of the Dutch original version of 1935-1937). Right: The Poley (2000) book of the early oil industry in Indonesia in the 1800s.

Industry geologist's publications

Numerous brilliant geologists worked in the oil, coal and mining industries of Indonesia since 1900, especially as employees of the *Koninklijke*/BPM. Unfortunately, the results of industry geological survey work were rarely made public. The confidentiality of most of this useful, historic survey work was due to a combination of data protection for competitive advantage, but apparently there were also legal restrictions regarding confidentiality of survey data in the Netherlands Indies (a practice that continues in Indonesia until now).

Fig. XIV.3. Collecting oil from a natural oil seep on the Ledok anticline, NE Java (Witkamp, 1917). A bundle of rice straw is dipped into the well, and then squeezed out into a bowl made from palm leaf.

Commercial value of oil before 1900

A typical crude oil from North Sumatra was composed of:
- 24 % light fraction, mainly gasoline (before 1900 of no value and mostly burned off);
- 48 % lamp oil (kerosene; marketed as Langkat kerosene in 1892, by 1898 rebranded as Crown kerosene);
- 26 % motor oil and paraffin (used in candle factories in Pangkalan Brandan, Balikpapan and Cepu; later also for motor oil and bunker fuel).

In 1890 only the lamp oil fraction of the crude oils had significant commercial value; much of the rest was burnt off. Later, the paraffin extracted from oils of western Indonesia was used for candle factories in North Sumatra (Pangkalan Brandan), East Borneo (Balikpapan) and NE Java (Cepu).

Lamp oil

Serious interest in petroleum and petroleum products in the Indonesian region dates from 1865, after American traders started marketing large quantities of 'lamp oil' (kerosene) from Pennsylvania, USA. Kerosene-fueled oil lamps rapidly became the most popular instrument for illumination across Asia, as they burnt cleaner and lasted much longer than previously used methods of illumination, like torches dipped in coconut oil or in 'damar' (a resin from dipterocarp trees).

The worldwide lamp oil/kerosene business had fueled the rapid growth and wealth of the *Standard Oil Company*. In order to replace the imported lamp oils from America and Russia with local sources, the search for oil in the Indonesian region started in earnest in the 1880s. By 1897, the Pangkalan Brandan refinery of *Royal Dutch* in North Sumatra (built in 1892) supplied 30% of the lamp oil in the Netherlands Indies and in SE Asia, mainly from 18 producing wells in the *Telaga Said* field, cutting into the Standard Oil-dominated market.

XIV.1. Earliest petroleum industry in Indonesia: drilling oil and gas seeps (1870-1900)

The strategy of the early oil pioneers in the late 1800s was to drill wells on surface oil or gas seeps. The technology of those days did not allow to drill deeper than a few hundred meters. Geologists did not get involved in the operations of oil companies until after 1900.

Oil and gas seeps

Surface seeps of oil and gas in the Indonesian region had been known for centuries to local people, who exploited some of the *minyak tanah* for lighting and medicinal and other purposes. For instance, De Groot (1864) reported that some 250 bottles of oil were recovered per year from shallow pits on Madura Island. W.H. de Greve Sr. (1865) and Von Baumhauer (1869) listed 53 known sites of oil seepage across the Netherlands Indies (44 of them in Java).

Some of these areas with seeps became significant oil-gas producing oil provinces (North and South Sumatra, NE Java, East Kalimantan). Other areas with seeps were tested, but never yielded any commercial discoveries, including the Semarang and Banyumas areas in Central Java, the Bengkulu Basin in West Sumatra, the Ombilin Basin of West Central Sumatra and Madura Island.

Fig. XIV.6.
An oil seep in the jungle near Lubuk Bendaharo, Central Sumatra (photo Arnold Heim 3/1928, ETH Zurich Photo Archive)

Oil and gas seeps are a classic '*good news- bad news'* story. The good news is that they prove that there is (or was) a working hydrocarbon system in the underlying basin. The bad news is that much (or all) of the hydrocarbons leaked to the surface, indicating there are problems with the integrity of sealing formations.

Sumatra is a good example of why the old '*follow the oil and gas seeps*' is not necessarily the best exploration strategy. The Central Sumatra Basin holds the largest oil fields in Indonesia, but there are no surface oil or gas seeps (Fig. XIV.7). By contrast, oil and gas seeps are quite common in the North and South Sumatra basins, but oil field sizes are much smaller than the Central Sumatra giant fields *Minas* and *Duri*.

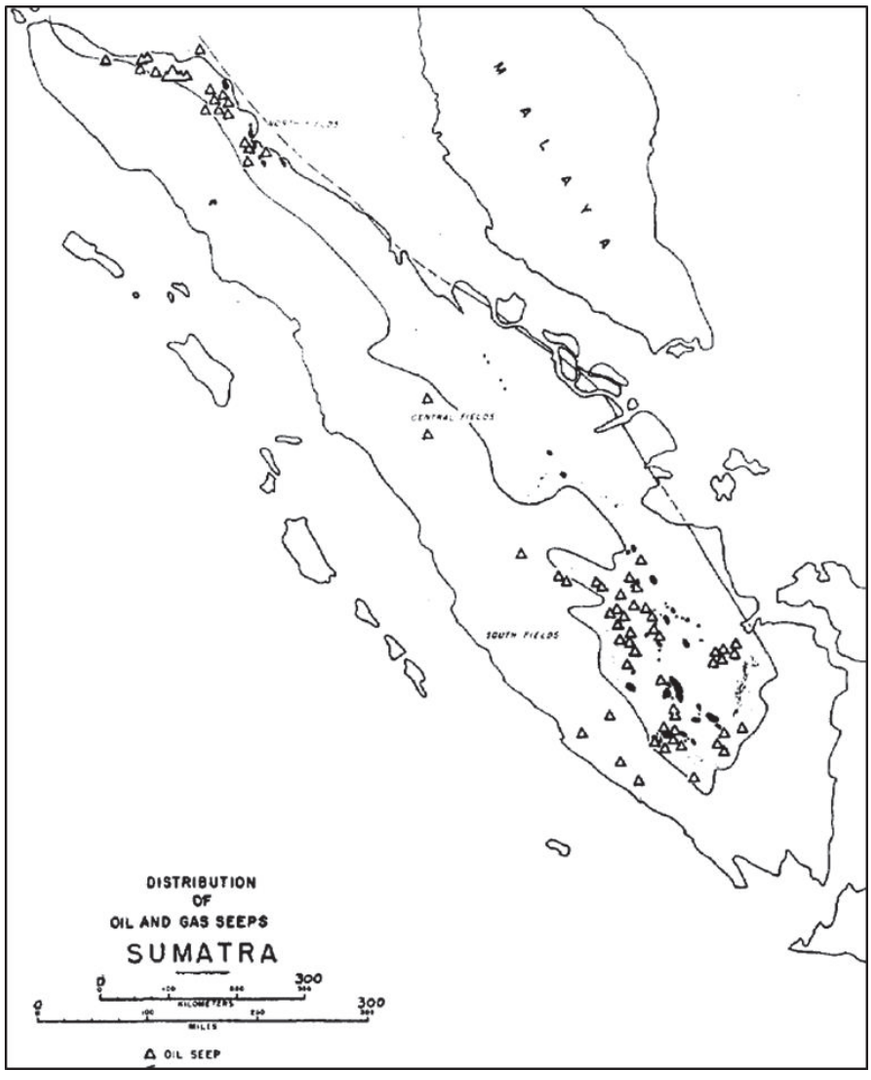


Fig. XIV.7.
A map of oil seeps in Sumatra (Link, 1952). Surface oil and gas seeps guided all early oil exploration since the late 1800s. However, Indonesia's largest oil fields are in Central Sumatra (Minas, Duri), in a basin without known oil or gas seeps.

F. Junghuhn advised against oil drilling on Java, 1863

In 1863, chemist Prof. E. von Baumhauer from Amsterdam and Ir. C. de Groot, Head of the *Dienst van het Mijnwezen* (Bureau of Mines) in Bogor, urged the Netherlands Indies government to drill test wells for oil on the many oil seeps that were known on Java, which could potentially lead to industrial scale oil production.

BRIEF

GERIGT AAN

ZIJNE EXCELLENTIE den GOUVERNEUR-GENERAAL van NED.-INDIË,

OMTRENT

DE EXPLOITATIE VAN AARDOLIE

OP

JAVA,

DOOR

Dr. Fr. JUNGHUHN.

Ingevolge bekomen last, vereer ik mij Uwe Excellentie mijne consideratien en advies uit te brengen omtrent het door de heeren Baumhauer en de Groot voorgestelde ter exploitatie van aardolie op Java.

Fig. XIV.8.
Parts of a 1863 letter by F. Junghuhn to the Governor General of Netherlands Indies, advising against the government's involvement in drilling for 'Earth oil' on Java' (Tijdschrift Nijverheid Landbouw in Nederlandsch-Indie 11, p. 357-361)

Derhalve vermeen ik Uwer Excellentie eerbiedigst te moeten aanraden, niet naar bergolie te laten zoeken, maar liever in de vlakte van Grobogan een boorgat op zout te laten maken, waar althans hoop bestaat eene sterk geconcentreerde zoutloog te verkrijgen.

Lembang,
30 Augustus 1863.

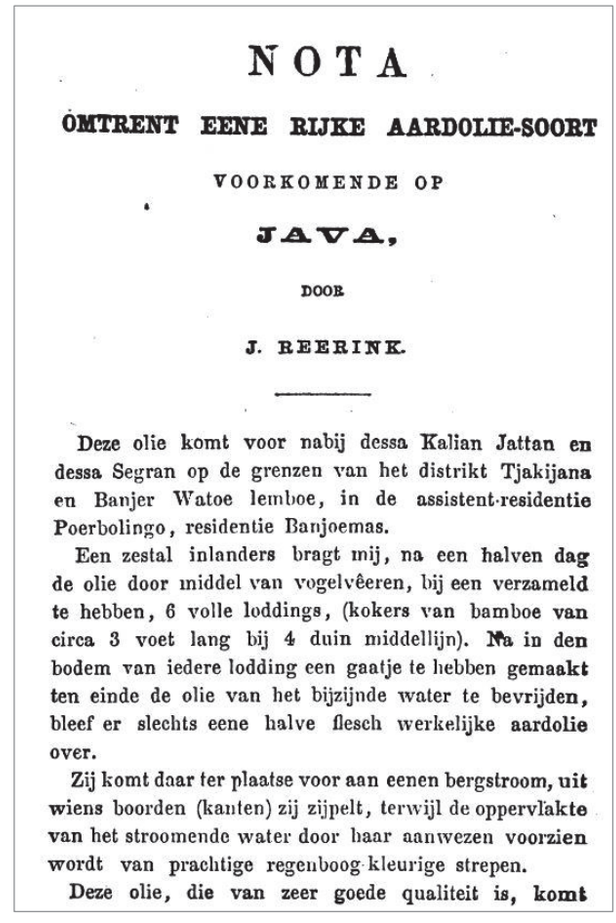
173. Jan REERINK (Haarlem 1836- Haarlem 1923)

Jan Reerink is known as the first oil drilling and production pioneer in Indonesia, operating near Cirebon in Central Java, between 1871 and 1876. He drilled the first oil discovery well in Indonesia in 1873, but his venture would ultimately be a commercial failure.

Jan Reerink (who later called himself Jan Reerink van Cheribon) was born on 7 October 1836 in Haarlem, The Netherlands, and grew up there. His father H.J. Reerink operated a grocery store in de *Grote Houtstraat* 14.

Netherlands Indies, 1860-1884

In 1860, at age 24, Reerink moved to Cirebon in West Java, to work in a rice mill. After several years he opened a General Store ('*Toko a Contant*') in Cirebon and was joined in the business by his brother. The store sold a large variety of tools and other hardware supplies, as well as imported food stuffs like cigars, wines, etc. In 1873 they added self-produced, purified petroleum, 'in American tin packaging' (Fig. XIV.16).



NOTA

OMTRENT EENE RIJKE AARDOLIE-SOORT

VOORKOMENDE OP

JAVA,

DOOR

J. REERINK.

Deze olie komt voor nabij dessa Kalian Jattan en dessa Segran op de grenzen van het distrikt Tjakijana en Banjer Watoe lemboe, in de assistent-residentie Poerbolingo, residentie Banjoemas.

Een zestal inlanders bragt mij, na een halven dag de olie door middel van vogelvêeren, bij een verzameld te hebben, 6 volle loddings, (kokers van bamboe van circa 3 voet lang bij 4 duim middellijn). Na in den bodem van iedere lodding een gaatje te hebben gemaakt ten einde de olie van het bijzijnde water te bevrijden, bleef er slechts eene halve flesch werkelijke aardolie over.

Zij komt daar ter plaatse voor aan eenen bergstroom, uit wiens boorden (kanten) zij zijpelt, terwijl de oppervlakte van het stroomende water door haar aanwezen voorzien wordt van prachtige regenboog-kleurige strepen.

Deze olie, die van zeer goede qualiteit is, komt

Fig. XIV.12. Portrait of Jan Reerink, the Cirebon trailblazer of first oil drilling in Indonesia (from Poley, 2000).
Fig. XIV.13. Title page of Reerink's 1865 paper on an oil seep in the Banyumas Residency of Central Java.

Around 1870 Reerink had learned of good quality light oil, seeping from Tertiary sediments along the Cibodas River at the western foot of the Ciremai volcano, ~40 km WSW of Cirebon. These seep locations had already been known to Junghuhn (1853) and De Greve (1865).

Reerink was the first to drill for and produce oil in Indonesia, from several shallow wells (~100m depth), named *Tjibodas Tanggat* 1-4, on the Madja oil seep in 1872-1873, using a 'Pennsylvanian rig, without using any casing, so the well could not be drilled deeper than 125m. The oil was relatively light, and of good quality for lamp oil. Reerink obtained an official production concession from the Department of Mines in August 1873.

Reerink stepped up his game in 1873, with a visit to oil-producing areas in Europe (Galicia in what is now southern Poland), the USA and Canada, to study petroleum industry operations and to buy equipment. With financial support from the *Nederlandsche Handel Maatschappij*, he bought a 'Canadian-type' steam cable tool

drilling rig and shipped it to Majalengka, Java. In the meantime, the first shallow wells flowed enough oil to start marketing *Madja Petroleum* lamp oil, the first oil commercialized oil in Indonesia.

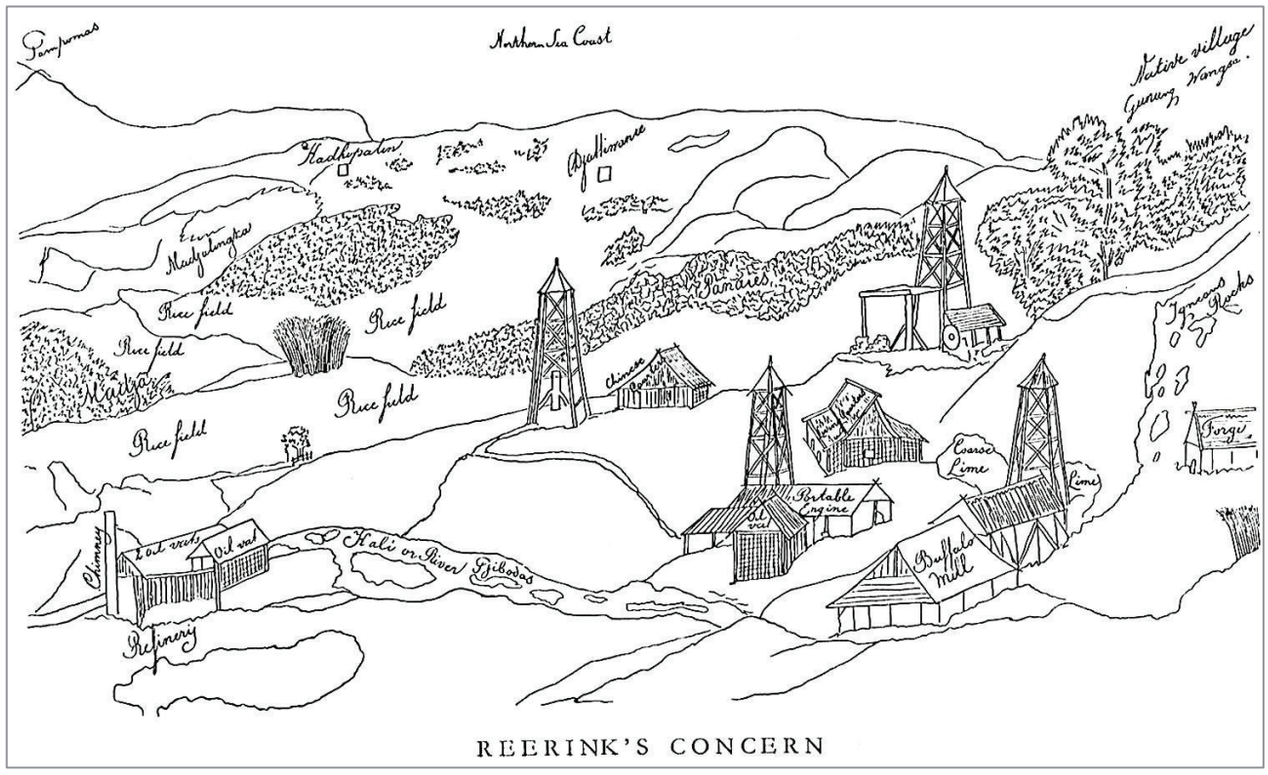


Fig. XIV.14. Sketch of Reerink's oil field in the hill country off the Cibodas River near Semarang in the 1870s (Gerretson, 1953).

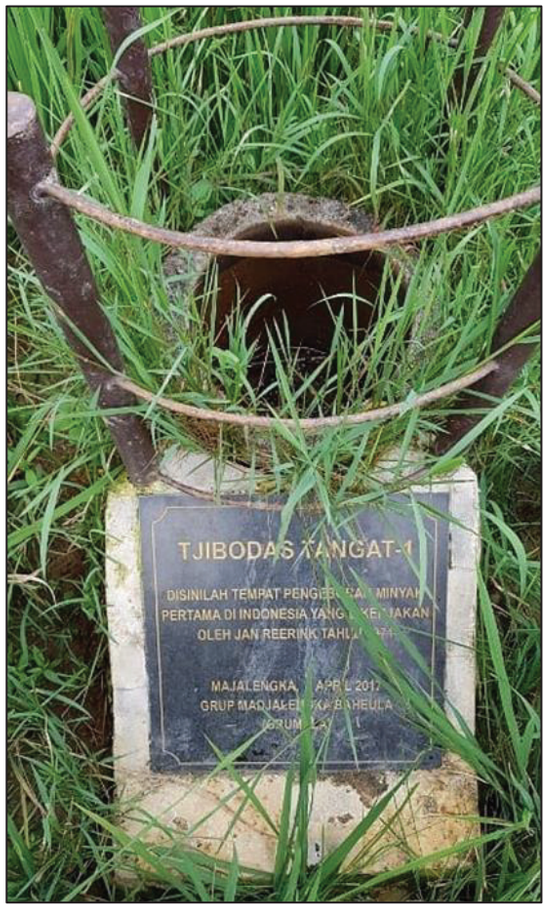


Fig. XIV.15.
A recent photo of the well head of Indonesia's first producing oil well Tjibodas Tangat 1, drilled by J. Reerink near Cirebon in 1871 (Izmed k. Anwar, Instagram post 04/2019).

Fig. XIV.16.
Advertisement for the Reerink Brothers General store in Cirebon, offering "good quality petroleum in American packaging, now 14 guilders per case" (Java Bode, 31 December 1873; www.delpher.nl).


1873. N°. 307 WOENSDAG 31 DECEMBER.

JAVA-BODE.

Puike Petroleum,

AMERIKAANSCHE VERPAKKING,

thans **veertien gulden per kist.**

GEBROEDERS REERINK,

5708 *Cheribon.*

Unfortunately, Reerink's new equipment was not optimally suited for drilling in the relatively soft rocks of northern Java. The new wells drilled in 1874-1876 at Tjibodas, Madja, Tjipinang and Palimanang were all were failures (Gerretson, 1953). In July 1876 Reerink ran out of money, and the *Handel Maatschappij* bank refused to invest additional funds. He therefore was forced to abandon his pioneering oil drilling efforts and returned to work at the *Gebroeders Reerink* general store in Cirebon. In 1882 his brother died and Reerink became sole owner of the store again.

Remarkably, although Reerink's wells were the first wells in the Netherland Indies to flow oil, this part of Central Java never developed into a commercial oil-producing basin.

In 1884 Reerink retired and returned to Haarlem, and never returned to The Indies. He married Johanna Reerink (a 22-year younger cousin?) at age 48, and the couple had three children. Reerink legally changed his last name to *Reerink van Cheribon*. J. Reerink van Cheribon passed away in Haarlem on 5 October 1923.

Fig. XIV.17.
Gravestone of 'Jan Reerink van Cheribon' and family, at Begraafplaats Kleverlaan, Haarlem, in December 2019.

Publications

Gerretson, F.C. (1953)- History of the Royal Dutch. E.J. Brill, Leiden, vol. 1, p. 1-287.

Huygen van Linschoten, J. (1596)- Itinerario, Voyage ofte schipvaert van Jan Huygen van Linschoten near Oost ofte Portugaels Indien 1579-1592. Cornelis Claesz, Amsterdam, 147 p.

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Poley, J.P. (2000)- Eroica- the quest for oil in Indonesia (1850-1898). Kluwer Academic Publishers, Dordrecht, p. 1-175.

Reerink, J. (1865)- Nota omtrent eene rijke aardoliesoort, voorkomende op Java, in Poerbolinggo, Res. Banjoemas. Tijdschrift Nijverheid Landbouw in Nederlandsch-Indie 11, p. 362-363.

174. Aeilko J. ZIJLKER (Nieuw Beerta 1840- Singapore 1890)

A.J. Zijlker was a manager of a tobacco plantation in Langkat, North Sumatra, who became a pioneering oil entrepreneur and successful oil driller and producer in North Sumatra in the late 1800s. He is viewed as the founder of Koninklijke Nederlandsche Petroleum Maatschappij ('Royal Dutch') which, long after Zijlker's death, merged into the Royal Dutch/Shell oil company.

Aeilko Jans Zijlker was born in Nieuw Beerta, Groningen on 31 May 1840, as son of a successful farmer, and later Member of the *Tweede Kamer* of the Dutch Parliament. At age 20 young Aeilko moved to the Netherlands Indies in 1860 to become a tobacco planter. He initially settled in East Java, but soon moved to North Sumatra as a Manager/Administrator for the *East Sumatra Tobacco Company*.

