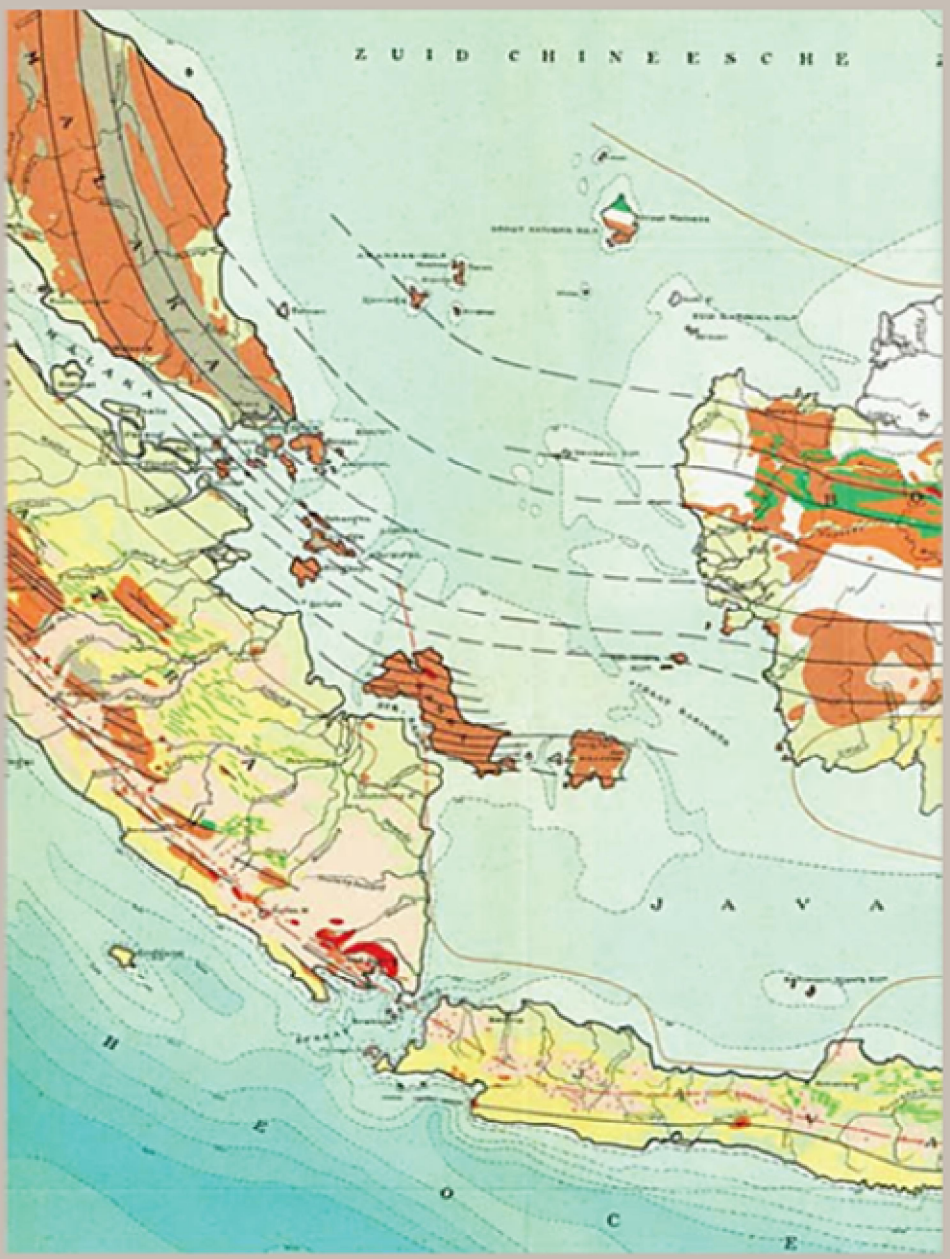
PIONEERS AND MILESTONES OF INDONESIAN GEOLOGY

2-GEOLOGICAL SURVEY, VOLCANOLOGY



J.T. VAN GORSEL

ITB Press

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

2- The Geological Survey, Volcanology

J.T. van Gorsel

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Geological Engineering - Institut Teknologi Bandung
Bandung
2022

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Cover Chapter VI: Part of an early map of outcropping coal beds in the Kutai Basin near Samarinda by Hooze (1887). The NNE-SSW trending ridges are young anticlinal structures. Black bands are outcrops of coal.

VI. *DIENST VAN HET MIJNWEZEN* (BUREAU OF MINES- 1), 1850-1922

VI.1. Overview

The *Dienst van het Mijnwezen van Nederlandsch Oost-Indie* (Bureau of Mines of the Netherlands Indies) was established in 1850, in order to increase the role of government in exploration and exploitation of economic minerals and coal. Coal had become a valuable commodity after the arrival of steamships in the 1830s. They were initially fueled by expensive imported coal from Europe, so development of a local coal mining industry would be of great economic and strategic importance (some coal deposits had already been identified by Members of the *Natuurkundige Commissie* in SE Borneo).

Before 1850, the Netherlands Indies government had little knowledge and virtually no control over the already widespread (albeit small-scale) native and Chinese gold and tin mining operations, mainly in Sumatra, Kalimantan and Sulawesi. Chinese immigrant miners were particularly numerous since the 1700s on Bangka Island and in NW Kalimantan, in an area known as '*The Chinese Districts*'.

After the 1820s, the Netherlands East Indies government had taken control of tin mining operations on Bangka, from Chinese *kongsis* and the Sultan of Palembang, but there was little or no government involvement in exploration or exploitation of coal and minerals in other areas of Indonesia before 1850, except for some of the survey activities by 'government-scientist' Dr. J.H. Croockewit (see below).