Fig. XIV.18.
Portrait of the North Sumatra tobacco planter Aeilko Jans Zijlker, who became the founder of the 'Koninklijke/Royal Dutch' oil company in the late 1800s (Geologie en Mijnbouw, 1933).

Drilling for oil in North Sumatra, 1880s

In 1880 Zijlker became aware of small ponds with smelly black substance near his Deli tobacco plantation in the Sultanate of Langkat along the NE coast of Sumatra. He quickly recognized these as petroleum seeps. These oil occurrences were locally known as *telagas*, and had been known to natives for centuries, who used it for lighting torches and for caulking of boats. Some of it had even been brought to Europe by Portuguese traders for medicinal purposes.

Zijlker sent a sample of oil from the Sumatra seeps for chemical analysis to Batavia in 1880, and it was reported to contain about 60% kerosene. At that time kerosene was the most desirable fraction of crude oils as it could be sold as lamp oil in a SE Asia oil market that was then dominated by imports from America by Standard Oil.

Realizing the potential for larger scale petroleum exploitation, Zijlker obtained the rights to land with oil seeps on the right bank of the Lepan River from the Pangeran (Sultan) of Langkat (this part of Sumatra was still a 'self-governing territory') in 1881 and embarked on some small-scale test drilling. In 1882 Zijlker traveled to the Netherlands to organize financing from private investors, which were then united in the *Voorlopige Sumatra Petroleum Maatschappij* (Provisional Sumatra Petroleum Co.).

Mining engineer Ir. Reinder Fennema of the *Dienst van het Mijnwezen* (Bureau of Mines) was assigned to Zijlker's project in late 1886, after Zijlker's first discovery well. He personally supervised the drilling of seven additional shallow petroleum wells from October 1887 until April 1890. Fennema was probably more important to the 'birth of the *Koninklijke Nederlandsche Maatschappij tot Exploitatie van Petroleumbronnen* (Royal Dutch Petroleum Co.) than was ever acknowledged. He not only provided drilling know-how and equipment from *Mijnwezen*, but also helped secure additional bank funding and wrote an outline of a business plan for Zijlker's oil venture (Fennema, 1890).

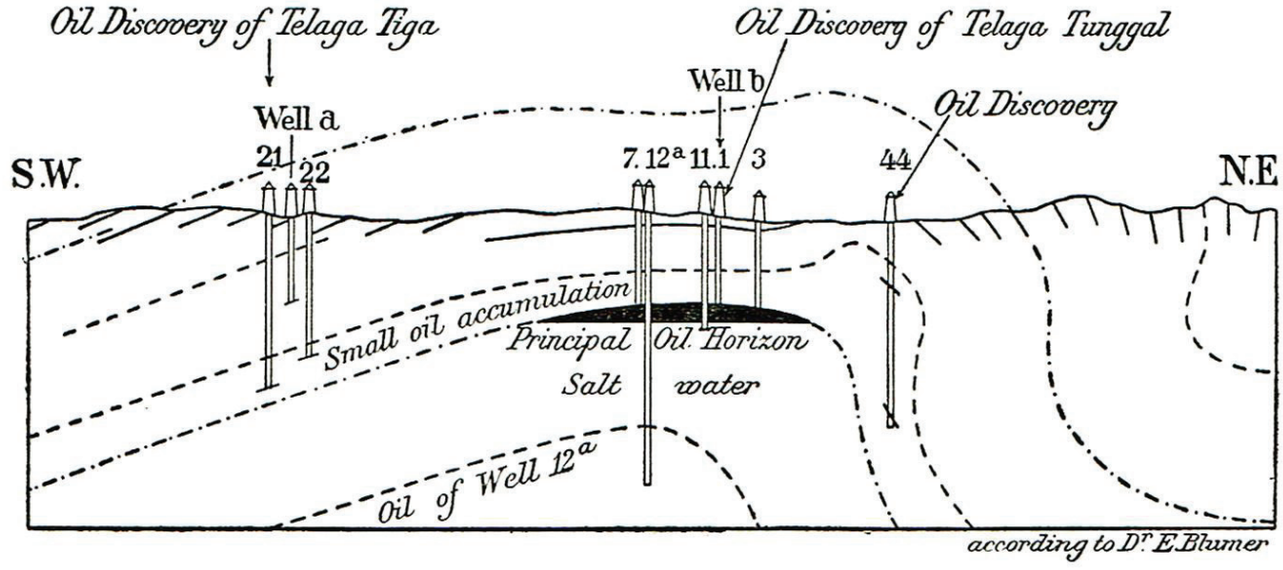


Fig. XIV.21. Cross-section through the Telaga Said anticline, North Sumatra (drawn by E. Blumer, in Gerretson, 1953).

Fig. XIV.22. Location of the Telaga Tunggal (Telaga Said 1) wellhead near Pangkalan Brandan, North Sumatra, around 1910. This is generally viewed as the first commercial oil well in Indonesia (Coll. KITLV 16870).

176. Adriaan STOOP (Dordrecht 1856- Bloemendaal 1935)

A. Stoop was a mining engineer, who turned into a successful pioneering oil explorer and producer, and was one of the founding fathers of the petroleum industry in Indonesia through his 'Dordtsche' oil company. He discovered the first oil in East Java in 1888 and followed up with a string of other discoveries in the 1890s, becoming the dominant player on Java. The success of A. Stoop in East Java and A.J. Zijlker in North Sumatra around that time triggered an unprecedented 'oil rush' during the 1890s in the Netherlands Indies.

Adriaan (Aad) Stoop Jr was born on 18 October 1856 in Dordrecht, as son of a beer brewer and small banker. He went to high school in Dordrecht. From 1873 until 1878 he studied mining engineering at the *Technische Hogeschool* in Delft, when the Mijnbouw department was headed by non-geologist Prof. T.H. Behrens. After the basic mining engineering program, he attended the usual final year internship at a mining academy in Germany, in Stoop's case at the Royal Prussian *Bergakademie* in Clausthal (Saxony).

Stoop was fairly typical of his generation of Delft mining engineers, who did not have much knowledge of, or interest in, geology, and did not value the possible contributions of geologists in his petroleum exploration ventures.

Dienst van het Mijnwezen, 1879-1887

In late 1879, at age 23, Stoop joined the *Dienst van het Mijnwezen* (Bureau of Mines) in Batavia as *Mining Engineer 3rd class*. His early assignments in 1880-1883 were with the *Grondpeilwezen* department (Ground water department), mainly in drilling shallow wells for drinking water supplies for the City of Surabaya, East Java (Stoop, 1883). In addition to finding potable groundwater supplies, Stoop encountered oil shows in some of the water wells drilled there.

Later projects included studies on the options for transportation of Ombilin coals to the west coast of Sumatra (Stoop, 1884), a cursory geological-hydrological survey of the Probolinggo area, East Java (Stoop, 1884), and surveys of the lava dome at the top of Merapi volcano in Central Java in 1884-1885 (with J.W. Retgers).

Fig. XIV.31. Portraits of Adriaan Stoop. Left: In Dordrecht, 1886, Middle: During home leave from Java in Arnhem, 1890, Right: In London in 1905 (from https://stoopvandeventer.nl/portfolio/opa-en-oma-stoop-2/).

In August- November 1886, during home leave in the Netherlands, Stoop requested permission and support for a fact-finding mission to Pennsylvania, USA, to study the American petroleum industry, its equipment and drilling techniques. There he met, amongst others, with steel and oil tycoon Andrew Carnegie. His learnings were published in an extensive report in the *Jaarboek van het Mijnwezen* (Yearbook of the Bureau of Mines of the Netherlands Indies), entitled *Rapport over de petroleum-industrie in Noord Amerika* (Stoop, 1888). It guided many later petroleum ventures in the Netherlands Indies.

In early 1887 Stoop returned to Java, where he repeatedly proposed to his superiors at the Bureau of Mines to investigate the petroleum potential in East Java by drilling, but the *Dienst van het Mijnwezen* did not see petroleum exploration as part of their mission. Stoop therefore requested and got permission for a three-year leave of absence, starting in September 1887, but never returned to *Mijnwezen*.

The founding of the Dordtsche Petroleum Maatschappij (1887), Kuti 1 discovery (1888)

Stoop started raising capital for a private drilling campaign from family and friends in the Netherlands, and in 1887 he founded the *N.V. Dordtsche Maatschappij tot opsporen en exploiteeren van petroleumbronnen op Java* (the Dordrecht Company for exploration and exploitation of petroleum sources on Java). Although Zijlker and his predecessor of *Koninklijke Olie* (Royal Dutch) had some drilling successes before that, the *Dordtsche P.M.* was actually the first legally official oil company in Indonesia. Stoop's company would grow into the most serious competitor of Royal Dutch/Shell in the early 1900s, when it built a commanding position in the NE Java Basin, with about 30 oil fields around 1890-1910.

Stoop applied and obtained concessions in the Surabaya area of NE Java, where oil seeps had been known to the locals and some of it was sold for medicinal purposes: *Djabakotta* (1889), *De Twaalf Desa's* (1892) and *Lidah Koelon* (1896). Stoop's early drilling was mainly on the 15 km long *Lidah* anticline. The first significant success was an oil gusher well near the village of *Kuti*, South of Surabaya, in January 1888. In 1890 the company was renamed into *Dordtsche Petroleum Maatschappij* (DPM), with head offices in Surabaya.

A small refinery was built nearby in Medaeng in 1889 (the first in Indonesia), for the processing of crude oil into lamp oil. In 1890 a larger installation followed at Wonokromo, just outside Surabaya. Lamp oil at that time was the only truly valuable component of crude oil, which before then was imported to Java from America and Baku (Russia). By the end of 1890 the Wonokromo refinery produced 995,000 liters of lamp oil, 473,000 liters of diesel oil and lesser quantities of gasoline and lubricating oil.

Fig. XIV.32. Management of the Dordtsche Petroleum Company in the head office in Wonokromo, near Surabaya, in 1896. On right Adriaan Stoop. Seated on left is his brother Jan Stoop (photo Nationaalarchief, The Hague).

XIV.2. The 1890s oil boom and a proliferation of oil companies

After the early oil drilling successes by A.J. Zijlker (*Koninklijke*/Royal Dutch) in Sumatra in 1884 and A. Stoop (*Dordtsche* Petroleum) in NE Java in 1888, a genuine '*black gold rush*' took place in the late 1890s and early 1900s. Dozens of entrepreneurs in the Netherlands and Netherlands Indies founded private oil companies and applied for (relatively small) concessions around oil and gas seeps. Around 1900 eighteen or more oil companies were active on oil concessions in the Netherlands Indies (e.g., De Jongh, 1922).

A major problem for these petroleum start-ups was not the drilling and production of oil, but refining and marketing. While small refineries were relatively easily built, there were usually no significant domestic markets around the new oil fields, while the Asian market for lamp oil was dominated by American giant *Standard Oil* (marketing American oil, mainly from California) and by the British *Shell Trading* company (mainly marketing Russian oil, from Baku).

In the 1890s *Koninklijke Olie* (Royal Dutch) had invested early in a refinery, at Pangkalan Brandan (North Sumatra), and a small fleet of oil tankers, which allowed them to cheaply and rapidly export oil and refined products to Singapore and other areas. This gave them a significant competitive advantage over growing new operators in more remote areas of Sumatra, like *SumPal* (a company that found the first oil in South Sumatra, in 1896), *Moeara Enim* (also with a South Sumatra oil discovery in 1896) and others.

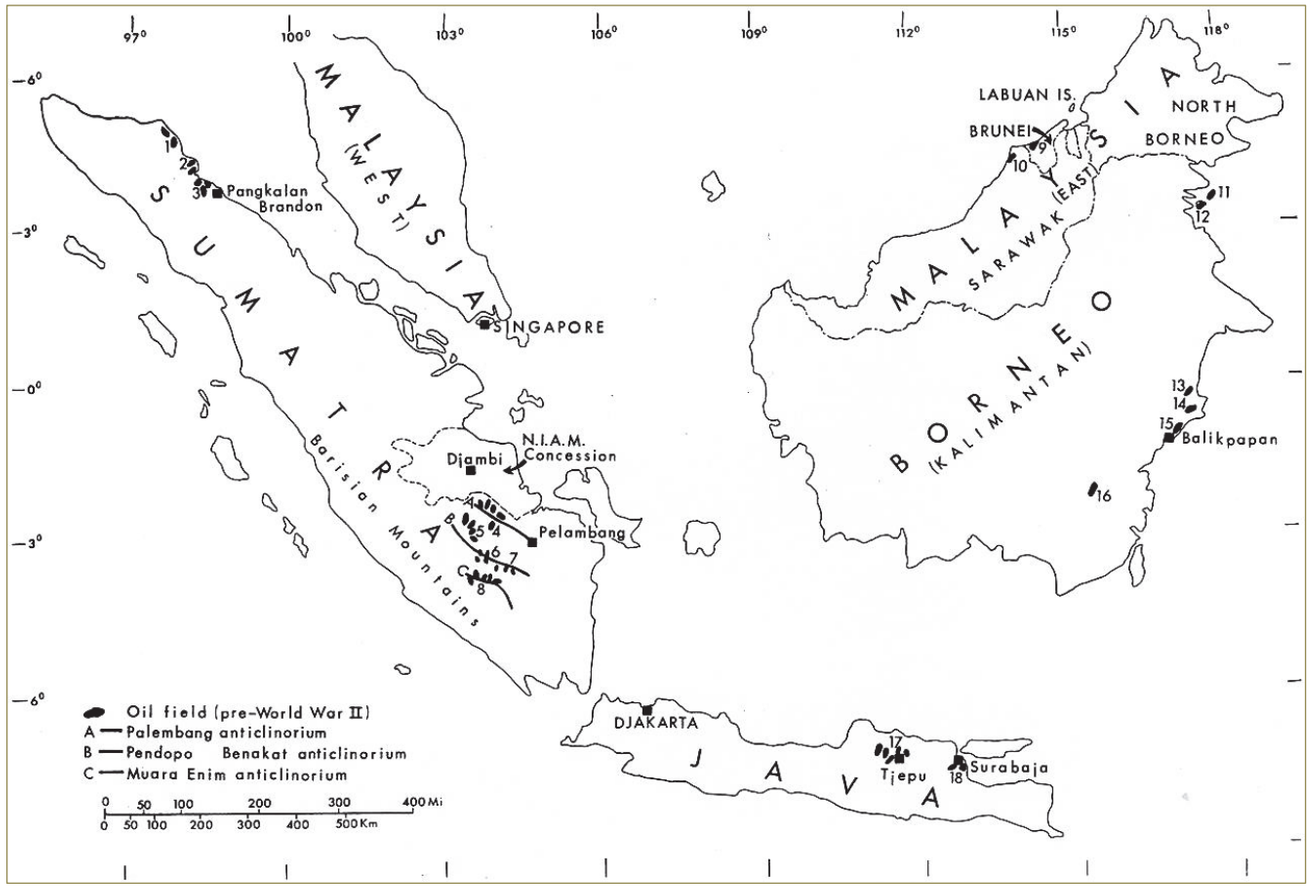


Fig. XIV.40. Map showing pre-World War II oil fields in the western Netherlands Indies (from Gisler, 2018). Note the oil fields in Central Sumatra and in the offshore had not been discovered yet.

The Moeara Enim Company, 1897-1904

One of the more successful new oil companies in the late 1890s in South Sumatra was the *Petroleum Maatschappij Moeara Enim*. It had become a significant competitor of Royal Dutch around 1900. The *Moeara Enim* company became a public company in 1897, after its initial investors (the '*Palembang Syndicaat*', a private group of investors formed by a Mr. Boissevain) had already drilled several successful shallow oil wells at *Minjak Itam* in the *Kampung Minjak* field in late 1896. The new company was led by former railroad engineer and General Manager of the Ombilin coal mines, J.W. Ijzerman (see also chapter XVIII/229).

XIV.3. The arrival of petroleum geology: mapping anticlines (~1900)

Oil exploration strategy in the Netherlands Indies before 1900 was quite simple: drilling wells on and around surface oil or gas seeps. The oil pioneers in the Netherlands Indies were relatively late to realize the important concept of the *Anticlinal Theory of oil accumulation*. This theory was reportedly first formulated in 1855 in Burma (Myanmar) by Thomas Oldham for the *Yenangyuang* field, and it was already commonly accepted in all 'classic' early petroleum provinces by the late 1800s, like Burma, Baku (Azerbaijan) and the Carpathians foredeep in Galicia (now SE Poland-Ukraine) and in Romania.

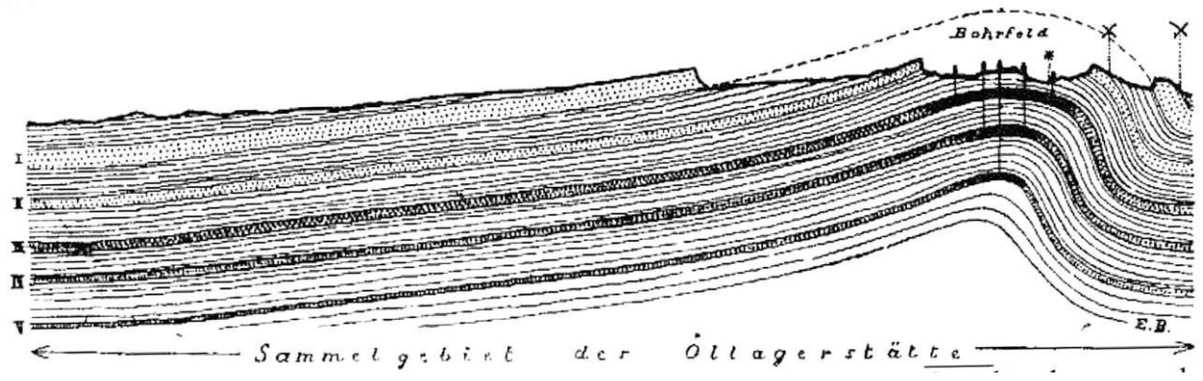


Fig. XIV.70. Cross-section illustrating the accumulation of oil (black) at the crest of an anticline, from a petroleum drainage area ('Sammelgebiet'), defined by structurally low 'spill-points' (E. Blumer, 1920). In the 1890s this geologic concept was known in other oil provinces, but had not yet been part of the exploration strategy of petroleum drillers in the Netherlands Indies.

Once accepted in the Netherlands Indies around 1900, petroleum geology became the most important tool in oil exploration. The strategy now focused on geological field mapping (geophysical methods were not used until the 1930s), and drilling of surface anticlines, whether there were surface hydrocarbon seeps or not. This resulted in the hiring of many petroleum geologists between 1900 and 1930s, who were employed primarily for geological mapping of surface anticlines. Remarkably, none of the early petroleum exploration geologists in the Indies were Dutch, but they were German, Swiss and Italian.

In the first one or two decades since the arrival of petroleum geologists, their work was limited to identifying and mapping of surface anticlinal structures. Only after around 1910, geologists were tasked to work with drillers, while wells were drilled, and to build subsurface models of oil fields.

The first petroleum geologists in the Netherlands Indies: Bucking, Schmidt and Porro, 1898-1899

The very first petroleum geologists in the Netherlands Indies were contracted in late 1897, not by the *Koninklijke/Royal Dutch*, as one would expect, but by entrepreneur August Janssen from Amsterdam, one of the main shareholders and Director of the *Deli Maatschappij* tobacco giant in NE Sumatra. The *Deli Maatschappij* had secured several oil concessions for their areas of tobacco plantations, not far from the oil operations of Zijlker's *Koninklijke Olie* (Royal Dutch).

The first petroleum geologists in Indonesia to arrive in Sumatra in 1898 were German Professor *Hugo Bucking* from the University of Strasbourg (at that time in the German province of Alsace, now in France), and his assistant from Luxemburg, *Leopold van Werveke*. Bucking's work for the *Deli Maatschappij* did not result in positive drilling recommendations for the Deli Maatschappij concession(s) in North Sumatra, because there were no anticlinal structures.

August Janssen, who was also a board member of *Koninklijke Olie* (Royal Dutch), routinely sought professional geological help for his various petroleum and mining interests in the Netherlands Indies (see also the A. Janssen chapter XIX/232, below). He and his consultant Prof. H. Bucking were probably instrumental in advising *Koninklijke Olie/Royal Dutch* in 1898, to use petroleum geologists to save it from probable bankruptcy.

Koninklijke Olie faced imminent bankruptcy in 1899. It had rapidly grown into an integrated oil company, with investments in a new refinery at Pangkalan Brandan and a fleet of tankers. Unfortunately, oil production at its first and only field, *Telaga Said*, went into a steep decline during 1898. Desperate to replace production, it incurred more financial losses with the drilling of 110 additional nearby shallow wells between September 1898 and December 1899. All were dry holes because no attention was paid to the geological structure of the area.

179a. The brothers Jacques, Emile and Hendrik Deen

In the late 1800s- early 1900s three brothers Deen, born in a family of Dutch-Jewish textile manufacturers and merchants in Tilburg, were remarkable early promotors of oil concessions in the Netherlands Indies. They became quite successful license hunters, outsmarting the *Koninlijke* (Royal Dutch) in acquiring oil concessions in North Sumatra, which they then sold to them. They were Jacob Mozes (Jacques) Deen (1855-1915), Emanuel Deen (Emile; 1860-1925) and Hendrik Deen (Henry, 1862-1934). In the Netherlands Indies they operated under several company names, including the *Oostersche Exploratie en Exploitatie Maatschappij* (1894), *Petroleum Maatschappij Holland-Perlak* (1899), the *Perlak Petroleum Maatschappij* (1901) and the *N.V. Petroleum Maatschappij "Zuid Perlak"* (1905).

Oldest brother Jacques Deen came to Medan in 1881, probably for a tobacco-related position. In 1885 he founded the Dutch-language newspaper '*Deli-Courant*' in Medan and became its Chief Editor. As a well-informed journalist, J. Deen was aware of the oil drilling successes of A.J. Zijlker in North Sumatra in the late 1880s, which inspired him to become a 'concession hunter'. Deen had no intention of drilling prospects himself, but planned to sell the concessions to 'real' oil companies like the *Koninklijke* (Royal Dutch) startup or to American *Standard Oil* company.

In 1891 J. Deen acquired the *Bukit Mas* concession in Langkat, covering part of the *Telaga Said* anticline, which he managed to sell to the *Koninklijke* in 1893. In 1895, J. Deen and his brothers also acquired a concession named *Peureula*, in an area near *Perlak*, Aceh, North Sumatra, with an oil seep near Rantau Panjang village. In 1899 Royal Dutch farmed into the Deen concessions at Perlak as operator and immediately drilled a major oil discovery.


terugbetaald.

PETROLEUM MAATSCHAPPIJ „ZUID - PERLAK"

NAAMLOOZE VENNOOTSCHAP

PETROLEUM-MAATSCHAPPIJ „ZUID-PERLAK",

gevestigd te AMSTERDAM.

OPGERICHT BIJ ACTE DEN 4DEN DECEMBER 1905, TEN OVERSTAAN VAN DEN NOTARIS MR. D. J. VAN STOCKUM, TE AMSTERDAM VERLEDEN.
GOEDGEKEURD BIJ KONINKLIJK BESLUIT VAN 30 DECEMBER 1905, N°. 92.

MAATSCHAPPELIJK KAPITAAL *f* 3,000,000.-,

VERDEELD IN:

f 1,500,000.— PREFERENTE Aandeelen en

f 1,500,000.— GEWONE Aandeelen.

PREFERENT Aandeel Nº 710

GROOT

DUIZEND GULDEN.

HOUDER dezes is gerechtigd tot **EEN AANDEEL, preferent** voor kapitaal en 6 pCt. dividend, groot **DUIZEND GULDEN,** in het Maatschappelijk Kapitaal der bovenstaande Naamlooze Vennootschap.

AMSTERDAM, 4 December 1905.

COMMISSARIS: DIRECTIE:

Hierbij afgegeven 10 Dividend-Bewijzen met Talon.

Figs. XIV.72 and XIV.73. Portrait of entrepreneur J. Deen, and a share of his South Perlak Oil Company (1905).

In December 1905 the Deen brothers created the *N.V. Petroleum Maatschappij "Zuid Perlak"*, to start their own drilling at a southern extension of the Perlak anticline, which was not covered by the original agreement with the *Koninklijke*. Swiss geologist Ernst Blumer was hired to supervise early drilling at South Perlak and to identify new acreage opportunities (see also chapter XIV/184, below).

Buoyed by their successes at Perlak, the Deen Brothers spread their wings to other areas. The small '*Zuid-Perlak*' company made a daring bid for the concession of oil exploration/production for the entire Jambi basin of South Sumatra around 1915, but this was awarded to N.I.A.M., a BPM-Netherlands Indies Government consortium (1922).

Emile Deen also made oil deals in the USA, buying a handful of small local Oklahoma oil companies. He failed to sell the assets to Royal Dutch-Shell, but managed to turn them over to the new *Union des Petroles d' Oklahoma* company in 1911. He became Director of this company and its successor, the *Oklahoma Producing & Refining Co.* in 1918-1920. After disappointing results, the Oklahoma interests were liquidated. The Deen brothers' fortunes appeared to have come to an end around 1930, after a series of lawsuits, and the liquidation of the *Zuid Perlak Maatschappij.*

179. F.C.B. Hugo BUCKING (Bieber, Germany 1851- Heidelberg 1932)

Hugo Bucking (officially spelled Bücking) is relatively little known in Indonesia today, but was one of the first of the German geologists to visit and describe the geology of various parts of the Netherlands Indies. While Professor of Geology in Strasbourg, Bucking consulted with businessman August Janssen in the late 1800s-early 1900s, on oil potential in NE Sumatra and on mining interests in other parts of the archipelago (including the Poeloe Laut coal mines). He supervised many of the earliest geologic mapping surveys of the Koninklijke Olie (Royal Dutch) in the early 1900s.

Fig. XIV.79.
Prof. Hugo Bucking in 1884, as a young professor in Strasbourg. (www.digiporta.net). Bucking was the first pioneer of petroleum geology in the Netherlands Indies and was the 'godfather' of several of Swiss and German early petroleum geologists that followed him and were successful in the Netherlands Indies.

Ferdinand Carl Bertram Hugo Bucking was born in Bieber im Spessart (now Biebergemund), in the Hessen province, Germany, on 12 September 1851, as the son of a mine inspector in the Spessart copper and cobalt mining district. He attended high school in Marburg and studied at the universities of Gottingen and Leipzig.

Bucking completed his university education in 1874 with a doctorate at the University of Marburg. After teaching for two years in Marburg until 1874 he became an assistant of Prof. P.H. von Groth in Strasbourg, Alsace from 1876-1879. From 1879-1881 he was with the Preussischen Geologischen Landesanstalt (Prussian Geological Survey) in Berlin, where he also taught petrography at the Bergakademie (school of mines). In 1881 Bucking was appointed as Professor of Mineralogy at the University of Kiel and as Director of the Mineralogical Museum.

Professor in Strasbourg, Alsace, 1883-1919

In 1883Bucking moved to the University of Strasbourg, which at that time was still the German province of Elzass-Lothringen (Alsace-Lorraine) and stayed here until 1919. He succeeded P.H. von Groth as Professor of Geology and Mineralogy at the university and also became the head of the *Geologische Landesanstalt Elsass-Lothringen* (Geological Survey of Alsace-Lorraine) and the Institute of Mineralogy.

The Alsace was one of the oldest petroleum-producing regions in Europe, where oil seeps near Pechelbronn had been mined from shallow pits since 1745 and where oil sands were mined and refined since 1857. This may have helped developed Bucking's expertise in petroleum exploration and exploitation. In 1927 Conrad and Marcel Schlumberger developed their first electrical resistivity logging in a well of the Pechelbronn oil field.

First petroleum geology in the Netherlands Indies, 1897, and links to Royal Dutch

Between 1897 and 1906 Bucking was an advisor of the successful entrepreneur August Janssen from Amsterdam, mainly through correspondence from Strasbourg. Janssen, whose father had made a fortune with the *Deli Maatschappij* tobacco company in North Sumatra, sought Prof. Bucking's geological expertise for his various potential oil and coal mining interests in the Netherlands Indies.

Under a consulting contract with Janssen, Bucking traveled extensively in the Netherlands Indies in 1898, to Sumatra, Java, Celebes (Sulawesi) and the Moluccas. This resulted in a series of papers in 1904, mainly in the journal of the Leiden Natural History Museum.

The main purpose of Bucking's journey to the Netherlands Indies in 1898 was to examine the oil concession(s) of the *Deli Maatschappij* in the Langkat region, which were adjacent to the *Telaga Said* oilfield of A.J. Zijlker

181. Cesare PORRO (Milan 1865- 1940)

Cesare Porro was a pioneering Italian petroleum geologist and oil-finder in the Netherlands Indies, who, together with Swiss professor C. Schmidt, made the first maps of anticlinal structures in the Tertiary basinal areas of NE Sumatra in 1899-1900.

Cesare Porro (full name *Count Cesare Porro dei Conti di Santa Maria della Bicocca*) was born in Milan, Lombardy, Italy, on 12 March 1865, as the son of Count Alessandro Porro. He studied at the University of Pavia and the University of Turin, where he graduated in engineering in 1891. He continued studies, presumably in mining and geology, at the *Bergakademie* in Berlin and the University of Strasbourg until 1893.

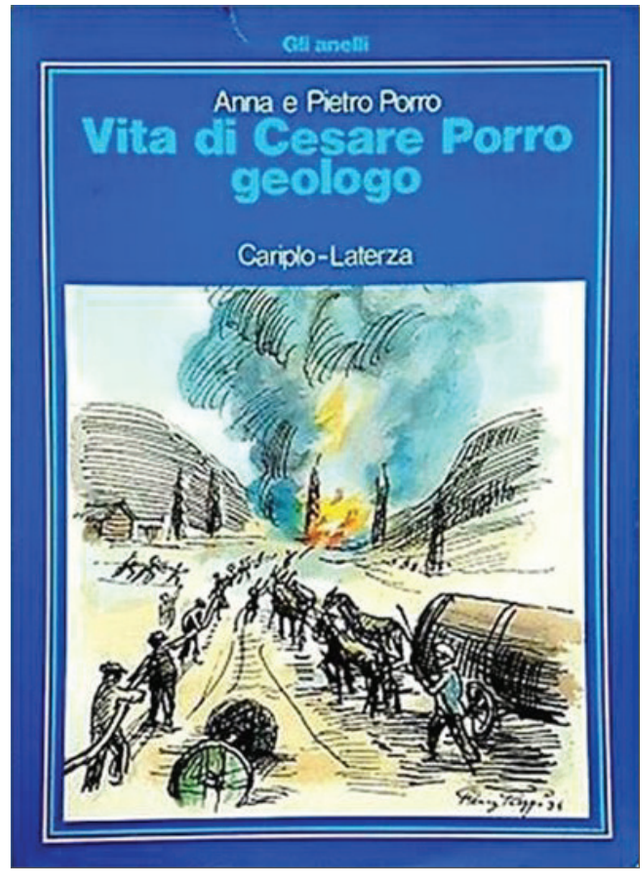


Fig. XIV.90. Portrait of Cesare Porro (from Harrison, 1952).
Fig. XIV.91. Cover of a biography of the geologist Cesare Porro by A. & P. Porro (1985; in Italian).

North Sumatra, 1899-1900

For an entire year in 1899-1900 Porro followed up on the 1898 geologic mapping work of Swiss Dr. C. Schmidt, following rivers big and small in the jungles of NE Sumatra, and digging 4-12m deep trenches in areas where anticlines were suspected but outcrops were poor. A final Porro and Schmidt fieldwork report was submitted to the *Koninklijke* in April 1899. The two geologists had identified a system of anticlinal fold trends and proposed new drilling locations along the crests of these structures.

The Porro and Schmidt recommendations were quickly followed by the discovery of the *Perlak* Field. In September 1899 Porro accompanied Hugo Loudon (a nephew of John F. Loudon of Billiton tin fame and now technical director of the *Koninklijke*) on a visit to *Perlak*. The purpose was to negotiate a concession with the local Raja Teungku Tji, and for a closer investigation of the Perlak oil seep and structure. A well was spudded soon thereafter, on 22 December 1899, which struck oil at 270' on 28 December (Gerretson, 1936).

The work of Schmidt and Porro signified the start of petroleum geology as an important tool for oil exploration in the Netherlands Indies. The *Perlak* field discovery saved *Koninklijke Olie* from imminent bankruptcy. Unfortunately, none of Porro's Sumatra work was published, although some of it was described in Gerretson (1936 Fig. XIV.92).

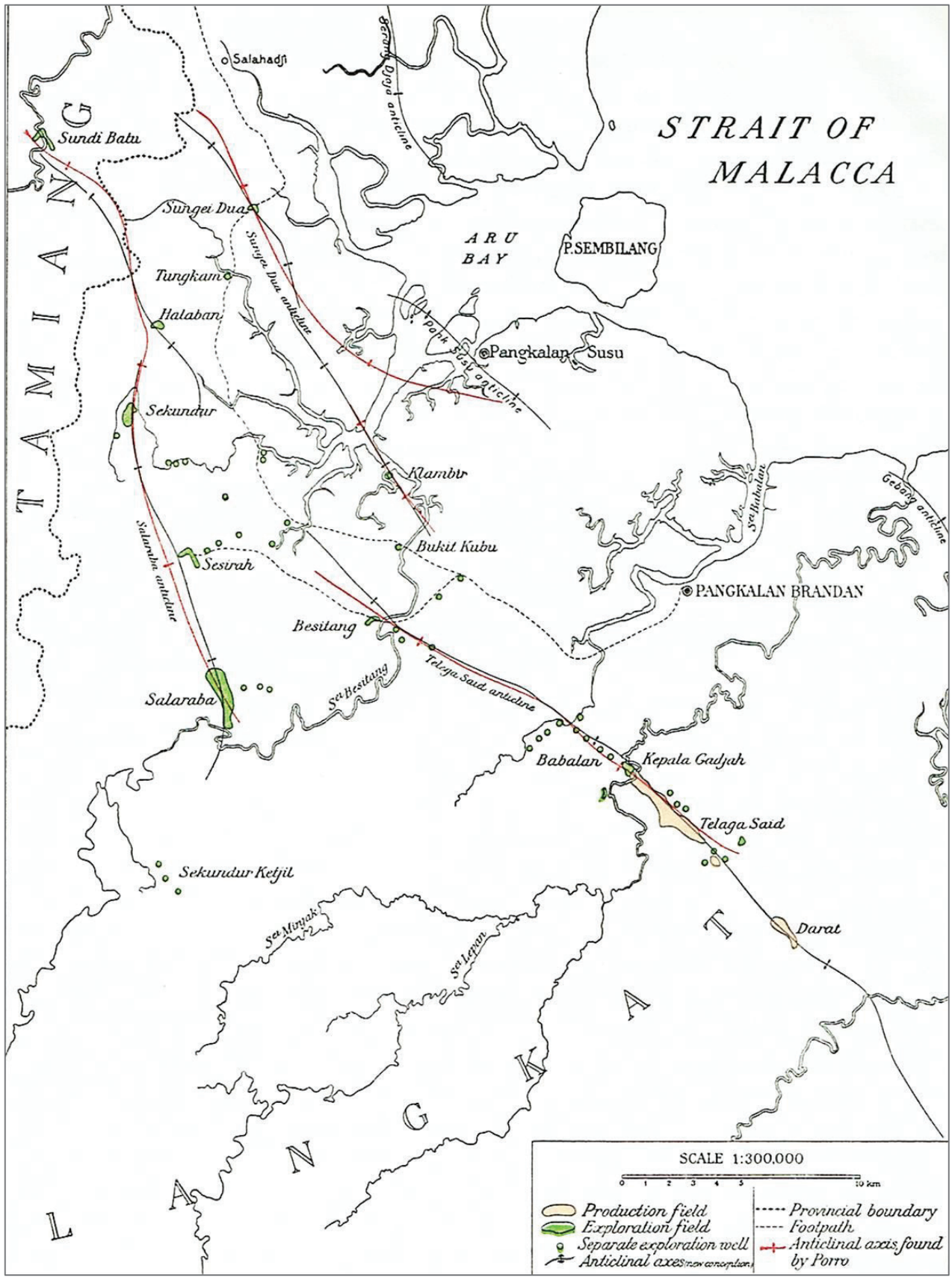


Fig. XIV.92. The first map of axes of anticlinal structures (in red) in Langkat, North Sumatra, made for the Koninklijke/Royal Dutch by Italian contract geologist C. Porro in 1899 (from Gerretson, 1953).

XIV.4. Arrival of specialists (geophysics, photogeology, micropaleontology), 1930s

Through the 1930s more specialized techniques were added to the petroleum explorationist toolbox, like micropaleontology, gravity surveying, photogeology, electrical well logging and, most significantly, seismic reflection surveying.

Gravity surveying became a routine tool in BPM in the 1920s, using the then 'revolutionary' *Eotvos* torsion balance (see also text box), to help identify hidden structures. After the mid-1930s, spring gravimeters became available, which were more rugged, quicker and more accurate than the old pendulum tools. Unfortunately, most of the gravity data collected by oil companies in the Netherlands Indies during this time remains unpublished, and no particular 'pioneer' names are associated with the early days of onshore gravity surveying by oil companies. One exception of published work that incorporated some BPM data is Collette (1954; Fig. XIV.152).

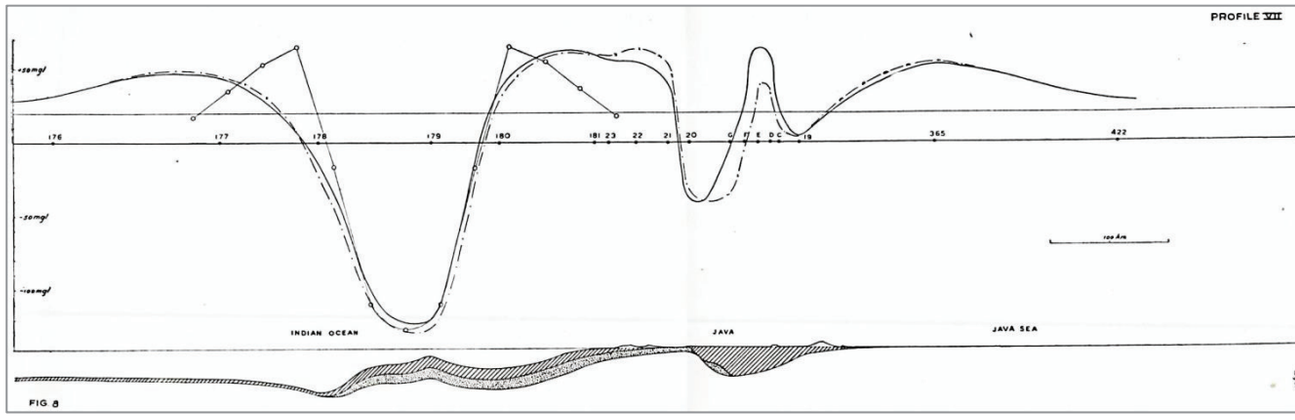


Fig. XIV.152. S-to-N regional gravity profile from the Indian Ocean across West Java and the Java Sea (Collette, 1954).

For more on marine gravity surveys in the 1930s see also the chapter on Vening Meinesz (vol. 3, XIII/166). Significant contributors to onshore gravity data in the Indonesian region in the late 1900s include geophysicist John Milsom of the University of London and Indonesian geophysicist Mohamad Untung of the Geological Survey, Bandung.

Seismic reflection imaging was mostly in an experimental phase in the 1930s. The first true seismic surveys were conducted by BPM/Shell on Java, Borneo and Sumatra in 1936. However, seismic reflection became the most significant tool for structure delineation and oil exploration only after World War II.

The advent of geophysical tools drastically changed the nature of oil and gas exploration. It reduced the need for detailed surface geology mapping, so the number of geologists engaged in geological fieldwork dropped significantly after the 1930s. Instead, most of the petroleum geologists' work shifted to well site work or office-based subsurface analyses, using seismic and well log interpretations, micropaleontology, geochemistry, etc.

Publications

Collette, B.J. (1954)- On the gravity field of the Sunda region (West Indonesia). Geologie en Mijnbouw 16, 7, p. 271-300.

Milsom, J. (2018)- The hunt for Earth gravity. A history of gravity measurement from Galileo to the 21st Century. Springer Publishing, p. 1-402.

Veldkamp, J. (1984)- History of geophysical research in The Netherlands and its former overseas territories. Verhandelingen Koninklijke Nederlandse Akademie Wetenschappen, Amsterdam, 1, 32, p. 1-139.

Gravity surveys with an Eotvos torsion balance in the 1920s-1930s

A geophysical tool that took the oil industry by storm in the 1920s was a torsion balance instrument that was developed in the late 1800s by Hungarian physicist Baron Lorand Eotvos. It allowed precise gravity measurements in the field. It was portable, but was heavier and less accurate than the more advanced spring gravimeters used after 1935.

Gravity profiling became a standard tool for oil companies in the 1920s and 1930s in the Netherlands Indies, as it provided information on basin configuration, sediment thickness and hidden anticlinal structures.

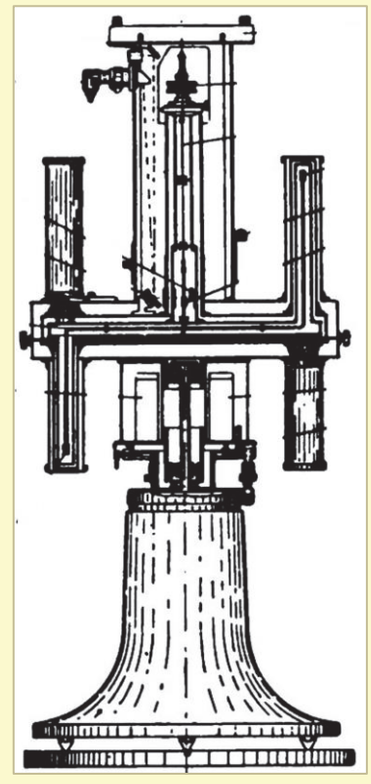


Fig. XIV.153. A torsion balance gravity survey crew in a swamp in Sumatra (probably a BPM crew in the late 1930s) (Coll. KITLV 140177). The instrumentt is probably a German-built Askania Z-40 Z-beam torsion balance, which would require 40 minutes to complete one station measurement. A gravity survey crew working day and night could set up and measure about eight stations per day.

Fig. XIV.154. A gravity survey crew carrying a torsion balance along a seismic line across a swamp in Sumatra or East Borneo, 1937 (Coll. KITLV 46286). The surveys often required a crew of 100s of native workers to cut trails and move equipment through jungles and swamps.

Cover Chapter XV: Chinese contract miners at the Koba Tin Mine 1 in Bangka, around 1919 (Coll. Rijksmuseum).

XV. MINING INDUSTRY AND MINING GEOLOGISTS

The principal products of mining during the Dutch colonial period were coal, tin and gold-silver. Additional mining was conducted for nickel, copper, iron, manganese, rock asphalt, diamonds and marble/limestone.

Many capable geologists spent their careers in coal and mineral mining ventures in the Netherlands Indies, but relatively little of their work was documented in geological publications. This is a general problem with industry geology, but for mining industry in particular. Part of the reason is the proprietary nature of the work, to maintain a competitive advantage over competitors, as has been common practice in the petroleum industry. Another probable reason is that much of the geological work associated with mine exploration and exploitation is typically only of local or of practical interest.