Much of the history of *Mijnwezen* and its impact during the Dutch colonial era were discussed in the recent book by former Shell Exploration Manager Peter de Ruiter (2016; Fig. VI.1; written in Dutch).

Fig. VI.1. Cover of the recent book on the history of the Bureau of Mines/Geological Survey in the Netherlands Indies by Dr. Peter de Ruiter (2016; Ph.D. Thesis of the University of Utrecht).

The *Dienst van het Mijnwezen* was reorganized in 1922 and renamed *Dienst van den Mijnbouw van Nederlandsch-Indie*. *Mijnwezen/Mijnbouw* played a central role in the progress of geological knowledge of the Netherlands Indies.

The quality of its geological work was generally deemed to be high, especially after the early 1900s, when personnel hired by *Mijnwezen* was encouraged to have a doctorate degree and 7-8 years of academic training.

The current chapters VI and VII are discussions of the history of the *Dienst van het Mijnwezen (Mijnbouw) in Nederlandsch-Indie* (Bureau of Mines/Geological Survey of the Netherlands Indies) and the lives and work of some of the more prominent geologists/mining engineers that had a (partial) career with *Mijnwezen*. Several other *Mijnwezen* specialist geoscientists are also discussed under the Volcanology, Paleontologists and Mining chapters. For some of the history of the final days of the Dutch-led Geological Survey between 1940 and 1950 see chapter VII.4, below.

Tasks and challenges of the first generations of government mining engineers, 1850- early1900s

During the first 50 years the stated goals of the *Dienst van het Mijnwezen* were to:

1. Provide technical support to the government-owned tin and coal mining operations;
2. Identify and evaluate occurrences of economic minerals and coal across the Netherlands Indies.
3. Later responsibilities added to the *Mijnwezen* responsibilities included groundwater drilling, licensing of exploration permits and concessions, technical management of government tin, coal and gold mines, volcano monitoring and mitigation work and geotechnical surveys (see also below).

These were rather ambitious tasks for a small group of young Dutch mining engineers. For the first ~60 or more years of its existence, the number of mining engineers at *Mijnwezen* was quite small, between 4 and 15. This number was generally deemed to be inadequate for the geological and prospecting fieldwork of a large, mostly unexplored country, especially since over half of the mining engineers were permanently seconded to non-geological activities (see also below, and Fig. VI.6). It is therefore not surprising how little was accomplished in the identification of new economic mineral/coal deposits, or in the collection of geological information during the early decades of *Mijnwezen* (De Ruiter, 2016).

In the absence of adequate staffing, limited budgets, and no apparent overall strategy, the early *Mijnwezen* engineers were typically dispatched to areas where coal or mineral occurrences were already exploited or known to local people, or where they were reported to *Mijnwezen* by local authorities. The *Mijnwezen* engineers deemed most of the prospects surveyed to be of no economic interest to the government (one exception: the Ombilin coalfields).

While some geological information was collected during the early mineral or coal surveys, geological mapping or research was not a priority for *Mijnwezen* in the 1800s and early 1900s. This had several reasons:

1. The science of geology was still in its infancy in the mid-late 1800s;
2. The first generations of *Mijnwezen* engineers came from a Dutch education system that offered no geology programs, and who grew up in a country of sand and clay, with virtually no opportunities to study rocks;
3. Before ~1900 geological studies were subordinate to the goals of coal and mineral exploration;
4. *Mijnwezen* was woefully understaffed for the task of evaluating a huge region;
5. Travel to remote regions of the Archipelago in the mid-late 1800s was challenging and time-consuming. It could take months of travel to reach remote field areas in Sumatra, Borneo or farther afield. For many areas there were no topographic maps, so the field parties needed to do their own topographic surveying as well. Logistics and health hazards could be extremely challenging.

The principal advocate for regional geological work was Ir. R.D.M. Verbeek in the late 1800s, who always argued that a regional geologic framework was essential for a smarter strategy in the search of economic minerals and coal. Geological investigations grew in importance during the rapid growth in number of *Mijnwezen* personnel after 1910 and the significant increase in their geological skills. It produced an impressive collection of geological papers, monographs and maps between ~1910 and 1940.

Name changes of the Bureau of Mines/Geological Survey

During its long existence it has undergone multiple reorganizations and name changes:

- 1850-1922: *Dienst van het Mijnwezen van Nederlandsch Oost Indie* (reorganized in 1872; initially located in Buitenzorg (Bogor), in 1866 moved to Weltevreden (Jakarta);
- 1923-1942: *Dienst van den Mijnbouw van Nederlandsch-Indie*; located in Bandung. The geological survey department within *Mijnbouw* was called the *Opsporingsdienst*;
- 1942-1945: *Kogyo Zimusho*, later *Chishitsu Chosacho* during the Japanese occupation:;
- 1950s: *Pusat Djawatan Tambang dan Geologi*, including *Djawatan Geologi* (Geology Department);
- 1978-2005: *Puslitbang Geologi* (Geological Research and Development Center, GRDC);
- 2005-now: *Pusat Survei Geologi*, PSG; Geological Survey Organization (including *Badan Geologi* (Geological Agency)).

It is remarkable that during the Dutch colonial period the organization was never officially called 'Geological Survey', unlike similar organizations in other countries. The closest was *Afdeeling Geologie van den Dienst van den Mijnbouw* (Geology Department of the Bureau of Mines).