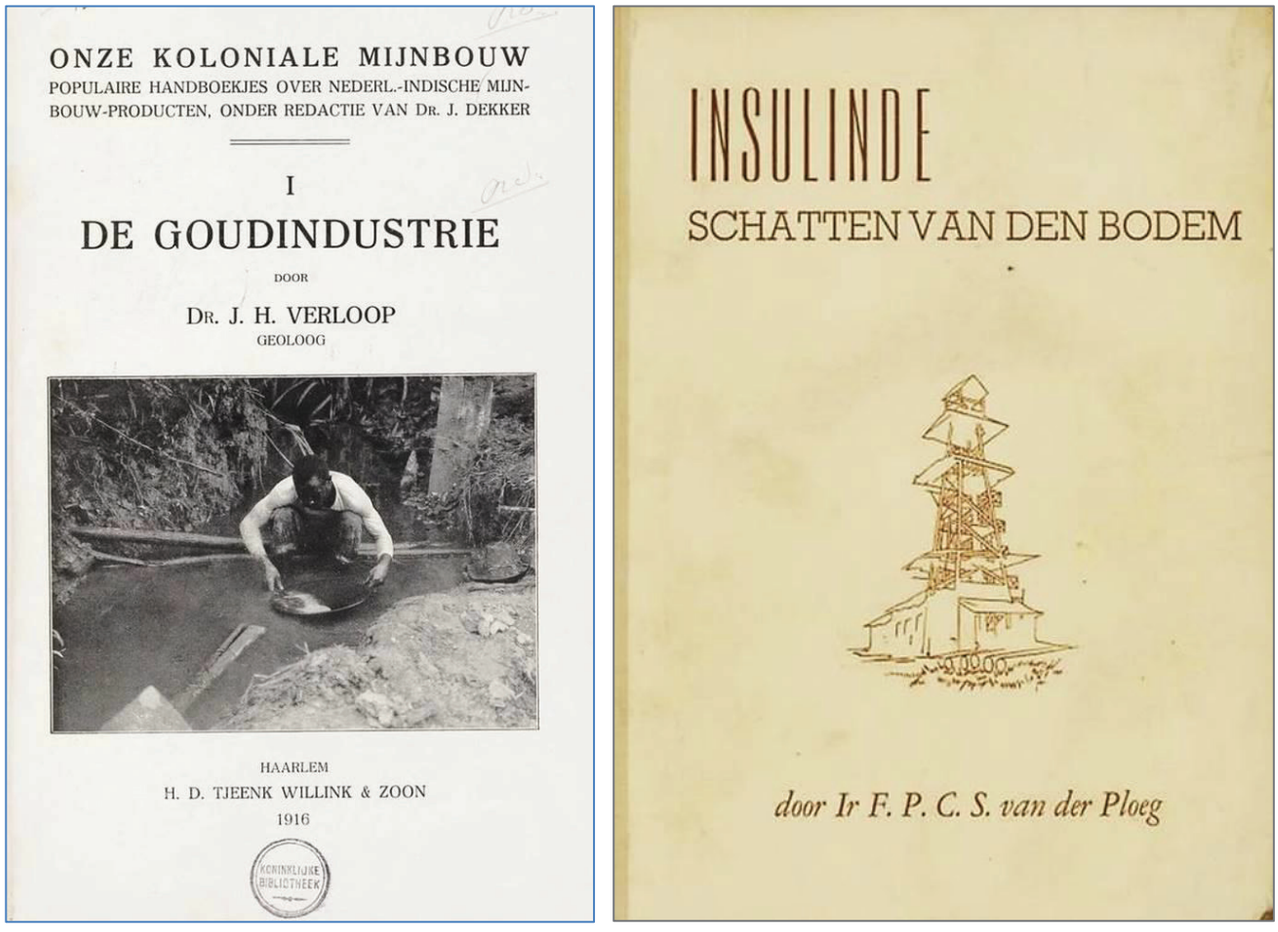


Fig. XV.1. Two early popular books on mining in the Netherlands Indies. Left: 'The gold industry', an early review of gold mining (Verloop, 1916). Right: An elegant overview of oil and minerals in the Netherlands Indies until the late 1930s by Van der Ploeg (1945). The author was mining engineer with the Dienst van het Mijnwezen since 1906 and was Head of Mijnbouw in 1927-1932. The book was commissioned by the Koloniaal Instituut/Tropenmuseum in Amsterdam. 'Insulinde' is a poetic name for the Netherlands Indies, first used by Multatuli in his novel Max Havelaar.

The old saying "*A mine is a hole in the ground, owned by a liar*" (attributed to American writer Mark Twain, but cannot be found in any of his published works) was certainly applicable to much of the private mining 'boom' in the Netherlands Indies in the 1890s. The majority of the mines and mining companies that were promoted here by private parties did not yield any of the promised returns, except for its promotors. This practice obviously did not apply to the big government-operated mines, or to the larger multinational mining and petroleum companies that arrived in more recent times.

XV.1. A long history of native and Chinese mining since pre-colonial times

Mining is one of the oldest industries in the Indonesian region, with reports of gold and diamond mining in Sumatra and Borneo going back for many centuries, to well before the Dutch colonial period. The presence of gold in 'Java' was mentioned in Chinese annals from the Tang Dynasty (618-906 AD; Hovig, 1914), although there is some speculation that the 'Java' in these old texts actually referred to the larger western Indonesia region and included Sumatra and/or Borneo.

Small-scale mining for gold by native people has been ongoing in Sumatra, Kalimantan, North Sulawesi and possibly Java since long before the Dutch colonial days. Similarly, diamonds have been mined across Kalimantan since before the 1700s, by native and Chinese miners. Native gold mining was (and is) often mainly a seasonal activity during quiet times between planting and harvesting of crops (Fig. XV.2).

Many remnants of old native gold mining operations can be found across Sumatra, some possibly dating back to the Hindu period and over 1000 years old. There is also archeological evidence that iron with 1-2% nickel was produced in the Lake Matano area of East Sulawesi more than 1000 years age (Bulbeck and Caldwell, 2000). The trade in iron products from this area continued between the East Sulawesi Kingdom of Luwu and the Majapahit Kingdom from 10th to the mid-15th century, and later with the Dutch VOC company.

Sumatra was believed by some scholars to be the legendary *Land of Ophir*, which was mentioned in the Hebrew Bible and other ancient texts as a region of great wealth, from which King Solomon imported gold, silver, sandalwood, etc., more than 2500 years ago. However, many other locations for *Ophir* have been suggested, including in the Middle East, India, Africa, The Philippines, etc.

The artisanal miners focused mainly on the relatively easy extraction from young, unconsolidated fluvial-alluvial deposits, but primary gold deposits have also been mined for centuries in Sumatra, Sulawesi, etc. Very little is known of the quantities produced historically.

Fig. XV.2. Native gold panning in the Singingis River, Central Sumatra, in 1928 (photo Arnold Heim; ETH Zurich archives).

Today, thousands of small-scale artisanal miners still work in mining of gold, diamonds, tin, manganese and coal in many parts of Indonesia (Sumatra, Kalimantan, North Sulawesi, Papua, etc.). Many of them operate outside government-issued concessions, or in concessions still held by Indonesian and international mining companies. These operations are technically illegal, and often have little regard for environmental damage caused. They also contribute little or nothing to the geologic knowledge of region.

XV.2. Tin

Tin has been known and has been mined in Indonesia probably since around 1710 (Hovig, 1914). Initially this was mainly from Bangka Island, but Belitung and Singkep islands also became significant tin producers after the1850s. Tin had also been mined near Malacca on the Malay Peninsula since the 1700s.

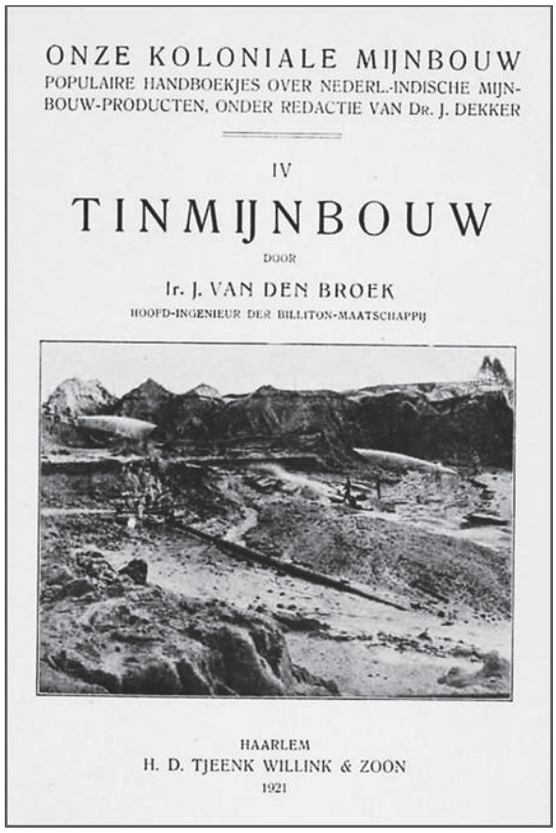


Fig. XV.6. Cover of the Van den Broek (1921) review of tin mining.
Fig. XV.7. A Chinese crew in Belitung, operating a manual coring tool known as a 'Banka drill' (Van den Broek, 1921).

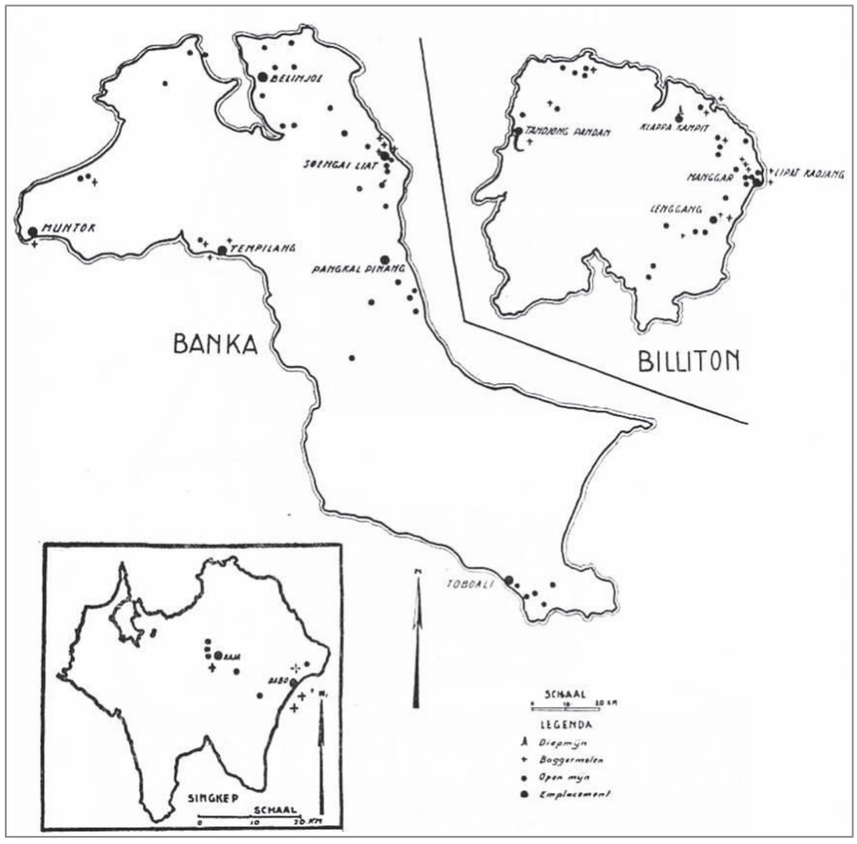


Fig. XV.8.
Map of the principal tin mines on Bangka, Belitung and Singkep (Braat, 1949).

195. John Francis LOUDON (Rotterdam 1821- The Hague 1895)

J.F. Loudon was an entrepreneur from a prominent Dutch family of industrialists and politicians, who was instrumental in the discovery of tin-bearing deposits on Belitung Island in 1851 and the development of the tin mining industry by the Billiton Maatschappij in the years thereafter.

The Loudon 'dynasty'

The Loudon family became a powerful dynasty in industry and politics of the Netherlands Indies and the Netherlands in the 1800s, largely due to their ability to network with the most influential people in the colony.

John Francis Loudon was born in Rotterdam on 21 May 1821 as the third son of a Scottish-born Alexander Loudon and a Dutch mother from the prominent Indies Valck family. Loudon Sr. had joined the British navy in 1811, as an officer in Java, during the British Interregnum of 1811-1816. Loudon Sr. had become Acting Resident of Semarang and remained in Java after the return of Dutch rule in 1816, as *Administrateur* (General Manager) of an English-owned plantation in the Krawang Residency. He became a Dutch national in 1824.

Fig. XV.22.
Portrait of John F. Loudon, probably around 1880 (Mollema, 1927).

The Loudon family moved to the Netherlands from 1828 until 1831, but returned to Java in April 1831, when John Francis was 10 years old. After the introduction of the *Cultuurstelsel* in the 1830s, Loudon Sr. made a healthy living from interests in sugar factories and an indigo factory in West Java. He died in 1839.

John F. Loudon had inherited some wealth when his father died in 1839, but it was not excessive, and he needed to pursue his own business interests in the 1840s-1850s. In early 1842 John went to The Netherlands for studies, but returned to Batavia in 1845. After some time in Batavia, and after temporarily managing a tea plantation, John won a government contract to produce sugar on land in Besuki, East Java, in 1848. This enterprise was named *Pandji*.

The beginnings of the Billiton Maatschappij, 1851-1867

In the late 1840s V.G. Baron van Tuyll van Serooskerken and Prince Hendrik of the Netherlands hatched plans to apply for a tin concession for Belitung Island. The presence of tin on Billiton (now called Belitung) had not been demonstrated yet, but a small piece of tin in the collections of the *Bataviaasch Genootschap* in Batavia, which reportedly came from Belitung, suggested tin might be present, similar to nearby Bangka Island.

In 1849-1850, J.F. Loudon had returned to Europe to recover from health issues. In October 1849 Van Tuyl asked Loudon to join him and Prince Hendrik in a new Billiton venture and become its main representative. In late 1850 they found a potential investor in Rotterdam. In January 1851 Loudon and Van Tuyl traveled to Cornwall, SW England, to study some of the tin mines there, and left for Batavia immediately thereafter.

In June 1851 J.F. Loudon and Baron van Tuyll embarked on their first fact-finding mission to Billiton and brought mining engineer Cornelis de Groot with them. Within a day of arrival, they were shown the presence of tin-bearing sands by a local (see also above). The Billiton mining concession was granted by the Netherlands Indies government in March 1852. After selling his equity in his *Pandji* sugar enterprise, Loudon bought a one-fifth interest in the newly formed *N.V. Billiton Maatschappij*, for 120,000 guilders. Between 1870 and 1890, these shares paid annual dividends of 20-80%.

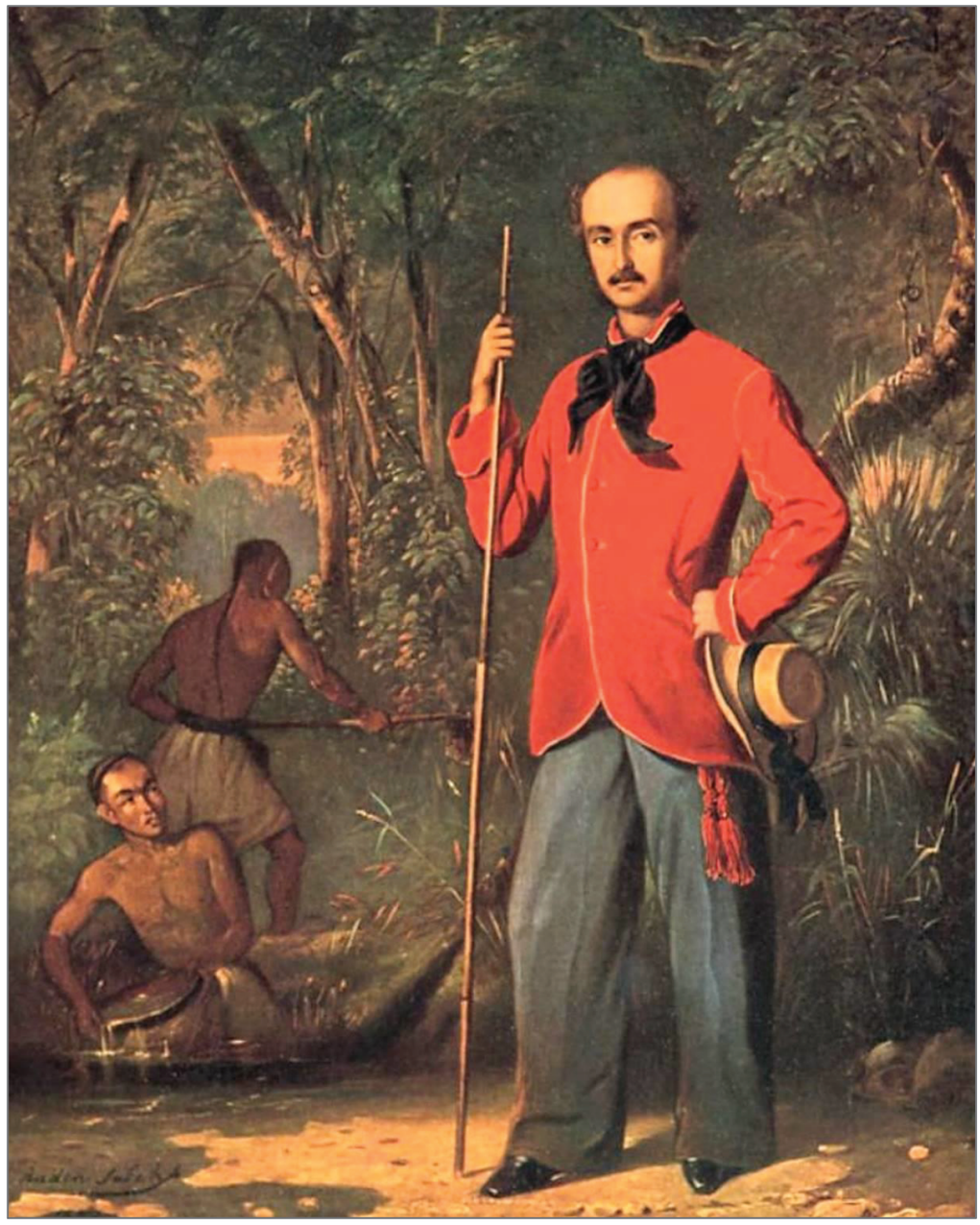
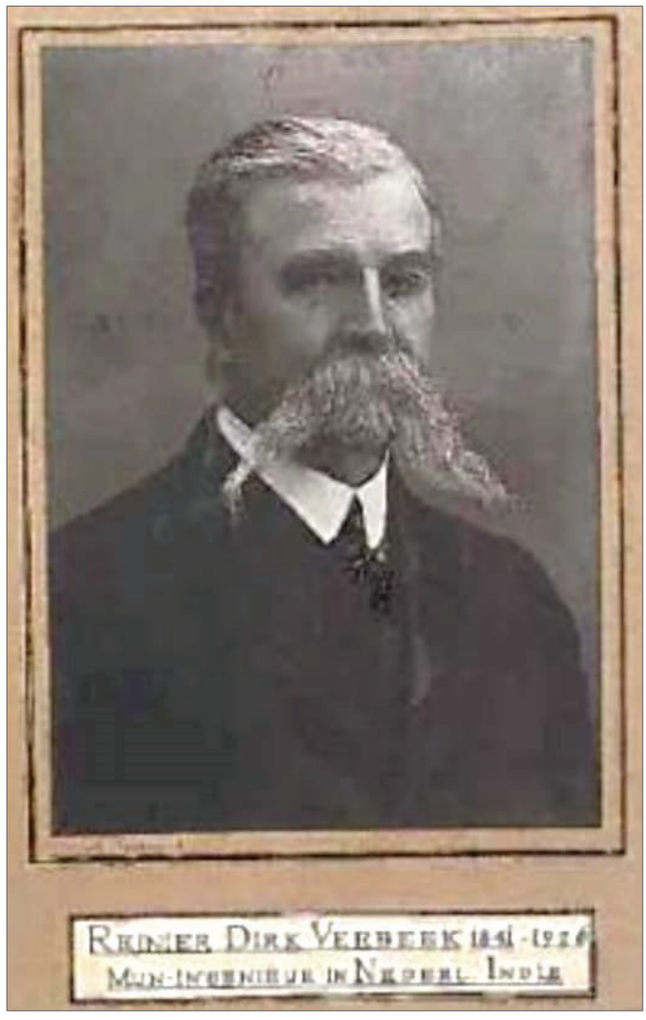


Fig. XV.23. John Francis Loudon (1821-1895), one of the founders and first Administrator of the Billiton Company, shown in Belitung with Chinese tin miners in background (painting by Raden Saleh, 1855).

199. Reinier Dirk VERBEEK (Maarssen 1841- The Hague 1926)

R.D. Verbeek was a mining engineer who chose a career as an independent gold prospector and promotor. He is primarily linked to the resurrection of gold mining at the former VOC Salida gold mine in West Sumatra. Reinier D. Verbeek is of about the same age as the famous Mijnwezen geologist/mining engineer Rogier D.M. Verbeek, but they are not related



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Reinier Dirk Verbeek was born in Maarssen, the Netherlands, on 5 September 1841. He probably attended high school in Amsterdam.

Unlike most Dutch mining engineers from the Netherlands, Verbeek did not study in Delft. He initially attended the University of Liege (Belgium), and then studied mining engineering in Germany, first at the *Bergakademie* in Clausthal, and graduating from the *Konigliche Bergakademie* of Freiberg, Saxony, in 1864.

Fig. XV.45.
Portrait of Ir. Reinier Dirk Verbeek
(Princessehof Museum, The Hague)
(not related to Ir. Rogier D.M. Verbeek)

Belitung

R.D. Verbeek first moved to the Netherlands Indies in the 1860s to work as mining engineer at the tin mines of the *Billiton Maatschappij*, which at that time were still in their infancy. He married in Padang in December 1869, with *Jonkvrouwe* (Lady) Elisabeth Cecile van Hogendorp.

Sumatra gold mines, 1875

After securing an exploration permit for the Salida mine area in 1875 Verbeek lived with wife and two small children in a primitive bamboo house near the old VOC Salida mine site near Pendjalangan (Painan), 75 km south of Padang, doing exploratory work for any remaining gold-silver deposits. Satisfied with the results, he applied for a gold-silver mining concession in 1876.

In April 1877 Verbeek received a visit from the J.W. Ijzerman expedition party, who described Verbeek's gold surveying operations, with the assistance of 18 laborers (Ijzerman et al., 1895; p. 51-52).

After around 1880 Verbeek traveled back and forth between Sumatra and the Netherlands, looking for investors to re-open the Salida mines (the Verbeek 1880 paper is essentially a promotion package). From 1881-1884, under the guidance of R.D. Verbeek, new prospecting work was done by the *Mijnbouw Maatschappij Salida* (Fig. XV.46), a company that in 1887 was succeeded by the *Mijnbouw Maatschappij Tambang Salida* company. The results of the programs did not meet expectations of shareholders. In 1889 the company was liquidated and in 1890 the Salida concession was relinquished.

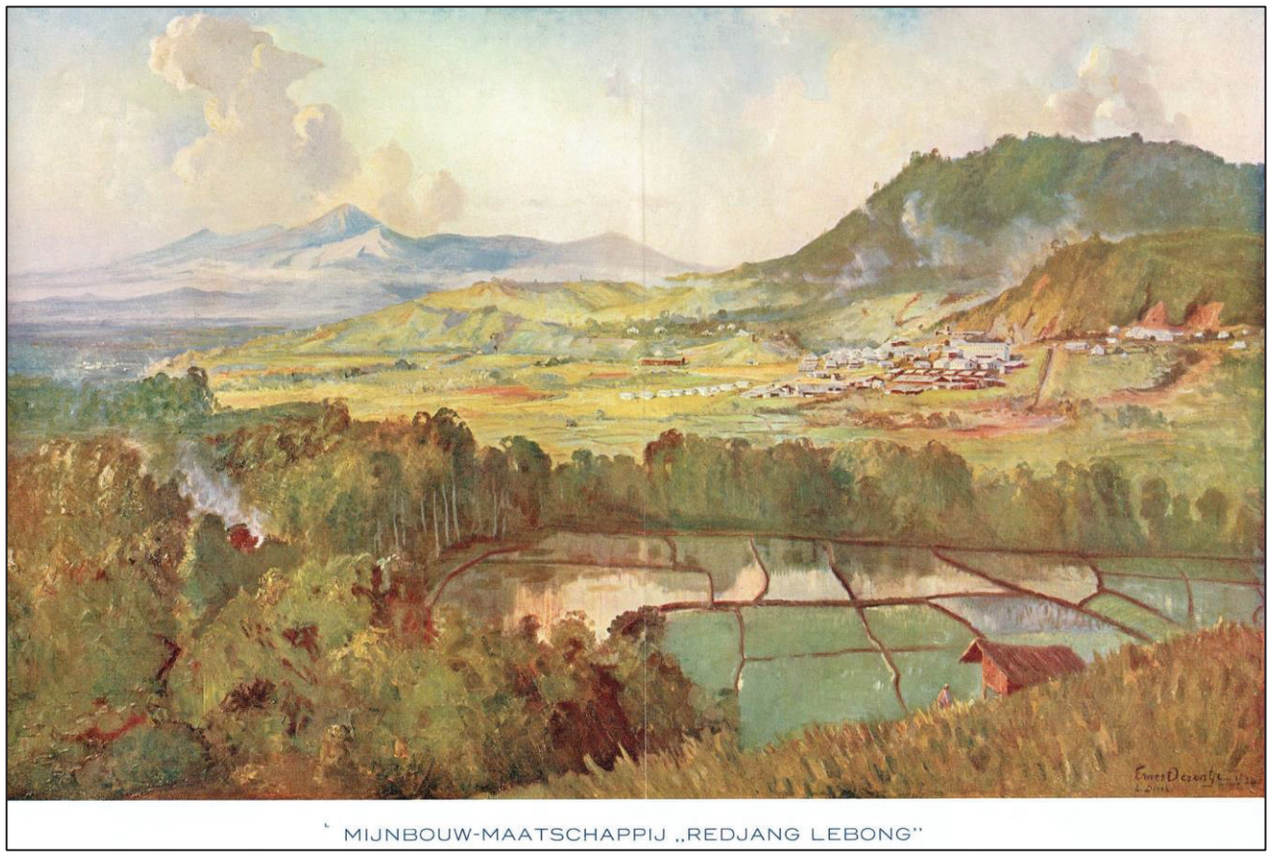
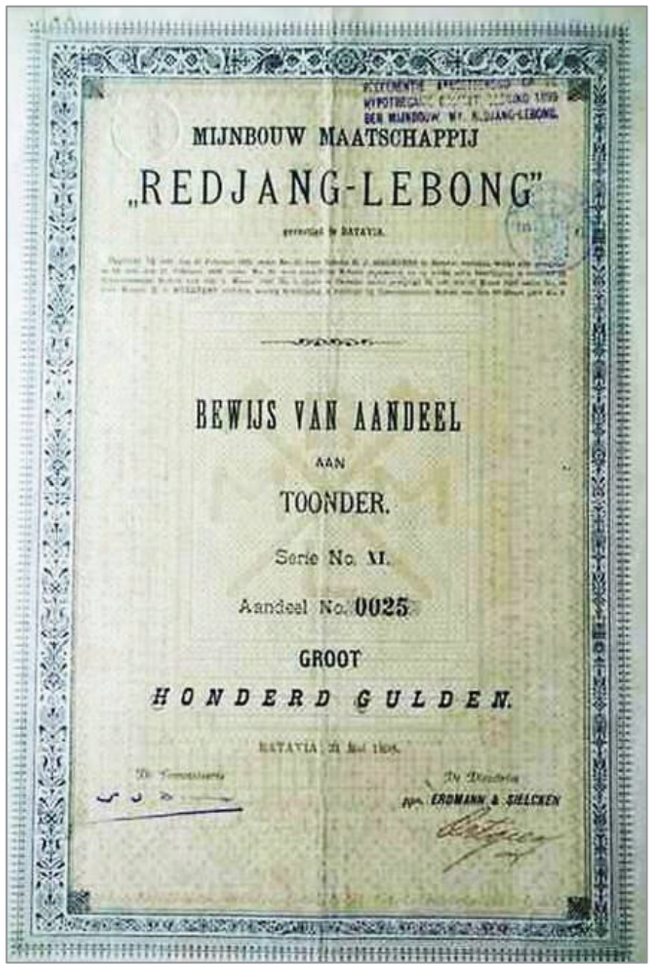


Fig. XV.50. View of the Redjang Lebong mine complex around 1910, along the edge of the Lebong Valley, one of the 'rift valleys' along the Great Sumatra Fault wrench fault zone in the Barisan Range (from 'De Indische Bodem, 1926)


MIJNBOUW MAATSCHAPPIJ

„REDJANG-LEBONG"

BEWIJS VAN AANDEEL

AAN

TOONDER.

Serie No. XI.

Aandeel No. 0025

GROOT

HONDERD GULDEN.

Fig. XV.51a.
Share of the N.V. Mijnbouw Maatschappij Redjang Lebong (operational 1901-1936).

Fig. XV.51b. Logo of the German-owned trading house Erdmann & Sielcken, which was initially primarily a sugar exporting company in Surabaya, but became the dominant investors and administrators of SW Sumatra gold mines in ~1900-1935.

XV.4. Gold - Borneo

Gold has been known from Borneo/Kalimantan for many centuries. Small scale native gold mining in Kalimantan probably dates back to Hindu or even prehistoric times, by Malay and Dayak miners, but reportedly in very limited quantities. Gold mining became much more significant after immigration of 10s of thousands of miners from SE China since the 1760s. The Chinese gold mines were mainly shallow, in alluvial placers and in gold-bearing weathering zones of gold-bearing hardrock.

Around 1900, a series of small gold mines were exploited by European mining companies, which mainly focused on hardrock mining of primary gold-bearing veins. This type of mining was more capital-intensive and had not been touched by Chinese miners. However, none of these companies seemed to last more than 10-20 years. Unregulated native alluvial gold mining in several areas of Kalimantan continues today.

Geology of Borneo gold

Unfortunately, for centuries of gold mining was conducted mainly by miners without geological backgrounds. Relatively little has been published of the geological contexts of the gold in the hundreds of small mines, and no clear regional picture exists of the gold belt that extends from West Sarawak (*Bau* gold mines) southward into NW Kalimantan. Primary gold is mainly in quartz veins in old schists and granites. Traditionally, much of the gold mined is from secondary, alluvial placer deposits and weathered granite (Van Schelle, 1883).

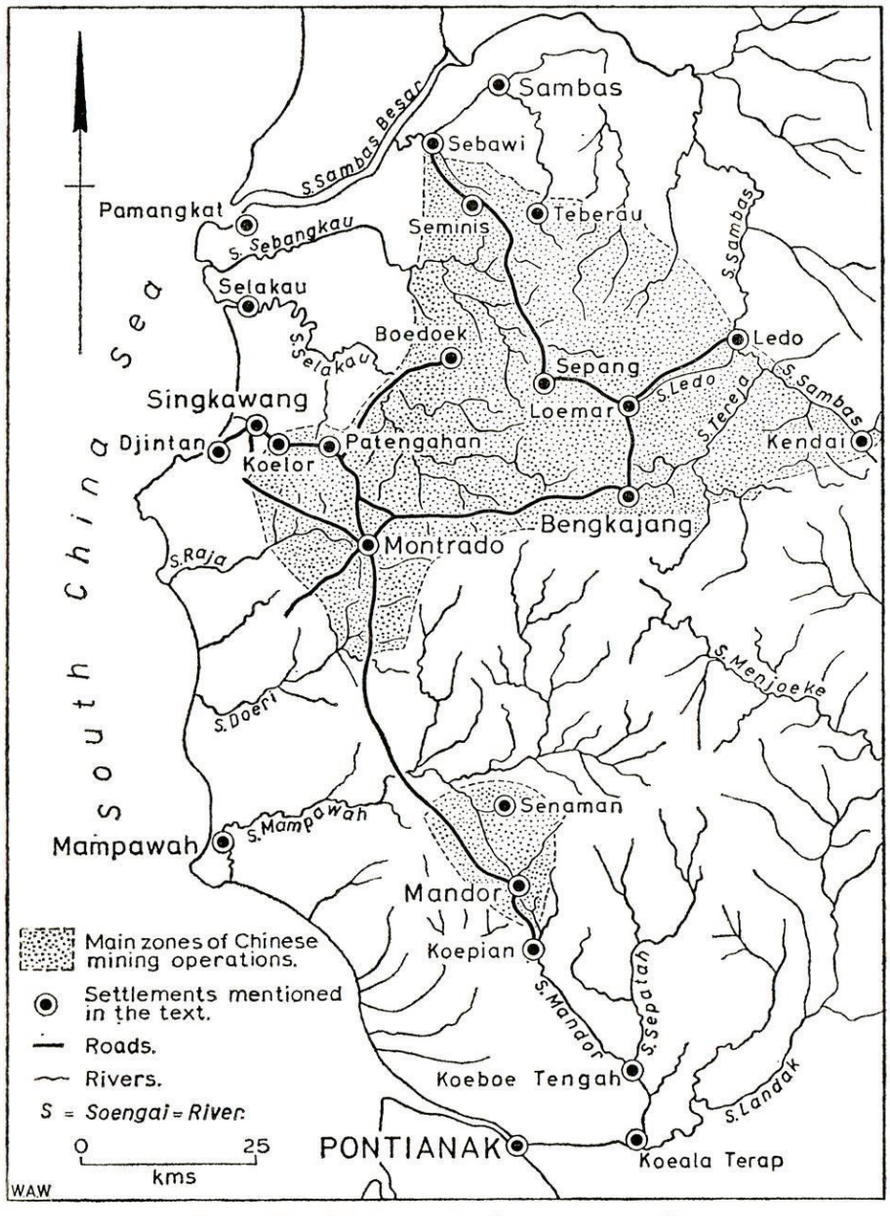


FIG. 4. THE WEST BORNEO GOLDFIELDS, *c.* 1850

The Chinese Districts of NW Borneo, 1770s-1884.

A large area in NW Kalimantan (North of Pontianak) has long been known as the *Chinese Districts*, which included area of the *Lan Fang* and other *kongsis* (Companies).

It was a community that started out as a group of gold mines around 1760, but from 1777 until 1884, the Chinese settlements had been organized into a self-governed district, beyond the control of the Netherlands Indies government and existing alongside the indigenous Dayak and Malay populations.

It was essentially a tributary state of China during the *Qing* Dynasty period (Somers Heidhues, 2003).

Fig. XV.89. Map of the main areas of Chinese gold mining in the 'Chinese Districts' of NW Kalimantan around 1850 (Jackson, 1970)

Since the mid-1700s over 50,000 Chinese immigrant miners (mainly Hakka Chines) were engaged here in exploitation of alluvial gold deposits, probably at the invitation of the Sultans of Western Borneo. All gold was exported to China. *Montrado*, *Mandor*, *Bengkajang*, *Loemar*, *Sepang* and *Seminis* were significant Chinese towns in the early 1800s (Fig. XV.89). However, in the late 1880s, Van Schelle (1884) and Wing Easton (1904) reported that most of the alluvial gold deposits in NW Borneo were already mined out, and that the peak of Chinese gold mining there was already long over.

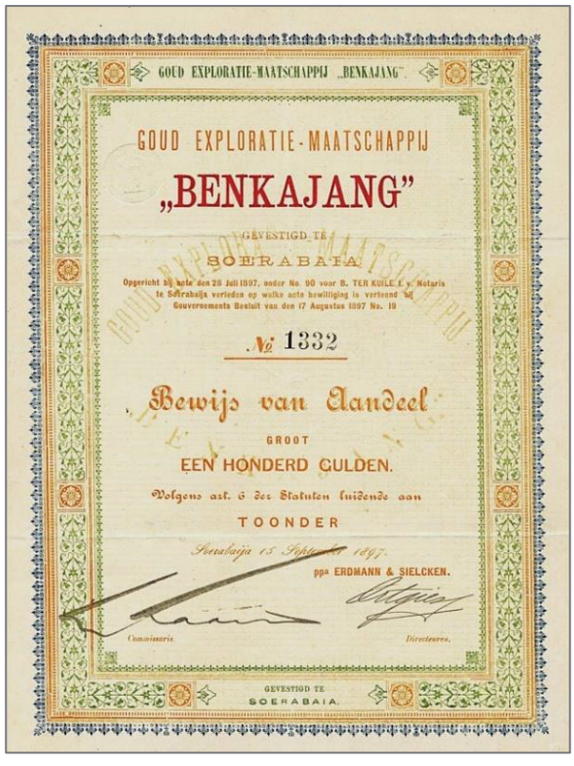
Chinese immigration already declined in the early 1800s, and by the mid-1800s, much of the Chinese mining in the area had disappeared. This was not only because the Netherlands Indies government started to exert control over the region and broke up the Chinese *kongsis* in 1857, but also because most of the gold-bearing alluvial deposits had all been mined out (H.L. Krol, in Dunselman, 1938). According to government geologist N. Wing Easton (1889) there were still ~100 small mines operating at that time in the Montrado, Loemar and Sambas districts, but they produced barely enough gold to cover the cost of operations (although the official numbers may well be underreported).

The widespread remnants of Chinese gold diggings attest to what once were widespread, rich gold deposits, but very little is known about the volumes of gold recovered here before 1850. However, the era of Chinese gold mining left extensive environmental degradation and infertile soils across large parts of West Borneo, where, a century later, only poor, stunted vegetation existed where there once was primary tropical jungle (Dunselman, 1938, De Tropische Natuur 27, p. 97-104).

The first government-sponsored mining-geological surveys in West Kalimantan were after 1850, at first by Ir. R. Everwijn, and later by C.J. van Schelle and N. Wing Easton. Most of the European gold ventures on Borneo during the late 1800s-early 1900s were relatively short-lived, and only marginally economic or commercial failures. Larger scale, significant mines came much later, like the largest gold deposit of Kalimantan, the *Kelian* gold mine of Rio Tinto, was a between 1992 and 2004.

The gold rush in Borneo: European-owned mining companies in the late 1890s - early 1900s

Like other parts of the Netherlands Indies, Borneo also experienced the effects of the gold rush of the 1890s in the Netherlands Indies. By 1899, more than 150 concessions had been granted, but only 4 were more or less active. Most of these were in NW Kalimantan. None of them appeared to have made significant profits.


GOUD EXPLORATIE-MAATSCHAPPIJ „BENKAJANG"

GOUD EXPLORATIE-MAATSCHAPPIJ

„BENKAJANG"

GEVESTIGD TE

SOERABAIA

№ 1332

Bewijs van Aandeel

GROOT

EEN HONDERD GULDEN.

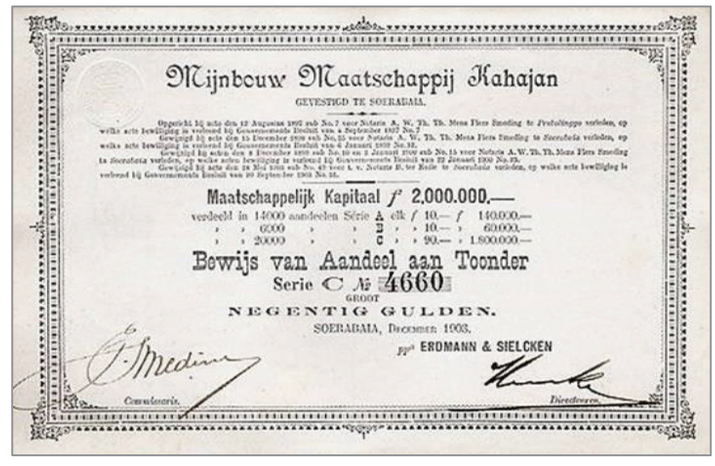
Volgens art. 6 der Statuten luidende aan

TOONDER

ppa ERDMANN & SIELCKEN.

Commissaris. Directeuren.

GEVESTIGD TE SOERABAIA.


Mijnbouw Maatschappij Kahajan

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SOERABAIA, DECEMBER 1903.

ppa ERDMANN & SIELCKEN

Commissaris. Directeuren.

Fig. XV.90.
Shares of two of the short-lived gold-rush companies formed by Erdmann & Siecken in Surabaya in 1897, for gold exploitation in West Kalimantan (Benkajang) and in the upper Barito area of SE Kalimantan (Kahajan).

During the Dutch colonial area, several short-lived European-operated gold mines were active in the upper Barito area near Teweh. These included the *Mijnbouw Maatschappij Kahajan* (1897; Fig. XV.90) in the early 1900s and

XV.5. Gold - Sulawesi

Native workings for gold have existed in North Sulawesi since before the early 1800s and some may date back to the Portuguese time (Truscott, 1902). The three most successful gold mining ventures around 1900 were along the north coast NW of Gorontalo (*Paleleh, Soemalatta*) and much farther east near the south coast of NE Sulawesi, South of Manado (*Totok* or *Ratatotok*).

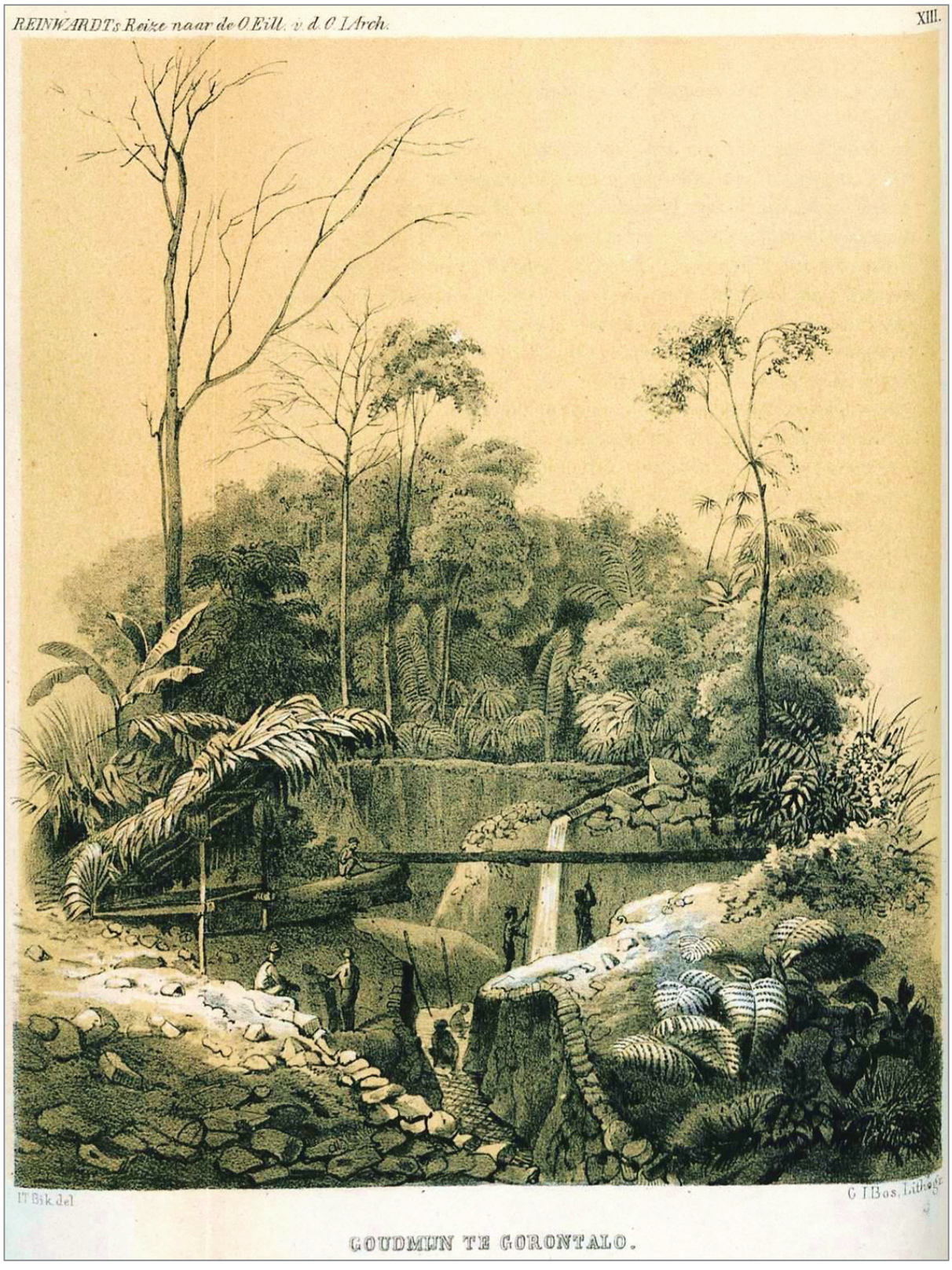


Fig. XV.97. One of several native gold mines in the Gorontalo area of North Sulawesi, visited by botanist/naturalist C.G.C. Reinwardt in 1821 (Reinwardt and De Vriese, 1858).

XV.6. Gold- Java, New Guinea

XV.6.1. Gold, Java

In the early 1900s it was assumed that Java Island did not contain any significant gold deposits, although in the 1700s the VOC conducted some marginally successful gold mining at *Gunung Parang* near Plered (Krawang) in West Java. Local sultans had also conducted similar small mining operations, and there were several areas of small-scale, native gold panning operations. Java was mentioned in ancient, pre-colonial texts as being rich in gold and silver (although, as mentioned above, some scholars believe that the Java mentioned in these old texts may have included Sumatra and Borneo)

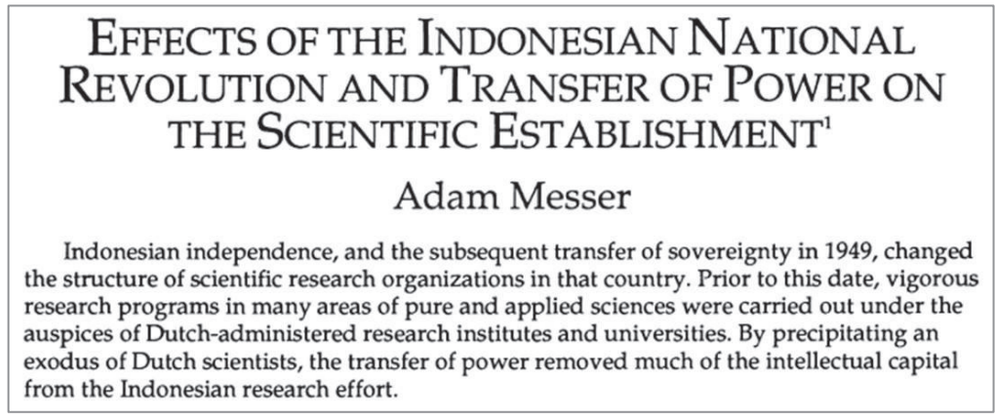
The highly esteemed Ir. R.D.M. Verbeek (1896), after several years of regional geological mapping on Java with R. Fennema and others, was adamant that there were no significant gold or silver deposits on Java, and that on geological grounds, none should be expected. The latter opinion was probably based on Verbeek's experience in West Sumatra where most gold-bearing veins were in Pre-Tertiary 'Old schists' and associated with granites, both rock types that are very rare on Java. He was wrong.