Organization and Tasks of Dienst van de Mijnbouw around 1930

After the reorganization of 1922 and the move to the new buildings in Bandung in 1929, the *Dienst van den Mijnbouw* reached 'full strength'. Until 1940 it included the following departments:

1. Head office with:
   - 1a. *Opsporingsdienst* ('Geological Survey; geological-mining surveying and geological mapping);
   - 1b. *Mijnverordeningen* (Mining Regulations; including departments for licensing of mining concessions (*Mijnrechten*) and mine inspections (*Mijninspectie*);
   - 1c. *Grondpeilwezen* (Groundwater survey; drilling of artesian wells around major cities for drinking water supplies, mainly on Java; part of *Mijnwezen/Mijnbouw* since 1871);
   - 1d. *Vulkaanbewakingsdienst* (Volcanological Survey; volcano monitoring and risk management);
   - 1e. *Technische Onderzoekingen* (Geotechnical surveys for infrastructure building projects);
   - 1f. Geological Museum and management of sample collections;
   - 1g. Paleontological and Chemical laboratories;
2. Government tin mines on Bangka Island;
3. Government coal mines in: West Sumatra (*Ombilin*, since 1892), South Sumatra (*Bukit Asam; since 1919*) and SE Kalimantan (*Pengaron* in Barito Basin, *Pulau Laut*, 1913-1931);
4. Government gold mine at *Tambang Sawah*, West Sumatra (since 1917-1930).

Office locations and buildings of the Dienst Mijnwezen/Mijnbouw

The Head Office of the Geological Survey of the Netherlands Indies moved between four locations during its 90-year existence during the Dutch colonial era. The first was in *Buitenzorg* (Bogor) from 1850-1866, in a few rooms in the house of its first Chief, C. de Groot, but later in its own building and laboratory. No photographs from this era could be found.

After a reorganization of government agencies in 1866, the *Mijnwezen* head office moved to a historic building in Weltevreden (Batavia, Central Jakarta; Fig. VI.2), where it stayed for almost 60 years.

Fig. VI.2. This historic building on Molenvliet West 111 in Weltevreden (Tanah Abang; now Jalan Gadjah Mada 111, Jakarta) was the second location of the head office of the Dienst van het Mijnwezen, from 1866-1924. It was originally built in 1760, as the 'country estate' of Governor-General Reinier de Klerk. It was repurposed as the 'Landsarchief' (National Archive) in 1925. Today it is the 'Arsip Nasional Museum'.

In July 1924 the *Dienst van den Mijnbouw* moved to Bandung, initially to the *Gouvernements Bedrijven* building ('Gedung Sate'; Fig. VI.3). The move to Bandung was recommended in the government report by Van Waterschoot van der Gracht (1915), to provide a healthier climate for recovery of geologists/mining engineers between field surveys in the hot lowlands.

Mining engineers versus geologists, 1850-1942

For over 50 years the Dienst van het Mijnwezen worked exclusively with Dutch mining engineers. The first geologist to work for *Mijnwezen* arrived in 1906 (August Tobler), as a temporary Contract Geologist, tasked with the geological mapping of anticlinal structures in Tertiary sedimentary basins of Indonesia, to accommodate the needs of the rapidly growing petroleum industry. Most of the early contract geologists were from Germany and Switzerland, as there were no academic geology programs in the Netherlands at that time.

The first regular *Mijnwezen* employee with a degree in geology instead of mining engineering was G.L.L. Kemmerling. He arrived in 1911 and, after some initial geological mapping work, focused primarily on volcano studies. Geologist numbers increased through time, but never exceeded 13, and were typically only 10-15% of total staff (Fig. VI.10).

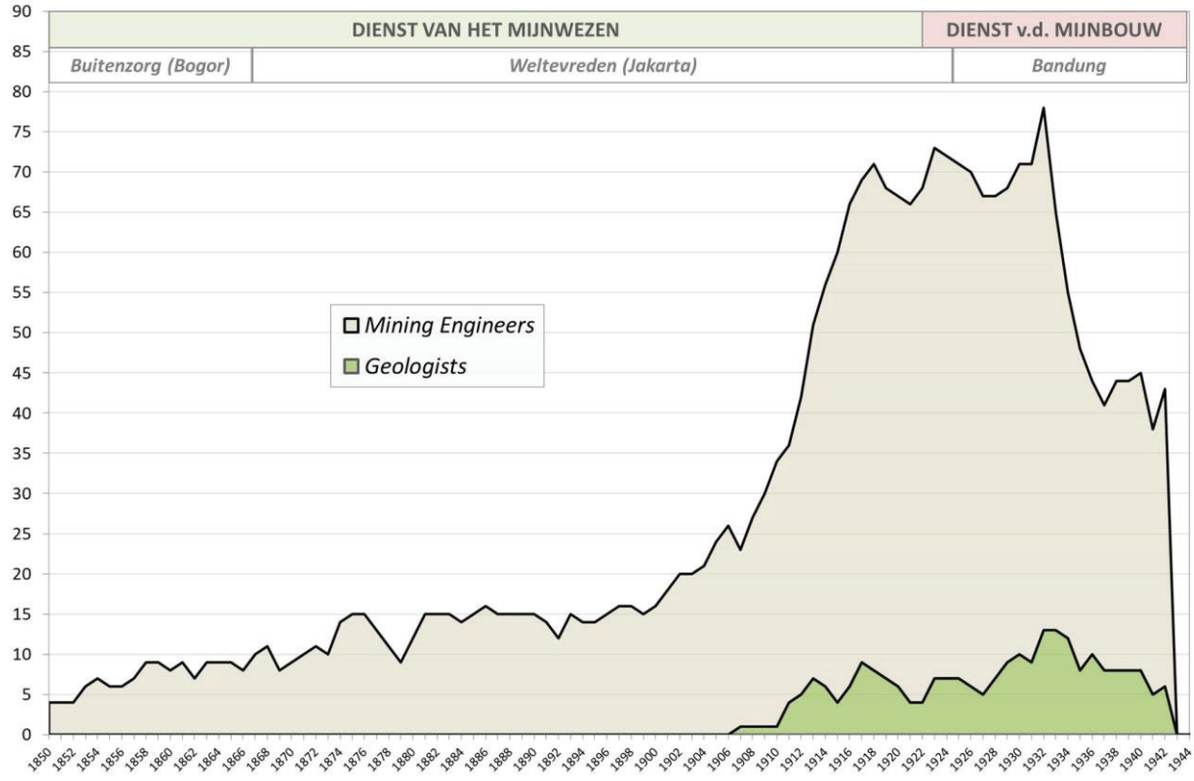


Fig. VI.10. A graph of the number of academic staff with the Dienst van het Mijnwezen/Dienst van den Mijnbouw from 1850-1940, showing the numbers of mining engineers (grey; maximum 65) versus geologists (green; maximum 13). Staffing levels were at a peak between 1920 and 1932.