Fig. XV.112. Test excavation of a gold-silver bearing quartz vein at Tji Bodjongdeet, Jampang, West Java, during a government-directed survey in the early 1920s (Dienst van den Mijnbouw 1924, Verslagen en Mededeelingen 16). None of the mineralized veins identified and evaluated was deemed to be of commercial interest.

XVI.2. Gradual elimination of the Dutch Earth Science heritage, 1942-1946, 1958

The Japanese invasion of 1942 brought a halt to virtually all of the once highly regarded Dutch colonial-era scientific research and know-how (although science funding had already been reduced significantly during the economic crisis of the 1930s). Many Dutch/European scientists had died during Japanese occupation of 1942-1945 and its aftermath. Most of the survivors tried to leave Indonesia at the earliest opportunity. The influx of trained scientists from Europe in all fields of science had also virtually stopped.

This loss of scientists in the 1940s was made worse in late 1957 by the banning of the Dutch scientists, Dutch language and Dutch-language publications (the language of most of the science before the 1940s). This was mainly a result of political squabbles between Indonesia and the Netherlands over the continued Dutch rule over western New Guinea. Its effect was that Indonesia eliminated much of its own history.



EFFECTS OF THE INDONESIAN NATIONAL REVOLUTION AND TRANSFER OF POWER ON THE SCIENTIFIC ESTABLISHMENT[1]

Adam Messer

Indonesian independence, and the subsequent transfer of sovereignty in 1949, changed the structure of scientific research organizations in that country. Prior to this date, vigorous research programs in many areas of pure and applied sciences were carried out under the auspices of Dutch-administered research institutes and universities. By precipitating an exodus of Dutch scientists, the transfer of power removed much of the intellectual capital from the Indonesian research effort.

Fig. XVI.6. In a 1994 paper, Adam Messer, American biologist at Cornell University, described how the Japanese occupation and the following Indonesian struggles for Independence resulted in the elimination of most of the scientific know-how in biology and medicine in Indonesia. A similar story applies to Earth sciences.

The consequences of the above breaks with anything-Dutch, still have an effect today. Knowledge of, and access to, colonial-era geoscience by present-day Indonesian geoscientists appears to be limited. It does not appear to be part of any university curriculum in Indonesia. Science philosophers argue that in order to understand a science one must know its history and learn from past mistakes. Perhaps if less radical minds had prevailed in Indonesian national leadership between 1945 and 1958, and a more gradual transition from Dutch to Indonesian rule could have been arranged, Indonesia might have produced many more internationally recognized geoscientists like Professor J. Katili and others, who had (at least partly) grown up in Dutch-language schools.

It would take several decades after Independence before internationally recognized new geological research work would come from Indonesian authors. This should not be surprising, as the number of geologists trained in the 1950s and 1960s was low, and also, understandably, they were trained primarily to fill practical jobs in mining and government, not for scientific research. The most favorable exceptions were the works of Professor J. Katili during the advent of plate tectonics in the 1960s and 1970s.

The (Dutch) language problem

The first requirement for teaching and conducting science is an effective language. Before Indonesian Independence, the languages used in geoscience were mainly Dutch, and also some English and German, but not Malay/Indonesian. Most of the first generation of geology students in Bandung in the early 1950s had attended basic education in the Dutch-language educational system (*Hollandsch-Inlandsche School*, etc.), and therefore benefited much more from the colonial-era geological scientific heritage than later generations of Indonesian geologists.

The Indonesian generations that went through elementary and high schools after 1957 did not have that benefit, so the first problem faced by Indonesian geology teachers after Independence was to build a new Indonesian geological vocabulary. Pioneers in compiling Indonesian dictionaries of geological terms were Soenoe Soemosoesastro (see also volume 2, chapter VII/81) and M. Mulyono Purbo-Hadiwidjojo in the 1950s and 1960s (Fig. XVI.7).

The Geology and Mining school of the Republik Indonesia, 1946-1949

Meanwhile, in Indonesian Republican-controlled territory in Central Java, a rival Geological Survey and Mining Center was established in Magelang in late 1946, which was led by former *Mijnbouw* Assistant Geologists A.F. Lasut (as head) and Sunu Sumosusastro (see also below). It included a geology and mining training program named *Sekolah Geologi Pertambangan*. The school later moved to Magelang and finally to Yogyakarta, and changed to *Akademi Geologi dan Pertambangan* (Academy of Geology and Mining; AGP).

The new program in Yogyakarta was similar to the 3-year *Assistent Geologen Cursus* of *Mijnbouw* that Lasut and Sunu S. had attended in 1938-1941. Among the first graduates in Yogyakarta in 1949 were future Geological Survey/Volcanological Survey geologists *M.M. Poerbohadiwidjojo* (M.M. Purbo-Hadiwidjoyo), *Djajadi Hadikusumo, Suryo*, *Rino Prajitno* and others (Koesoemadinata, 2015). They became prominent geologists during the transition from the *Dienst van den Mijnbouw* to *Jawatan Pertambangan* in Bandung after the transfer of sovereignty of December 1949, when the former Dutch (Bandung) and RI (Yogyakarta) Geological Survey organizations were combined in Bandung. Some of these assistant-geologists later registered as first-year students with the UI Geology Department of Prof. T. Klompe in Bandung.

Start of academic geology education at UI FIPIA (later ITB), Bandung, 1950

The most significant development in restarting geoscience in Indonesia in the late 1940s was the creation of the Geology Department at the Technical Faculty of the University of Indonesia (commonly abbreviated as UI FIPIA; after 1959 renamed *Institut Teknologi Bandung*; ITB) in Bandung, with the vision to train a new generation of Indonesian geologists and mining engineers by mainly Dutch professors, who were firmly rooted in the pre-war Dutch geological heritage. However, this was cut short within 6 years by political decisions in late 1957-1958, which were aimed at removing all Dutch influence in Indonesia.

Since 1922 a course in Technical Geology (*Technische Aardkunde* or *Toegepaste Aardkunde*), and possibly also mining, was part of the curriculum of the civil engineering program at the *Technische Hogeschool* in Bandung. (for the early history of building TH Bandoeng around 1920 see the Ijzerman chapter XVIII/230; below).

Part-time lecturers were Dutch engineering consultants or personnel from the nearby *Dienst van den Mijnbouw* (Geological Survey), including B. von Faber (1922-1924), F.T. Mesdag (1932-1934), G. Pott (1936-1938) and M.E. Akkersdijk (1936-1942). During the Japanese occupation of 1942-1945, all Dutch faculty had to abandon the school, but it re-opened in 1944 as *Bandung Kogyo Daigaku*.

Fig. XVI.8. The first logo of the Technische Hoogeschool Bandoeng/THB, founded in 1920 (left), and after a period as part of the University of Indonesia it became independent again in 1959 as Institut Teknologi Bandung (ITB) (right).

After the Japanese surrender in 1945 the school was renamed *Sekolah Tinggi Teknik Bandung*, but most of the Indonesian faculty soon evacuated to Republican Territory in Yogyakarta for political reasons. In 1947, after the Dutch had regained control of Bandung, TH Bandung was reopened, but now as a branch of the University of Indonesia, and no longer an independent college. There were two faculties, the *Fakultas Teknik* (Technical Faculty) and *Fakultas Ilmu Pasti dan Ilmu Alam* (Faculty of Mathematics and Natural Sciences).

A new mining department was established within the Technical Faculty in 1948 by Prof. M.E. Akkersdijk. One or two years later Prof. T.H.F. Klompe established a Geology Department within the Faculty of Mathematics and Natural Sciences. The first Geology-Mining Department in Bandung was led by Prof. Dr. *T.H.F. Klompe*, until 1958. In 1950-1951 Klompe taught General Geology, Historic Geology and Paleontology, assisted only by Prof. Ir. M.E. Akkersdijk (Economic Minerals) and Ir. P.G.H.A. Fermin (Mining). By 1952 a more diverse faculty was in place with:

- Prof. Ir. *M.E. Akkersdijk* (1951-1955; Technical Geology, Mining, Mineralogy). Akkersdijk was a former *Dienst van den Mijnbouw* employee who had taught *Toegepaste Geologie* (Applied Geology) at the *Technische Hogeschool Bandung* before the Japanese occupation in 1936 and 1939-1942;
- Dr. *Peter Marks* (1952-1957; Paleontology-stratigraphy);
- Dr. *Dirk de Waard* (1952-1957; Petrology, metamorphic rocks);
- Ir. *Petrus G.A.H. Fermin* (1952-1957; Ore processing and metallurgy). Previously mining engineer with the *Dienst van den Mijnbouw*;
- Dr. *Rudolf A.J. Osberger* (1952- March 1955). Austrian geologist-paleontologist; moved to Bangka in 1955.

Two seismologists from the Meteorological and Geophysical Institute in Jakarta were part-time Adjunct Professors of Geophysics: Dr. *H.P. Berlage* (1948-1950) and Dr. *A.R. Ritsema* (1952-1958). Around 1956-1957 additional faculty members included Canadian Dr. *James F. McDivitt* (Economic Geology), *Ong Goan Eng* (Micropaleontology) and *S.A. Manus* (Petrology).

Only four students had graduated in geology in the Klompe-led department before the upheaval of its faculty in 1958: *Soetaryo Sigit* (Fig. XVI.9), *John Katili*, *Sartono* and *Johannas*. Among the students that had reached the halfway point (*Kandidaatsexamen*) was *R.P. Koesoemadinata*.

Fig. XVI.9. The first student to graduate from the Geology Department of the University of Indonesia in Bandung was Soetaryo Sigit, in October 1956. Seated during the graduation, from left: Prof. T. Klompe, Prof. H.T.M. Leeman (Dean of the Mathematics and Natural Sciences Faculty) and Prof. D. de Waard.

The second Assistent-Geologist course of the Bureau of Mines, 1953-1955

Meanwhile, the *Jawatan Pertambangan* (Geological Survey/Bureau of Mines) resurrected the 3-year *Assistent-Geologen Cursus* program in 1953. But instead of teaching it in-house, like previous iterations of the course in 1938-1951 and 1946-1949, the *Pertambangan* students were sent to Prof. Klompe's Department of Geology at UI FIPIA in Bandung. They essentially completed the first stage of the academic program (until *Kandidaatsexamen*) and took some supplemental courses from the Mining Department, then were awarded the diploma from *Jawatan Pertambangan*. Well-known attendants of this course were volcanologist *Kama*

215. Theodorus H.F. KLOMPE (The Hague 1903- Kuala Lumpur 1963)

T.H.F. Klompe (officially spelled Klompé) had a varied career in geology in Indonesia, which straddled the political transitions from petroleum geologist with NKPM/Stanvac in the Netherlands Indies in the 1930s, to prisoner of war during the Japanese occupation, to Professor of Geology in Bandung during the first decade of the Republic of Indonesia. After the Dutch exodus from Indonesia in 1958 he became professor of geology in Bangkok and Kuala Lumpur.

Theodorus Henricus Franciscus (Theo) Klompe was born in The Hague, Netherlands, on 30 December 1903. He studied geology at the University of Leiden from 1923 until February 1928, finishing with a doctorate under Prof. B.G. Escher in November 1929, with a thesis on the geology of the Bergamask Alps, northern Italy.

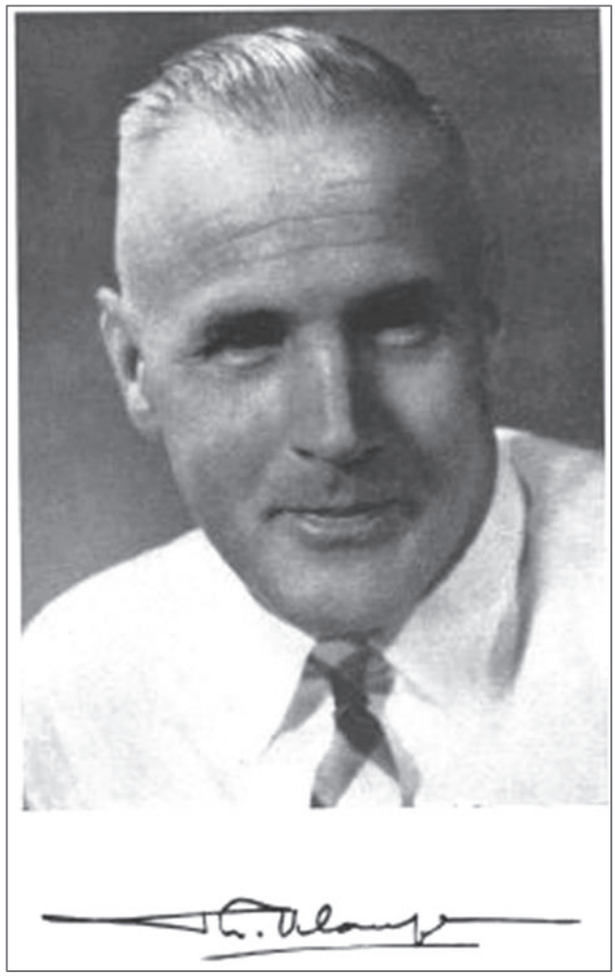


Fig. XVI.14.
Prof. Dr. T.H.F. Klompe (from Katili, 1963).

Netherlands Indies with NKPM, 1929-1941

From 1929 until 1942, Klompe was employed by the *Nederlandsche Koloniale Petroleum Maatschappij* (NKPM; a Standard Oil affiliate, renamed *Stanvac* after 1945). During that time he worked in South Sumatra (Sungei Gerong/Palembang), in Netherlands New Guinea (seconded to NNGPM in October 1937-January 1939) and in East Kalimantan. This was interrupted by brief work assignments in China and Japan.

Japanese internment, 1942-1945

In late 1941, Klompe was conscripted as a Lieutenant in the Netherlands Indies Army (KNIL) in preparation for the Japanese invasion. He was captured by the Japanese in Bandung on 12 March 1942 and was interned in prisoner of war camps in Bandung, Jakarta.

In January 1943, Klompe was transported to Singapore in the hull of an old cargo ship, the *Harugiku Maru* (formerly the KPM freighter *Van Waerwijck*), as part of the 'Java Party 7' group of about 1000 Dutch prisoners. Geologists J. Duyfjes and J.G.H. Ubaghs from the Geological Survey were on the same transport. Most of this group of POW's was shipped from Singapore to Japan, to work in coal mines, or were transported by train to Thailand to work on the Burma-Thailand railroad (Duyfjes). However, Klompe and Ubaghs remained in Camp Changi for the remainder of the war.

Geologic map of Indonesia, 1954

One of Klompe's main contributions was a new edition of the country-wide 1:2 million scale geologic map of Indonesia in 1954, the first since the compilation by Abendanon in 1914 (Fig. XVI.16). It was first published in conjunction with the 1954 ECAFE meeting. A slightly updated version was published by the U.S. Geological Survey (Klompe and Sigit Soetaryo, 1965).

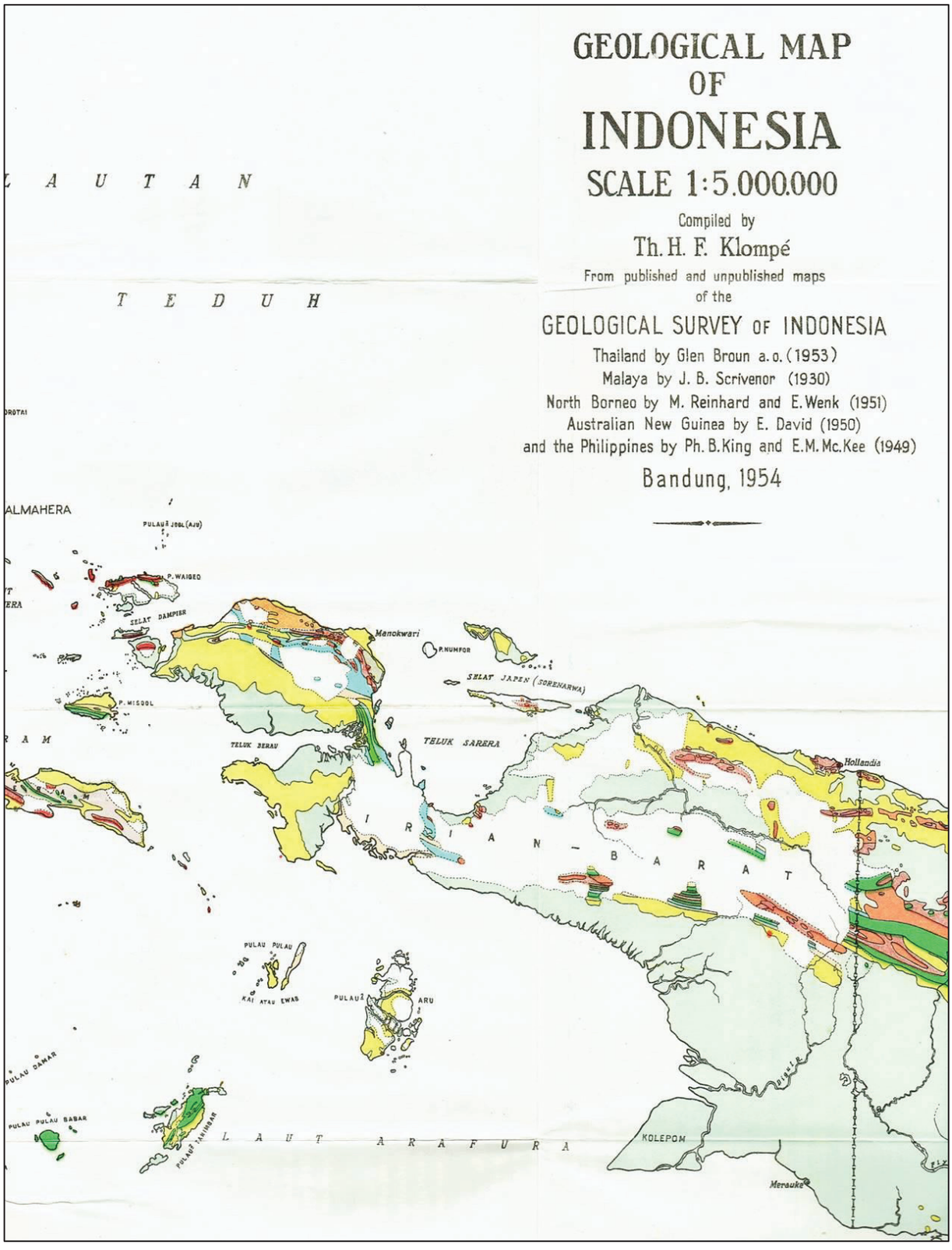


Fig. XVI.16. Part of the Geological map of Indonesia compiled by Klompe (1954). This was the first country-wide map since Abendanon (1914). Much of the interior of New Guinea/Irian Barat was still unknown at that time.

220. John Ario KATILI (Gorontalo 1929- Jakarta 2008)

J.A. Katili was a leading figure in Indonesian academic geology and in government administration in the 1960s-1980s. He has been called "Bapak Geologi Indonesia" (Father of Indonesian geologists). He was one of the first geologists to graduate from the University of Indonesia (now ITB) and also one of the last to be intimately familiar with the geological work from the Dutch colonial era. Together with Warren Hamilton of the U.S. Geological Survey, Katili was an early pioneer in plate tectonic re-interpretation of the geology of the Indonesian region in the late 1960s-1970s, which earned him international recognition.

John Katili was born in Gorontalo, Sulawesi, in 9 June 1929. He went to a Dutch-language elementary school in Poso, and high schools in Manado and Makassar. From 1950 Katili studied at the Department of Geology of the University of Indonesia in Bandung (renamed as ITB in 1959), which at that time was staffed by Dutch professors under the leadership of Professor T. Klompe. Katili was one of its first graduates, in November 1956, and became a teaching assistant in the UI Department of Geology.

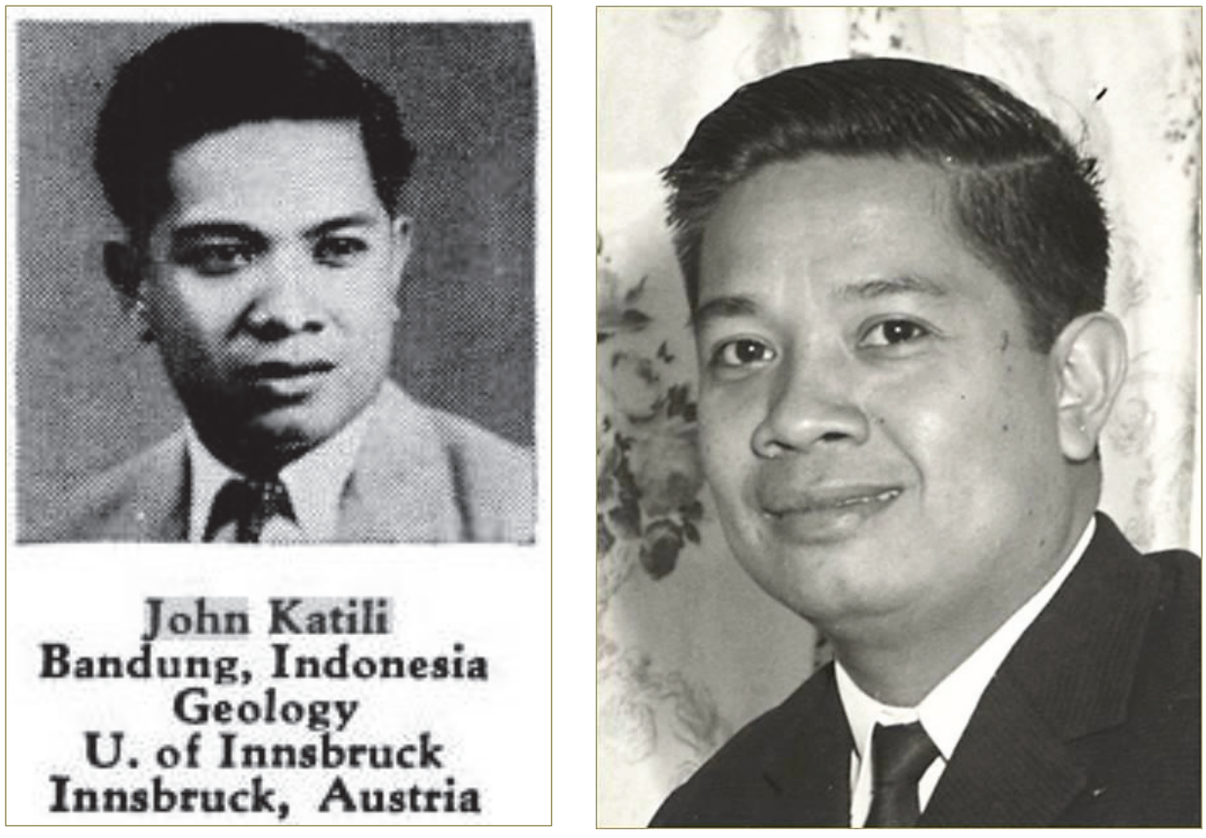


Fig. XVI.43. Left: Portrait of a young John Katili in 1957 (The Rotarian, 1957). Right in 1963 at the University of Kentucky (Kentucky Digital Library).

Post-graduate in Innsbruck and doctorate in Bandung, 1957-1960

Katili did post-graduate studies at the University of Innsbruck, Austria from 1957-1958, with a grant from the Rotary Foundation. When he returned to Bandung in 1958 to work on his doctorate under Professor Klompe, all Dutch professors had been expelled by the Soekarno government and Klompe had already moved to Bangkok. Katili regretted this political development and called it '*an excess of nationalisation*' (Verstappen, 2008). Katili managed to continue work on his doctorate in Bandung after 1958, under the direction of USAID Professor Robert W. Decker and became the second (after Sartono) to complete a doctorate in geology in Indonesia, in May 1960. His thesis was on the geology of the (mid-Cretaceous) *Lassi* Granite in Sumatra (Katili, 1960).

Professor of Geology, 1961, Head of LIPI 1962, Director of Mines 1973

In 1961 J. Katili became Professor of geology at his old Department of Geology (now part of Institut Teknologi Bandung). From here rapidly moved into a series of important government managerial positions:
- Head of the National Institute of Geology and Mining LIPI (1962-1971);
- Deputy Head of the Indonesian Institute of Sciences (LIPI) (1969-1974);
- Director General of Mines (1973-1984);
- Director General of Geology and Mineral Resources (1984-1989).

Between old and new Indonesia geology

As one of the last of the generation that was still educated under the Dutch system, Katili was one of the small group of transitional individuals who formed the main links between the Dutch colonial geoscience and the younger Indonesian geoscientists. Others in the same mold included his classmates H.D. Tjia, Sartono, M.T. Zen and Soetaryo Sigit, and slightly later Sukendar Asikin, R.P. Koesoemadinata and others.

The arrival of plate tectonics theory in Indonesia, early 1970s

Despite his high-level managerial positions, Katili continued to be a dominant force in Indonesian geoscience. Katili's 1971 and 1989 papers were excellent reviews of the history of the many tectonic models and tectonic maps that had been published for Indonesia before 1970. Many of the older authors had recognized the Indonesian Archipelago as a place of intersection of Asian and Australian mountain systems and continents, and also that the Indonesian island arcs represent early stages of formation of mountain belts.

As concluded by Katili, the newly emerging *Theory of Plate tectonics* formed a superior basis to explain many features of Indonesian geology. Several of Katili's papers from the early 1970s were pioneering examples of how the geology of Indonesia could be understood in plate tectonics terms (Fig. XVI.44). This was major progress, although, not surprisingly for a complex geology like Indonesia, not all of his early interpretations are still accepted (e.g., Quaternary spreading of Makassar Straits).

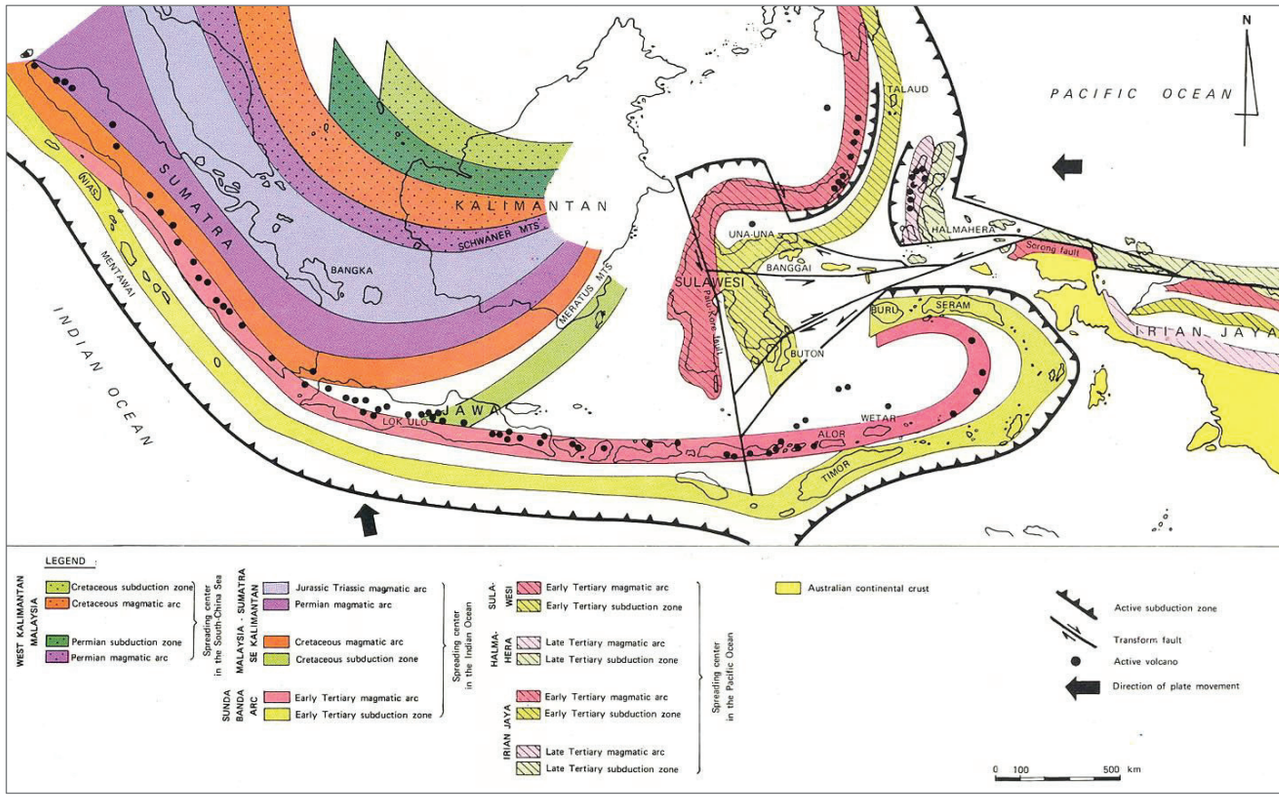


Fig. XVI.44. A frequently-reproduced figure by Katili, showing the locations of magmatic arcs in the Indonesian region through time since the Late Paleozoic (Katili, 1974).

Large transcurrent faults

Katili (with F. Hehuwat) was the first to recognize the *Semangko*/Great Sumatra Fault Zone across the Barisan Range in Sumatra as a large right-lateral transcurrent fault. He interpreted similar large wrench fault zones in Sulawesi (Palu-Koro) and in New Guinea (Sorong Fault Zone).

Books and papers

Katili authored some 250 papers, mainly on tectonics and igneous rocks of Indonesia in the 1960s-1980s. In 1963 Katili wrote the first geology textbook in the Indonesian language, together with his former lecturer Dr. Peter Marks. It is succinctly titled *Geologi* and is 855 pages long. Collections of reprints of Katili's scientific works were published in 1980 and 1985 (Fig. XVI.45).

XVI.4. 'Decolonization' of Indonesian geoscience in The Netherlands

As described above, the transfer of geoscience knowledge from the Dutch colonial era to the post-independence generations of Indonesian geologists was not smooth and mostly inadequate. In the opinion of Prof. J. Katili, the nationalist political drives to purge all Dutch influence from Indonesia in the 1940s and 1950s went too far, and resulted in 'the good going out with the bad'. These political changes in Indonesia also forced drastic reorientations in focus of the geoscience world in The Netherlands. Before World War II, much of the training of geologists and mining engineers at universities and the *Technische Hogeschool* in Delft was focused on careers in the Netherlands Indies.

During World War II geology students in the Netherlands were unable to travel to 'traditional' fieldwork training areas in Spain, the Alps, etc. Some students now did practical work in the coal mines of Limburg, or worked on topics in Quaternary geology of the Netherlands (e.g., D. de Waard, G.A. de Neve). Others did research on rock and fossil collections from the Netherlands Indies in university collections, including:
- W.P. De Roever and C. Egeler worked on petrography of Sulawesi samples of H.A. Brouwer in Amsterdam;
- M.G. Rutten worked on the Witkamp rock collection from NE Kalimantan in Utrecht;
- J.H. Germeraad, W. Valk and J. Van der Sluis worked on the Seram collection of L. Rutten in Utrecht.

After the traumatic events of World War II and continued hostilities towards the Dutch in Indonesia during the late 1940s and 1950s, interest in the geology of Indonesia rapidly diminished in the Netherlands. Interest died almost completely after 1958, after the nationalization of Dutch economic interests, the banning of Dutch-language publications, and the expulsion of all Dutch nationals from Indonesia. Much expertise, libraries and geological collections from the Indonesian region were now no longer in demand.

The 1958 nationalizations of Dutch mining and other industries in Indonesia

Escalating political tensions between Indonesia and the Netherlands over governance of West New Guinea in the 1950s led to the nationalization (essentially confiscation, generally without fair compensation) in late 1957- early 1958 of the remaining Dutch-owned private companies in Indonesia. This involved several banks, hundreds of plantations, the KPM shipping company, trading companies, manufacturing companies, utilities, railway companies and all Dutch mining and petroleum interests, including:
- the *Billiton* mining company;
- the Portland Cement Maatschappij in Padang;
- the *Parappattan* coal mines in East Kalimantan;
- the once mighty *BPM/Royal Dutch-Shell* oil company, nationalization was delayed after briefly reinventing itself as a British company, but between 1959 and 1968 all its assets were transferred to state company *Pertamina* (American companies *Caltex* and *Stanvac* were allowed to continue to operate in Indonesia);

Other venerable Dutch institutions that were nationalized:
- the *Nederlandsche Handelsmaatschappij* bank and other trading houses;
- the *Deli Maatschappij* tobacco plantations and other plantation industries;
- the *K.P.M.* inter-island shipping company had moved headquarters to Singapore in 1957 to avoid nationalization and evacuated many of its ships out of Indonesia. It was then prohibited from operating in Indonesian waters and the company was liquidated in 1967.

'Stranded' geological expertise in the Netherlands

In the 1950s-1960s, virtually all expertise on the geology of Indonesia resided in the Netherlands, but was no longer utilized. Many of the professors and lecturers of geology at universities in the Netherlands in the 1950s-1970s were internationally recognized experts in Indonesian geology:
- B.G. Escher and I.M. van der Vlerk in Leiden;
- J.H.F. Umbgrove and J.J. Dozy in Delft;
- H.A. Brouwer, G.L. Smit Sibinga, W.P. de Roever, J.J. Hermes, H.J. MacGillavry and A.L. Simons in Amsterdam;
- R.W. van Bemmelen, R. von Koenigswald, P. Marks and M.G. Rutten in Utrecht;
- P.H. Kuenen in Groningen.

However, after the breakdown in relationships between Indonesia and The Netherlands in the late 1950s and 1960s, many Indonesian geology students were sent overseas for training to the U.S.A., Canada, Germany, Austria, etc., but not to the Netherlands, where most of the geoscience know-how was. Their overseas training was undoubtedly adequate for learning general geological skills, but it probably taught them little or nothing about the geology of their own country.

XVII. MEANWHILE IN NEW GUINEA, late 1800s-1970s.

XVII.1. New Guinea Island- General

XVII.1.1. Some colonial history

New Guinea is the second largest island on Earth, after Greenland. Its existence had been known to Portuguese and Spanish explorers since the early 1500s. Dutch explorers like Willem C. Schouten and Abel Tasman followed in the early 1600s. Geographically, ethnically and culturally, New Guinea is part of Melanesia (SW Pacific Ocean), not the Indo-Malayan realm of SE Asia or Aboriginal Australia. Prior to European colonization, there were no prominent kingdoms/sultanates in New Guinea, just numerous small, relatively isolated and often warlike tribes, which lived nomadic lifestyles or were subsistence farmers, while still utilizing stone-age tools.

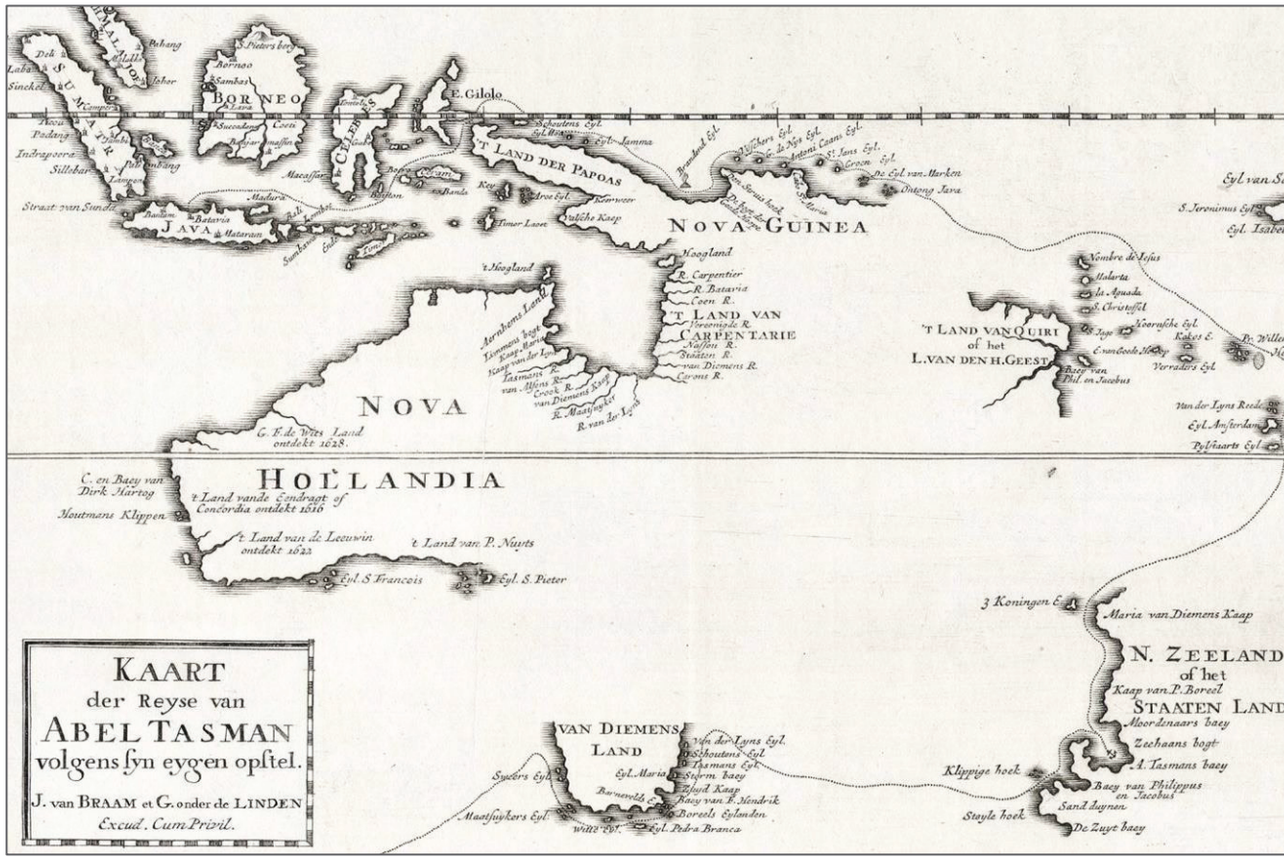


Fig. XVII.1. Map by Dutch navigator Abel Tasman after his voyages of in 1642-16443 (as reproduced by Valentyn, 1726), He sailed around northern New Guinea and discovered New Zealand and Tasmania. In 1644 he also surveyed parts of SW New Guinea and NW Australia, but did not discover that New Guinea was an island, separated from New Holland.

Despite a series of naturalist and geographic expeditions during the 1800s (see also volume 1 of this book), New Guinea long remained a poorly-known and economically insignificant backwater, outside any colonial influence. Until the 1950s, very little was known about the interior and large areas remained unmapped. Despite half a century of earlier activities, major industrial-scale mineral (gold, copper) and oil and gas projects did not materialize anywhere in New Guinea until the 1970s. These have since become major contributors to the economies of PNG and Indonesia.

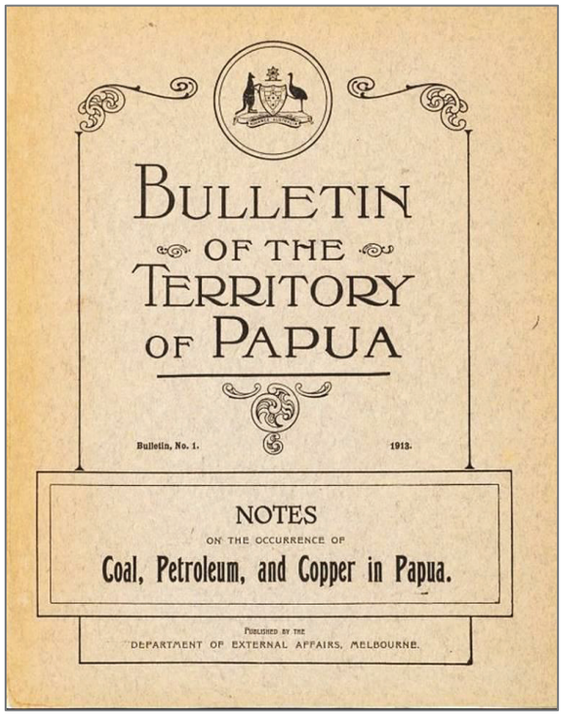
New Guinea had a rather complicated recent political history. Colonization of New Guinea by European nations was relatively late, because, unlike other parts of SE Asia, it did not produce natural or agricultural products that were valued by Europeans at that time, and most of the interior was virtually inaccessible. The Netherlands had claimed ownership of the western half of New Guinea island in the 1600s and again more seriously in the 1800s, but left it mostly unsettled and undeveloped, while eastern New Guinea remained 'unclaimed' by European colonizing nations until the late 1800s.

In the fields of geological surveys and mapping, mining and petroleum exploration, western (Dutch/Indonesian) New Guinea always tended to trail several decades behind that of eastern New Guinea (now PNG).

XVII.3.2. Petroleum exploration, PNG

The first reports of oil in PNG were from 1911, but commercial oil-gas discoveries arrived only since the 1980s. For a more detailed history of petroleum exploration see Rickwood (1990). The first oil seeps in PNG were discovered in 1911 by two planters or gold prospectors near the south coast of Papua, in the lower Vailala River area, in the eastern Papuan Basin NW of Port Moresby. Government-supported search for hydrocarbons in the Territory of Papua started soon thereafter. However, despite the teasers of seepages and massive efforts and investment in oil exploration, the results long remained disappointing, until significant discoveries were made in the southern PNG Highlands in the 1970s and 1980s (with first oil shipped in 1992 from the first commercial oil discovery at *Iagafu* in 1986).

In 1912, two geologists had been dispatched to Papua by the Commonwealth government to independently verify the reports of oil seeps. One was the newly appointed Government geologist for Papua, Evan R. Stanley. The other was Joseph Edmund Carne (1855-1922), Assistant Government Geologist for New South Wales.


BULLETIN
OF THE
TERRITORY
OF PAPUA
Bulletin, No. 1. 1913.
NOTES
ON THE OCCURRENCE OF
Coal, Petroleum, and Copper in Papua.
PUBLISHED BY THE
DEPARTMENT OF EXTERNAL AFFAIRS, MELBOURNE.

Joseph Carne's main objective during his January-May 1912 mission was the *Purari Coal Expedition*, to survey reported coal occurrences along the Purari River, but the Purari coals were of low grade and in thin beds, and of no commercial interest (Carne, 1913). As a last-minute addition to this expedition, he was asked to survey the Vailala oil seeps and the *Astrolabe* copper mining activities near Port Moresby.

Carne managed to locate the reported seeps, as well as a number of additional oil and flammable gas seeps between the Vailala and Purari Rivers, and published a relatively thorough report that included an inventory of reported oil and gas indications in New Guinea and comparisons with the oil fields in Java and Borneo (Carne, 1913; Fig. XVII.15, 16). The results of Stanley's and Carne's missions triggered the engagement of the British professional petroleum geologist Dr. Arthur Wade by the Australian Commonwealth government in late 1913.

Around the same time, in 1912, oil seeps were found in the Sepik District in German New Guinea, but, despite a budget for further German exploration, World War I ended this.

Fig. XVII.15. Cover of the report by J.E. Carne (1913) on his pioneering 1912 survey work in the Territory of Papua.