It may be noted that after 1900 the private petroleum industry rapidly became the largest employer of geologists (in particular the *Koninklijke/Royal Dutch*, later named *Royal Dutch-Shell* or *BPM-Shell*), and most of their geologists came from Switzerland. Much high-quality, pioneering geological surface mapping was done by oil companies in early 1900s, but, unfortunately, most of it has remained unpublished (see also vol. 4, Chapter XIV-Petroleum Industry).

VI.3. Projects of Mijnwezen/Mijnbouw

Principal Geological-Mining Projects, 1868-1942

The main focus areas of mineral/coal survey activities by *Mijnwezen* in the late 1800s and early 1900s were:

- Coal in SE and East Kalimantan (Pengaron, Palau Laut), South Sumatra (Bukit Asam) and West Sumatra (Ombilin, Bengkulu);
- Tin on the Riau islands (Bangka, Belitung and Singkep) and East Sumatra;
- Gold-silver in West Sumatra (Tambang Sawah mine), West Kalimantan, SW Java;
- Asphalt on Buton;
- Nickel and iron in East Sulawesi and SE Kalimantan;
- Manganese, sulfur, etc. in Java, etc.
- Limited involvement in oil and gas: technical assistance to A. Zijlker in North Sumatra in the late 1880s, partner in N.I.A.M. in Jambi Basin (South Sumatra) and NE Kalimantan in 1920s-1930s.

In 1927 systematic geologic mapping programs were started in Sumatra and Java, but by 1932 most of these projects were significantly reduced. The government-operated Pulau Laut coal mine and the Tambang Sawah silver-gold mine in Sumatra closed for the same reasons in 1931.

Below is a listing of most of the multi-year geological-mining projects of the *Dienst van het Mijnwezen/Mijnbouw* (Bureau of Mines) conducted between 1868 and 1942. These projects generally required mining engineers/geologists and their families and support staff to live in the survey areas for extended periods of time. The reports of these surveys were often of high quality and some still contain geological information that can not be found anywhere else.

(GMO = *Geologisch-Mijnbouwkundige Onderzoekingen*: Geological-Mining Investigations)
(GMV = *Geologisch-Mijnbouwkundige Verkenningen*: Geological-Mining Reconnaissance)

1. Sumatra's Westkust (Sumatra West Coast), 1868-1881: *W.H. de Greve, R.D.M. Verbeek;*
2 Zuider- en Oosterafdeeling van Borneo (SE Kalimantan), 1869-1888: *R.D.M. Verbeek, P.J.A. Renaud, J.A. Huguenin, J.H. Menten, J.A. Hooze;*
3. Benkoelen (Bengkulu), 1881-1882: *R. Fennema;*
4. GMO Westerafdeeling van Borneo, 1881-1877, 1894-1899: *J. van Schelle, N. Wing Easton, M. Koperberg;*
5. Geologische Opneming Java en Madoera, 1883-1894: *R.D.M. Verbeek, R. Fennema, J. Retgers;*
6. Geologische Opneming Eiland Billiton, 1894-1995): *R.D.M. Verbeek;*
7. GMV Residentie Menado (North Sulawesi), 1897-1905: *R. Fennema, M. Koperberg;*
8. GMV Ambon en Oostelijke Archipel (Ambon and Eastern Archipelago), 1898-1901. *R.D.M. Verbeek;*
9. GMO Residenties Benkoelen en Palembang, 1905-1916: *M. Koperberg, P.J. Jansen, P. Hovig, C. Moerman, O.G. Heldring, H. von Steiger;*
10. GMO Djambi, 1906- 1914): *A. Tobler, E.R.D. Gollner, W.F.F. Oppenoorth, G.A. Hogenraad, J.E. Loth:*
11. GMO Residentie Timor en Onderhoorigheden, 1910-1914: *J.J. Pannekoek van Rheden;*
12. MO Celebes en Onderhoorigheden (Sulawesi), 1911-1917: *J. van der Kloes, J. Reijzer:*
13. GMO Zuidelijk Celebes (South Sulawesi), 1913-1916: *C.W.A.P. 't Hoen. K.G.J. Ziegler:*
14. GMV Gouvernement Atjeh (Aceh), 1913-1918: *W.F.F. Oppenoorth, L.J.C. van Es, G.A. Hogenraad, J. Zwierzycki;*
15. GMO Residentie Palembang (Rawas), 1914-1916 : *W. Dieckmann, F.G. Mannhardt;*
16. GMV Res. Oostkust Sumatra en Padangsche Bovenlanden, 1914-1917: *C.A. de Jong, H.A. Brouwer, H. von Steiger;*
17. GMV Westerafdeeling van Borneo (West Kalimantan), 1915-1917: *J.E. Loth;*
18. GMO Zuider-Oosterafdeeling van Borneo, 1915-1919: *L.H. Krol, C.A.F. Macke;*
19. GMO Palembang (Muara Enim, Tanjung), 1917-1919: *K.G.J. Ziegler, F.G. Mannhardt;*
20. GMO Verbeekgebergte (Malili), 1917-1922: *W. Dieckmann, C.A.F. Macke, M.W. Julius, W.C. Benschop Koolhoven;*
21. Onderzoek fossiele brandstoffen Atjeh (fossil fuels in Aceh), 1917-1920: *C.W.A.P.' t Hoen, W.J. Twiss, J. Zwierzycki;*
22. GMO Noord Nieuw Guinea (North New Guinea), 1919-1922: *G.A. Hogenraad, H.H. Horneman, E. Hartmann, J. Zwierzycki, N.J.M. Taverne;*
23. MGO eiland Timor (Kapan) 1919-1923: *L.J.C. van Es, C.W.A.P. 't Hoen, M.F. Hunerwadel;*
24. MGO eiland Flores (Flores Island), 1921-1923: *J.J. Reijzer, H. Ehrat*
25. GMO Oost Celebes en onderhoorigheden (East Celebes, incl. Buton, based in Bau-Bau), 1922-1930: *J.J. Reijzer, W.C. Benschop Koolhoven, A.C.D. Bothe, W.H. Hetzel, H.E.G., Straeter;*
26. MGO Indragiri en Pelawan (Riau) (Taluk), 1922-1926: *H.J. van Lohuizen, K.A.F.R. Musper, J.H. Loth;*
27. MGO Beraoe en Boeloengan (Tarakan, Tanjung Seilor), 1922-1927: *W.F.F. Oppenoorth, W. Leupold, J. Veldkamp;*
28. MGO Pasir/Tanahboemboe/Oost Borneo (Tanah Grogot, Samarinda), 1923-1934: *G. Pott, C. ter Haar, J. Ubaghs, C.P.A. Zeijlmans van Emmichoven;*
29. MGO Kleine Soenda Eilanden, 1923-1925: *C.W.A.P. 't Hoen, M.F. Hunerwadel, G.L.L. Kemmerling, H. Ehrat*
30. MGO West Borneo (Sintang, Pontianak), 1923-1932: *L.H. Krol, J. de Kroes, H. Ehrat, G. ter Bruggen, F.X. Krekeler, C.P.A. Zeijlmans van Emmichoven;*
31. Sumatra Kaarteering (Sumatra Mapping), 1927-1933: *J. Zwierzycki, K.A.F.R. Musper, R.W. van Bemmelen, J. Westerveld, J.F. van Tuyn, G.H. van Raalten;*
32. Java Kaarteering (Java Mapping), 1927-1942: J. Zwierzycki, *W.C. Benschop Koolhoven, A.C.D. Bothe, C.E.A. Harloff, W.H. Hetzel, W.F.F. Oppenoorth, C. ter Haar, O.A.S. Ludwig, J. Duyfjes, R.W. van Bemmelen, K.A.F.R. Musper, J. Ubaghs, A.L. Simons.*