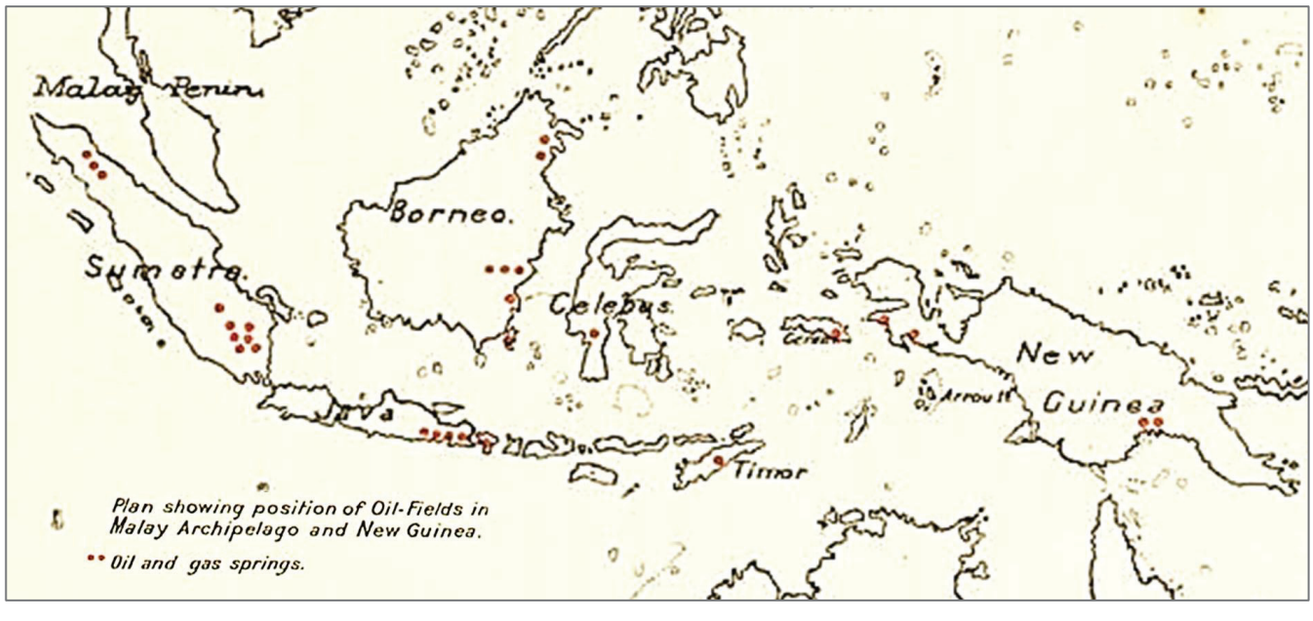


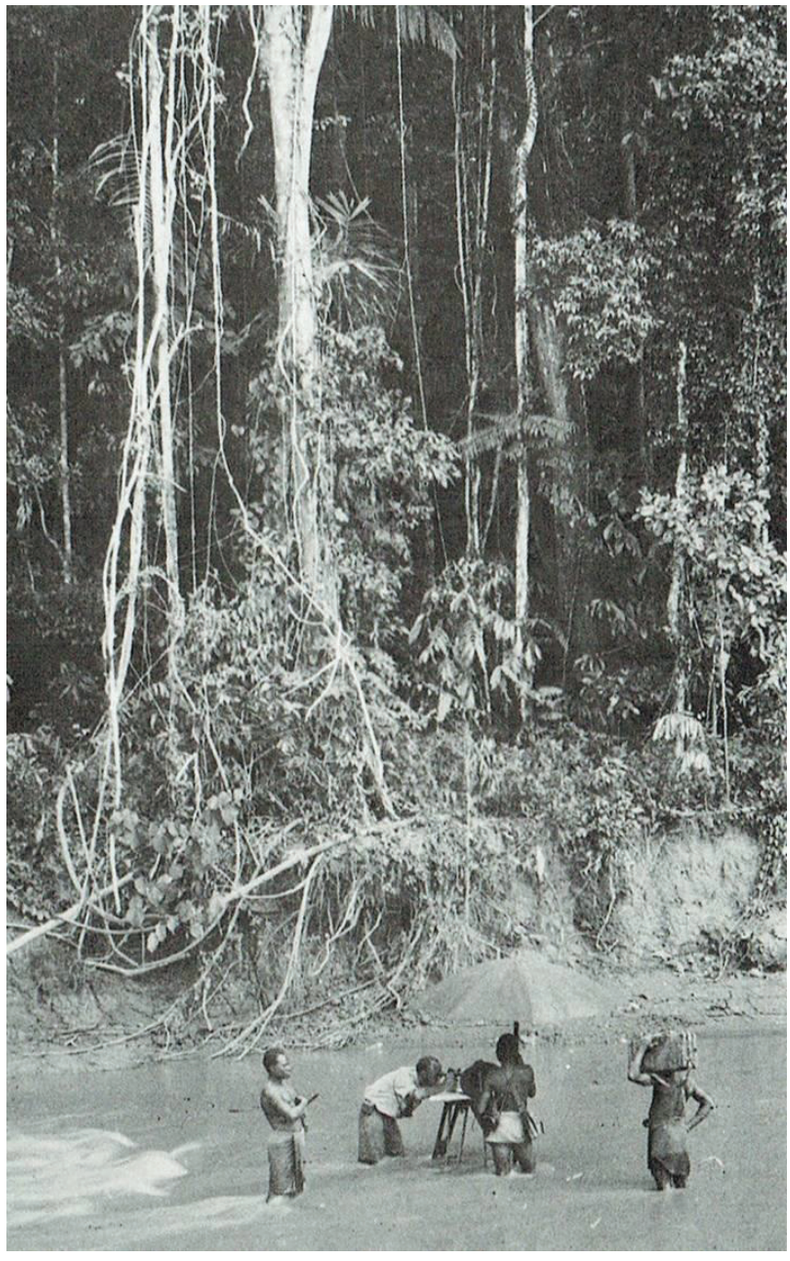
Fig. XVII.16. Locations of the newly discovered oil and gas seeps in southern PNG and known oil fields in the Netherlands Indies (red dots; from Carne, 1913).

The Wade- Stanley petroleum survey, 1914

Soon after the discovery of the first oil seeps in Papua, English petroleum geologist Dr. Arthur Wade was commissioned by the British and Australian governments in late 1913, to conduct the first government-sponsored petroleum geological survey of the southern part of the Territory of Papua (see also the Wade chapter XVII/227, below). During the eight-month expedition in 1914, Wade was assisted by Australian government geologist for New Guinea E.R. Stanley (who had already done some preliminary work in the area in 1912; see also the Stanley chapter XVII/226, below), several surveyors and two drilling crews for drilling shallow test holes.

Petroleum geological surveys in those days focused on locating oil and gas seeps and mapping anticlinal structures. The work in the uncharted, sparsely populated and mostly impenetrable jungles was arduous. All food had to be carried in, and all topography had to be surveyed by tape and compass. The geology of the survey area was found to be all folded Neogene clastic sediments with thin limestone interbeds, and many anticlinal structures could be identified. The initial work was in the Vailala River area near Upoia. A shallow well drilled here delivered a few 1000 gallons of light oil (presumably the first oil produced in PNG), but this 'discovery' was non-commercial.

Post-World War I petroleum exploration in PNG



In mid-1919, shortly after the end of World War I, the Australian and British governments commissioned the *Anglo-Persian Oil Company* (later renamed BP) to take over systematic oil exploration across Papua, but without success.

The unsuccessful exploration program included the drilling of some deeper wells near Popo and was discontinued in 1929. Its results were published in Anglo-Persian (1930). Meanwhile, several small oil companies started exploration and drilling programs in the Tertiary basins in the northern parts of eastern New Guinea in the 1920s and 1930s, but again no commercial quantities of oil were found.

The main company to conduct follow-up oil exploration after the departure of APOC was *Oil Search Ltd* (OSL) a company created in 1929 and still active in PNG today. Two of their best-known geologists since the 1930s were G.A.V. Stanley (Fig. XVII.17; not related to E.R. Stanley) and W. Sam Carey (see also chapter XVII/228, below).

Many of their operations were in remote, uncontrolled territories, without much help from government officers. For its first 50+ years of OSL, only some non-commercial gas and oil fields were discovered.

Fig. XVII.17. Australian Oil Search geologist George A.V. Stanley during a plane-table survey in northern New Guinea in the early 1930s (Rickwood, 1990). (G.A.V. Stanley (1904-1965) worked in PNG as a petroleum geologist from 1927 until his death in 1965).

XIX. INFLUENCERS AT THE FRINGE OF 'INDIES' GEOSCIENCE

This chapter discusses five 'larger than-life' personalities that were not geoscientists, but did have a significant impact on geology and mining in the Netherlands Indies through their leadership roles.

234. Jan Willem IJZERMAN (Leerdam 1851- The Hague 1932)

J.W. Ijzerman was a true lesson in leadership and may be called a 'Renaissance Man' for his wide range of interests. He was a civil engineer, not a geologist or mining engineer, but he is included in this book for his key roles in the development of the Ombilin coal mines in West Sumatra in the early 1890s, and in the growth of the oil industry in South Sumatra in the late 1890s-early 1900s as general manager of the Muara Enim Petroleum Company and later as board member of Royal Dutch/Shell.

Prior to the above industry management positions, Ijzerman had already left significant marks on the Netherlands Indies through overseeing major railway construction projects on Java and Sumatra, and through archeological studies and restorations of Hindu antiquities in Central Java. After retirement he was a politician and historian, and worked to improve higher education in the Netherlands Indies, as the principal driver behind the founding of the Polytechnische School in Bandung in 1920 (now Institut Teknologi Bandung, ITB).

Jan Willem Ijzerman (also spelled Yzerman) was born in Leerdam, The Netherlands, in April 1851, a son of a *hoefsmid* (farrier, horseshoe smith). He completed his education in civil engineering at the Royal Military Academy (K.M.A.) in Breda in 1870 and started work as 'luitenant-ingenieur' in civil army projects in the Netherlands.

Fig. XIX.1. Left: A young Jan Willem Ijzerman, probably in the mid-1870s (https://rkd.nl/explore/images/164920). Center: J.W. Ijzerman, around 1880 (Coll. KITLV 8085). Right: J.W. Ijzerman around 1930 (from https://kolonialemonumenten.nl/2017/03/19/j-w-ijzerman-bandoeng-1931/.

Java railways and Central Java antiquities, 1874-1887

In February 1874 Ijzerman arrived in the Netherlands Indies, to work as a railway construction engineer for *Staatsspoorwegen* (State Railway Company) on Java. From 1874-1878 he from was based in Malang, working on the construction of the Surabaya-Malang rail line. In 1878-1881 he was based in Bogor to work on the Bogor-Bandung-Cicalengka rail line. In 1881 he became Chief engineer and moved to Yogyakarta, in charge of the construction of the Yogyakarta-Cilacap line.

Ijzerman developed an interest in the Hindu antiquities of Central Java and became a serious amateur archeologist during his railway tenure on Java between 1880 and 1887. He became a founder and the first president of the *Archeologische Vereeniging te Jogjakarta* (Archeological Society of Yogyakarta) in 1885. He became a driving force in the study, cleanup, excavation and preservation of several of the ~1200 years old ruins of Buddhist and

Fig. XIX.10. A Dutch drilling supervisor and three Chinese laborers at a 'Canadian-type' cable tool rig at the Babat 34 well of the Moeara Enim oil company, around 1902 (Coll. KITLV 31921, Leiden). The Babat field is listed as a 1902 discovery and became the second largest oil field of the Muara Enim Maatschappij, after Kampong Minyak. About 40 wells were drilled in the early 1900s and it produced 8-9 million barrels of oil, which was quite significant at that time. It is located west of Sekayu near the Musi River. The oil was piped to a refinery at Plaju near Palembang.

After the oil exploration successes of Zijlker and Kessler in North Sumatra and by A. Stoop in East Java, a group of Dutch investors led by M.J. Boissevain had started a consortium to invest in petroleum exploration/exploitation in South Sumatra. In 1896 they had obtained exploration concessions near Muara Enim in the South Palembang Basin, in an area where Everwijn (1860) and Gramberg (1865, 1869) had reported many oil seeps. The first wells on the *Muara Enim* concessions were drilled by a Russian crew from Baku.

After initial successful wells, which led to the discovery of the *Kampong Minyak* field in 1896, the *Petroleum-Maatschappij Moeara Enim* was formed in Amsterdam in 1897. Additional successful wells were drilled, with another discovery at *Babat* (Fig. XIX.10). In 1897 a refinery was built along the Musi River at Plaju, East of Palembang. The crude oil was transported by pipelines from the Muara Enim and Babat areas to Plaju.

Under Ijzerman's direction the *Moeara Enim Company* had become the largest oil producer in Sumatra in the late 1890s, with more oil production than its more established and more diversified competitor *Koninklijke Olie* (Royal Dutch) in North Sumatra. In 1898 Standard Oil was looking to enter the Netherlands Indies oil scene and negotiated with Ijzerman about a takeover of the *Moeara Enim* Company (Fig. XIX.11) but the potential American takeover was blocked by the Netherlands Indies government.

Meanwhile, in 1895, the *Koninklijke* (Royal Dutch) had also expanded into the South Sumatra Basin, but was less successful there than the start-up company *Moeara Enim*. In 1904, after being hit financially by a price war over lamp oil on Java between Standard Oil and Royal Dutch, and partly under pressure from the colonial government fearing a takeover by American Standard Oil, the *Moeara Enim Company* agreed to a merger with the *Koninklijke/Royal Dutch* company. Ijzerman stayed on as *Commissaris* (board member) of the *Koninklijke* and its of successor *Royal Dutch-Shell* from December 1904 until October 1932.

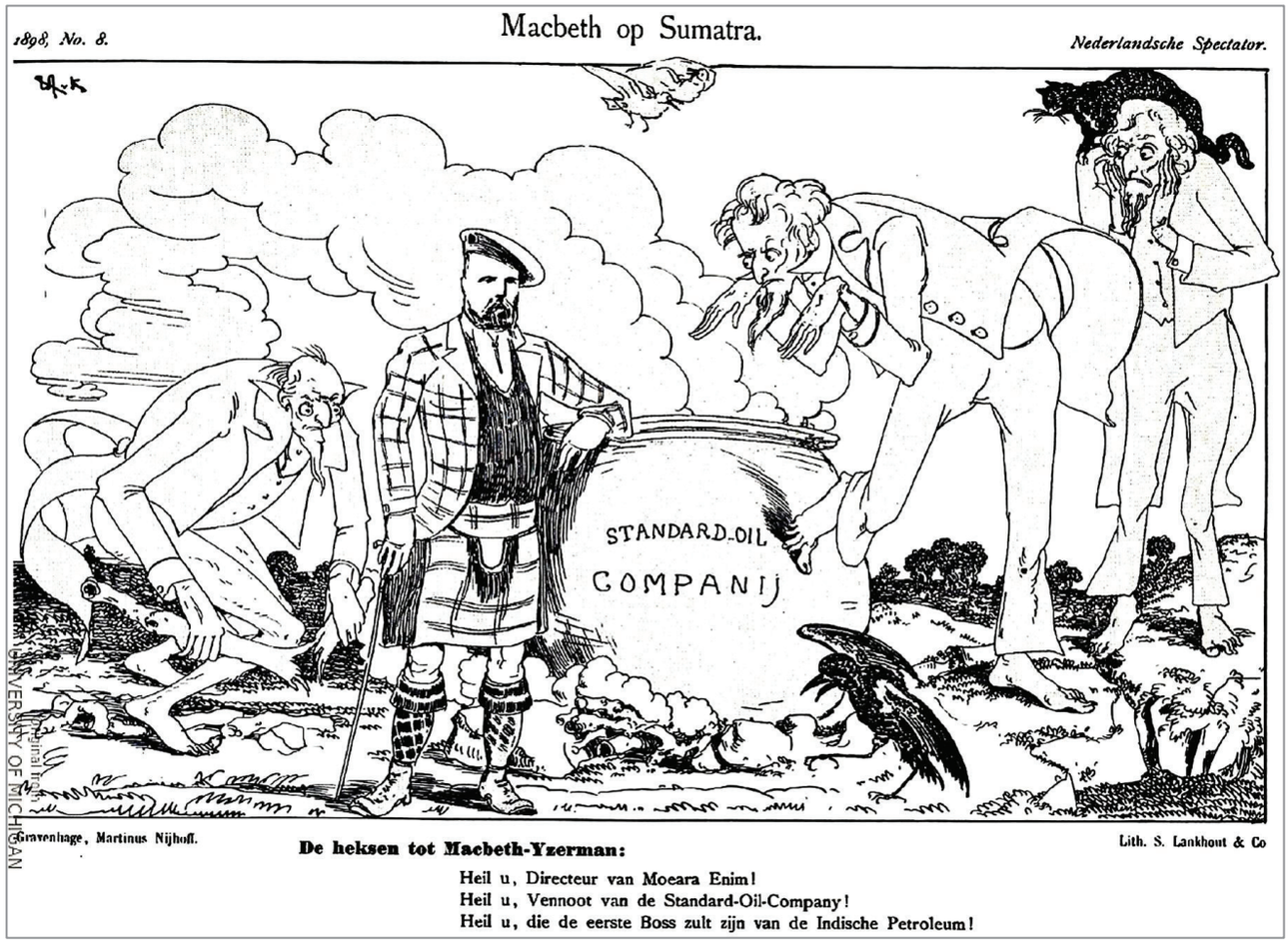


Fig. XIX.11. A satirical magazine cartoon from 1898, of J.W. Ijzerman in the role of Macbeth in Sumatra. At this time the American Standard Oil Company attempted to buy out the successful Muara Enim Oil Company, of which Ijzerman was director. In this cartoon, the Standard Oil 'witches' tell Macbeth (Yzerman) that if he became a Standard Oil partner, he would be 'the biggest boss of the Netherlands Indies petroleum'. This was a reference to a scene from Shakespeare's play Macbeth, in which the witches predict Macbeth will become king (Nederlandse Spectator, 1898, 8).

'Retirement': politician, director, historian, builder, 1904-1932

During his 'retirement' in The Netherlands, Ijzerman continued to be extremely active. As a politician he was a councilman of the City of Amsterdam (1899-1906) and served two terms as a member of Dutch Parliament (1905-1909 and 1917-1918). He also became a leading figure in several scientific and civic organizations, including:

- President of the *Koninklijk Nederlands Aardrijkskundig Genootschap* (KNAG; Royal Dutch Geographic Society; 1899-1921);
- President of the *Koninklijk Instituut voor Taal-, Land- en Volkenkunde* (KITLV; now Royal Netherlands Institute of Southeast Asian and Caribbean Studies; 1927-1932);
- One of the founders and board Member of the *Koloniaal Instituut* (later *Tropenmuseum*; Royal Museum of the Tropics) in Amsterdam;
- President of the *Koninklijk Instituut voor Technisch Hooger Onderwijs in Nederlands-Indie* (Royal Institute for higher technical education in the Netherlands Indies; 1917-1924). In this role Ijzerman coordinated the fundraising and planning for the *Technische Hogeschool Bandoeng*.

Co-founder of Technische Hogeschool Bandoeng (ITB) around 1920

Ijzerman is recognized as the main instigator for the creation of the *Technische Hogeschool te Bandoeng* (THB; since 1959 known as *Institute of Technology Bandung*/ITB). This school was intended to be the Indonesian equivalent of the *Technische Hogeschool* in Delft, the Netherlands.

By 1919 Ijzerman had raised 3.5 million gulden from donations of companies (BPM, KPM), as well as private donors (in particular the well-known tea planter and philanthropist from Malabar, K.A.R. Bosscha), to build the first school for engineering and architecture in the Netherlands Indies. Ijzerman temporarily moved to Bandung in 1919-1920, to oversee the construction of the first buildings and to recruit the teaching staff (Fig. XIX.12).

The school officially opened in July 1920. One of its best-known students was future President Ir. Sukarno, who attended from 1921 and graduated as *Ingenieur* in 1926.

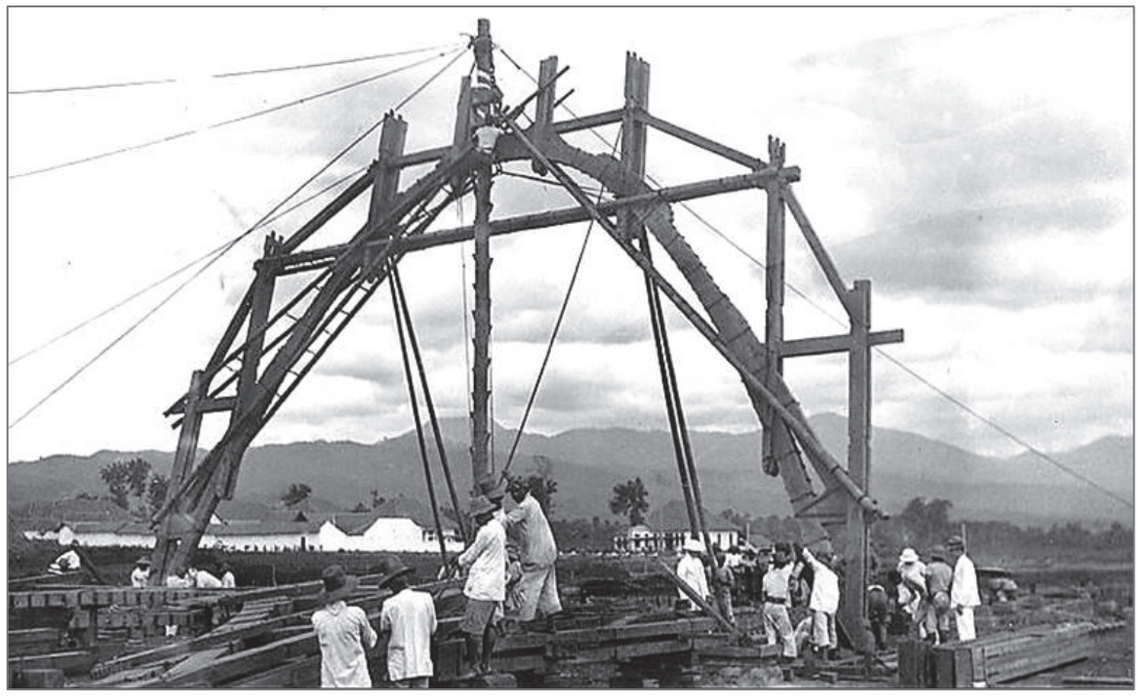


Fig. XIX.12. Start of the construction of the Technische Hoogeschool Bandoeng (later ITB) in 1919.

Fig. XIX13.
The original bronze bust commemorating J.W. Ijzerman as the main founder of the TH Bandung /ITB in 1926 (Coll. KITLV 26256). It was placed at 'Ijzerman Park' (now Taman Ganesha) at the ITB campus, but it was removed, probably in the late 1950s.

Fig. XIX.14.
A replica of the bust of Ijzerman is now on display at the ITB Rector's office, Bandung.

In April 1925 the *TH Bandoeng* awarded Ijzerman an honorary Doctor of Science degree. The park in front of the main gate of ITB was named *Ijzerman Park,* and a bronze bust of Ijzerman was erected here (Fig. XIX.13). Sometime around 1950-1960, Ijzerman Park was renamed *Taman Ganesha* and the statue was removed. It is not clear today when and by whom it was dismantled, and where the original statue went. A replacement replica of the Ijzerman bust is now on display at ITB rector's office (Fig. XIX.14).