Publications of the Dienst van het Mijnwezen/Mijnbouw, 1850s- 1940

Publications of the *Dienst van het Mijnwezen/Dienst van den Mijnbouw* (Geological Survey) can be found in a number of different journals and reports series (Figs. VI.11 and VI.12):

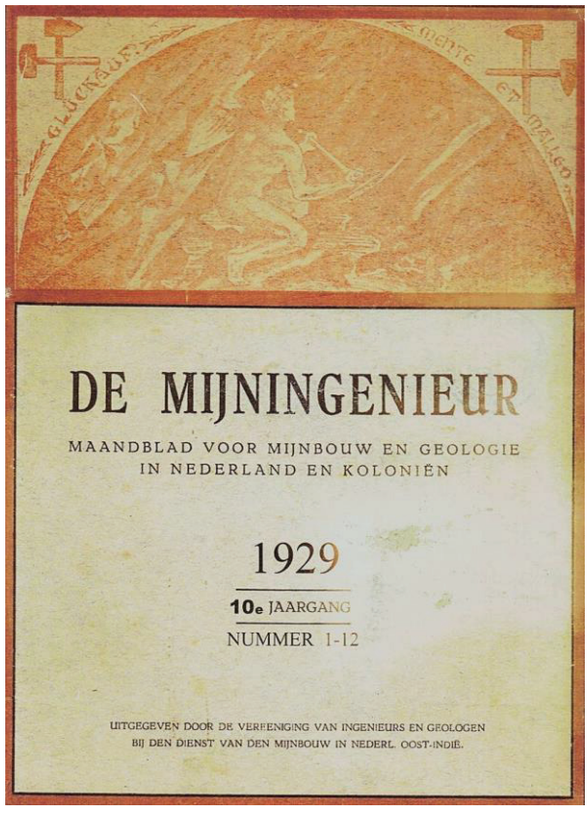
1. *Natuurkundig Tijdschrift voor Nederlandsch-Indie*. A general natural science magazine that initially was the main publication outlet of summary results of geological survey work by *Mijnwezen* from ~1850-1872;
2. *Jaarboek van het Mijnwezen* in Nederlandsch (Oost)-Indie (Yearbook of the Bureau of Mines), published annually from 1872-1940, in two parts, one General/Administrative and one or more scientific volumes

(*Verhandelingen*). These books and Atlases with extensive documentation of results of geological-mining surveys by *Mijnwezen/Mijnbouw* personnel are the most comprehensive and source of knowledge of the surface geology of the Indonesian region. The first issues of the *Jaarboek* included many papers that had appeared in the *Natuurkundig Tijdschrift* before, during the 1850s-1860s;

3. *Wetenschappelijke Mededeelingen* (1924-1940); a series of 28 more academic geological studies.
4. *Vulkanologische Mededeelingen* (1921-1940); 13 monographs on Indonesian volcanoes, 1921-1940;
5. *Bulletin of the Netherlands Indies Volcanological Survey* (~1927- 1941); 98 issues:

Fig. VI.11. Four of the most important publication series from the Dienst van het Mijnwezen/Dienst van den Mijnbouw in Nederlandsch-Indie, 1870-1940 (numbers 2-5 in the above listing).

6. *Verslagen en Mededeelingen betreffende Indische delfstoffen en hare toepassingen* (1917-1940); Reports of studies on economic minerals in the Netherlands Indies and their applications) (23 issues);
7. Geological maps.
   - *Geological overview maps Netherlands East Indies Archipelago* 1: 1,000,000 (1915-1932; 12 of 21 planned sheets published)
   - *Geologic map of Sumatra* 1: 200,000 (1927-1937; incomplete series; 13 sheets published)
   - *Geologic map of Java* 1: 100,000 (1927-1941 ; incomplete series; 11 sheets published).
8. *De Mijningenieur* ('The Mining engineer') (1920-1933; vols. 1-14) and its successor *De Ingenieur in Nederlandsch Indie, section IV. Mijnbouw en Geologie.* This was a non-*Mijnwezen* journal of short engineering papers, which became more relevant when no geological-mining volumes of the *Jaarboek van het Mijnwezen* were published in 1931-1938 due to budget cuts.



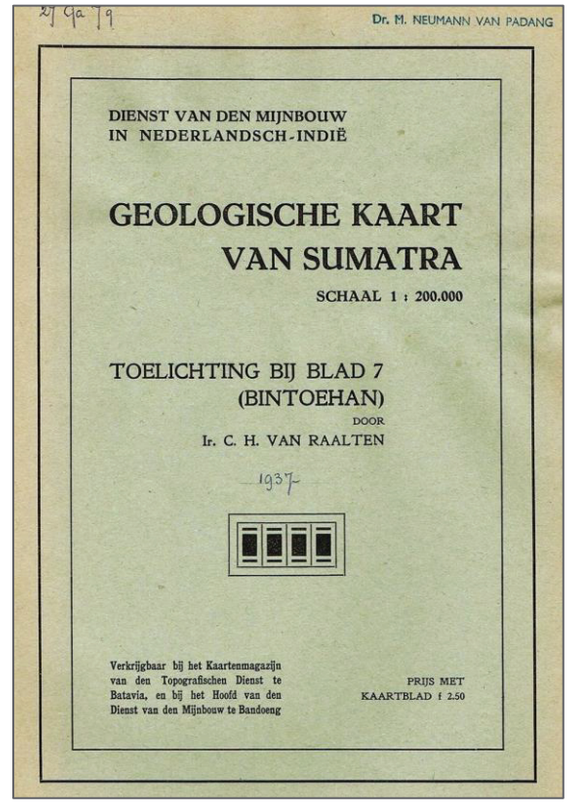


Fig. VI.12. Left: De Mijningenieur, a monthly journal with technical papers and news from personnel of the Dienst van den Mijnbouw. Right: Cover of Explanatory notes of one of the maps from the systematic geological mapping programs

Publications - Dienst van het Mijnwezen/Dienst van den Mijnbouw

De Jongh, A.C. (1925)- Mijnbouwkundige opsporingen en geologische opnames in Nederlandsch-Indie'. Gedenknummer De Mijningenieur, p. 44-46.

De Ruiter, P. (2012)- The Dutch Indies, fertile ground for earth science. In: P. Floor (ed.) Dutch Earth Sciences- development and impact. Royal Geological-Mining Society of the Netherlands (KNGMG), The Hague, 7.1, p. 232-263.

De Ruiter, P. (2016)- Het Mijnwezen in Nederlands-Oost-Indie, 1850-1950. Ph.D. Thesis University of Utrecht, p. 1-305.

Hochstetter, F. (1858)- Nachrichten uber die Wirksamheit der Ingenieure fur das Bergwesen in Niederlandisch-Indien. Jahrbuch kaiserlichen-koniglichen Geologischen Reichsanstalt, Wien, 9, p. 277-294.

Nash, J.M.W. (1930)- De Opsporingsdienst, de geologische dienst van Nederlandsch-Indie, en zijn laboratorium. De Mijningenieur 11, 1, p. 6-18.

Rutten, L.M.R. (1932)- De beteekenis van de Opsporingsdienst (Geologische Dienst) van den Dienst van den Mijnbouw in Nederl.-Indie in verband met geruchten over krasse bezuinigingen. De Indische Mercuur 55, 20, p. 297-298.

Rutten, L.M.R. (1938)- De nooden van de Geologische Dienst in Nederlandsch-Indie. De Indische Mercuur, 20 Juli 1938, p. 3-18.

Sukamto, R., T. Soeradi & R. Wikarno (2006)- Menguak sejarah kelembagaan geologi di Indonesia: dari kantor pencari bahan tambang hingga Pusat Survei Geologi. Badan Geologi, Bandung, p. 1-183.

36. Cornelis DE GROOT (VAN EMBDEN) (Delft 1817- The Hague 1896)

C. de Groot was the first Head of the Dienst van het Mijnwezen, i.e., the Bureau of Mines or the Geological Survey of the Netherlands Indies, from 1850-1866. At that time Mijnwezen was a very small group of young and relatively inexperienced mining engineers, operating from headquarters in Bogor. De Groot was not known as a great scientist, but he apparently he was well organized and played roles in the development of tin mining on Belitung and coal mining in SE Kalimantan.

Cornelis (Kees) de Groot was born on 25 March 1817 in Delft and also was raised there. His legal last name was *De Groot van Embden*. After odd jobs as a clerk in the tax office and in a carpet factory in Delft, De Groot volunteered as a 16-year old for service in the Netherlands Army from 1833-1840.

In January 1843, De Groot was admitted to the newly-established *Koninklijke Akademie ter Opleiding van Burgerlijke ingenieurs* in Delft (Royal Academy for the Education of Civil engineers; now Technical University Delft), where he graduated as civil engineer in June 1846 and was initially selected to become a water management engineer in the Netherlands Indies.

Fig. VI.13. Left: Cornelis De Groot (from Gedenkboek Billiton, 1927). Right: Cornelis de Groot van Embden in 1865 (in Poley, 2000).

In 1846 the Ministry of Colonies in the Netherlands decided to form a corps of Dutch mining engineers for the Netherlands Indies. A group of six civil engineers from Delft were selected for additional training in mining practices in Cornwall, England from 1847 until 1849.

Mining engineer in the Netherlands Indies, 1850-1865

De Groot arrived in the Netherlands Indies in July 1850 as *Ingenieur der 2e klasse voor het Mijnwezen*. Because he was almost 10 years older than his peers, De Groot was appointed as Chief of this first and relatively inexperienced group of five mining engineers from Delft for service in the Netherlands Indies. He thus became the first Head of what would become the *Dienst Mijnwezen voor Nederlandsch-Indie* (Bureau of Mines/Geological Survey of the Netherlands Indies).

During De Groot's career the head office of *Mijnwezen* was located in *Buitenzorg* (Bogor), on the ground floor of De Groot's home. The main focus of this first group of mining engineers was the surveying for coal deposits.

Bawean, 1851

The first geological-mining survey by De Groot was of Bawean Island in the Java Sea in February-April 1851, where he was assisted by Prince Aquasi Boachi. The main reason was to investigate rumored coal occurrences, but these were deemed to be only uneconomic, irregularly distributed lignite beds. The trip did result in what was probably the first geologic map of Bawean Island (Fig. VI.14).

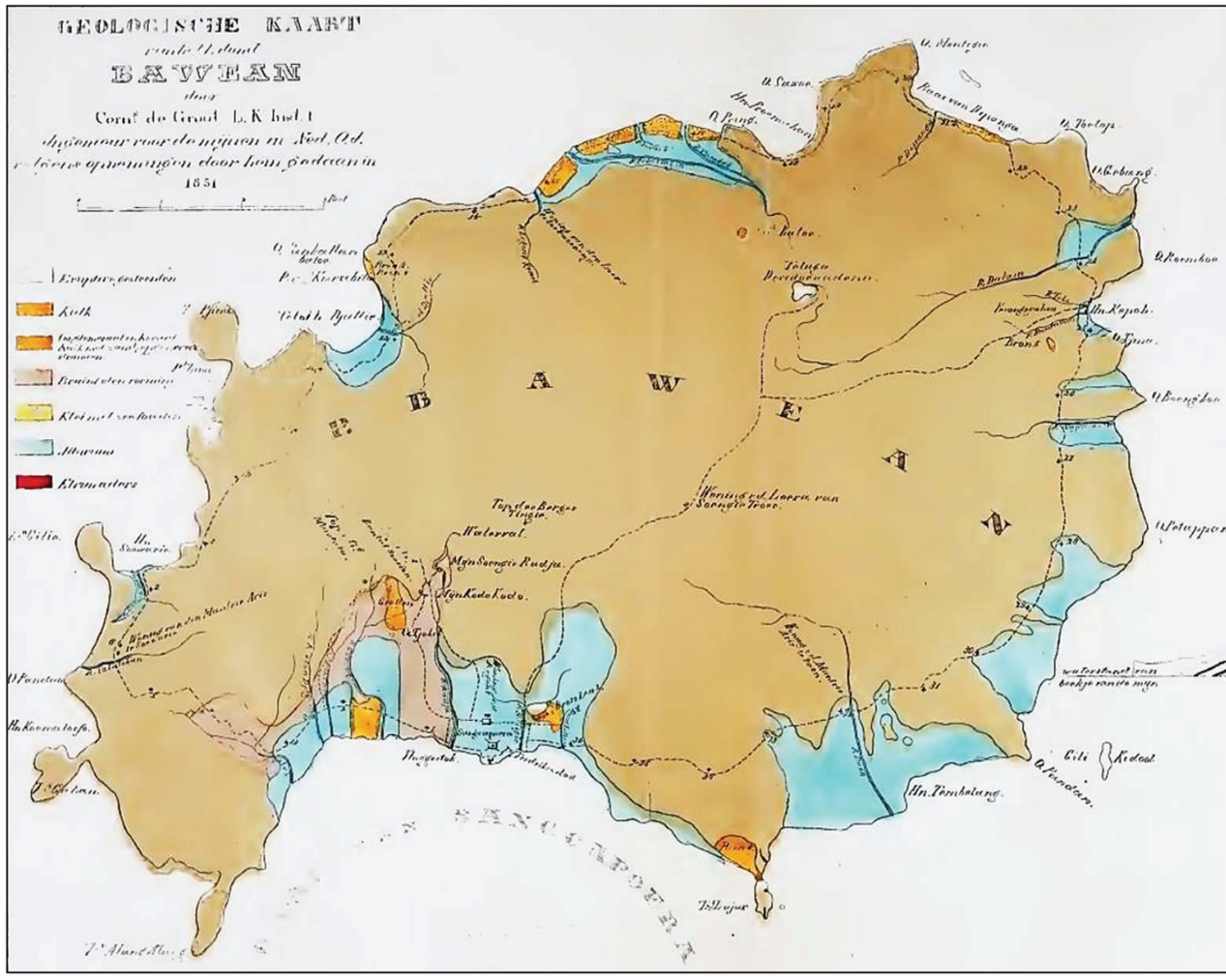


Fig. VI.14. First geologic map of Bawean Island in the Java Sea, showing a core of volcanics and a fringe of Neogene-Recent sediments (De Groot, 1851).

Belitung Island tin survey, 1851

Ir. Cornelis de Groot is often credited for the first discovery of tin on Belitung. Immediately after the Bawean survey he was requested to accompany potential investors John F. Loudon and Baron Vincent van Tuyll to Billiton (Belitung) Island to investigate the presence of tin in July-November 1851. This initiative was strongly supported by Prince Hendrik of the Netherlands (Yzerman, 1927; Manders, 2010), despite an earlier negative report by Netherlands Indies government scientist Dr. J.H. Croockewit in 1850.

There had long been speculation that the tin deposits on Bangka Island (exploited since 1710 or earlier) might extend to nearby Belitung. The presence of tin ore could be confirmed within hours of arrival of the Loudon- De Groot party at Belitung, but in the memoirs of J.H.F. Loudon, it was argued that De Groot's role in this discovery was quite limited. He just happened to have just arrived on the Island when an Indo-European administrator from Bangka, F. den Dekker, who accompanied the party, convinced the locals to show them where some of the tin-bearing deposits were. Additional alluvial tin-bearing deposits could be located later on in the Cicurup valley and other localities (De Groot, 1852).

37. Aquasi BOACHI (Kumasi, Ghana 1827- Bogor 1904)

The West African Prince Aquasi Boachi was one of the first five Delft-educated mining engineers to arrive in the Netherlands Indies in 1850, to work at the newly established Dienst van het Mijnwezen in Bogor. His higher education in the Netherlands was part of trade deals between the Dutch government and Aquasi's father, the King of Ashanti (now part of Ghana) in 1837. Aquasi is not known for major geologic contributions or discoveries in the Netherlands Indies, but he was a unique historic character in the early history of Mijnwezen. His short career with Mijnwezen was unsuccessful, apparently affected by race-motivated obstruction by his superiors. After leaving Mijnwezen in 1856 he spent the rest of his life on Java as a planter, with mixed success.

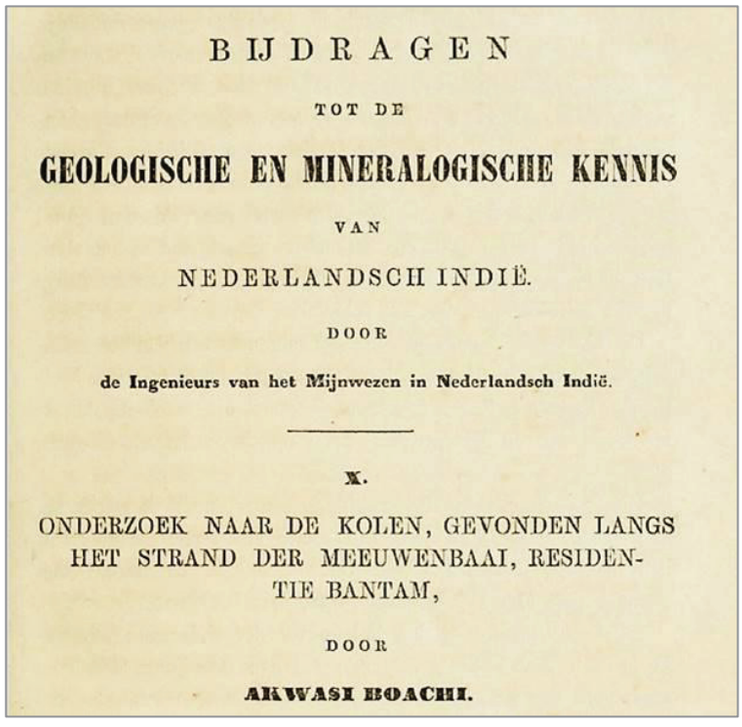
Aquasi Boachi (also spelled as Kwasi Boakye) was born on 24 April 1827 in Kumasi, as the oldest son of the West African King of Ashanti. His kingdom bordered on the Dutch trading post of *St. George d'Elmina* at the 'Gold Coast' of Guinea (now Ghana), which through the 1600s- 1800s engaged in trading of gold, ivory and slaves (Fig. VI.22).

After the end of slave trading by the Dutch in 1814 and before the British takeover in 1872, *Elmina* served as a recruitment post for West African volunteer soldiers for the Netherlands Indies army (KNIL). The army continuously faced manpower shortages at that time because many European soldiers were lost to the tropical climate and diseases. Between 1831 and 1872, an estimated 3000 recruits from Ghana were enlisted, who served in campaigns in Sumatra, Borneo, Celebes, Bali, Timor and in the Aceh war. Many of them returned to Ghana after their 6-year contracts were completed. Many others had established families with native women and stayed in the Netherlands Indies, establishing small communities of *Belanda Hitam* across Java.

Fig. VI.22. Fort Elmina on the Gulf of Guinea, West African Gold Coast (now Ghana), in the late 1600s (image from Atlas Blaeu van der Hem, 1668). The fort was initially built in 1482 as a Portuguese trading post. It was conquered by the Dutch in 1637 and renamed 'Casteel St. George d'Elmina'. The Dutch interest in the fort was mainly to source slaves for the Dutch (sugar) plantation colonies in South America (Nieuw Holland in NE Brazil, and after 1667 for Surinam). It continued to serve as a trading post with local kingdom, and became a notorious focal point for the Atlantic slave trade until 1814. The slaves were not captured by the Dutch but were bought from local rulers. After the Anglo-Dutch Sumatra treaties of 1871 the fort became a British possession.
Prince Aquasi Boachi was from the nearby Kingdom of Ashanti and passed through this Fort in 1837 as a 10-year-old, on his way to a European education in the Netherlands

Aquasi's education in the Netherlands, 1837-1849

In order to cement the alliance between Dutch traders and the Ashanti kingdom the Dutch government offered to provide a European education in The Netherlands for the young prince Aquasi and his cousin Kwame. Both princes, about 10 years old, left for Delft in 1837. During their years of education in the Netherlands, the African princes were treated as royalty and had frequent personal contacts with the royal families of King Willem II and Queen Anna Pauwlona of the Netherlands.



BIJDRAGEN

TOT DE

GEOLOGISCHE EN MINERALOGISCHE KENNIS

VAN

NEDERLANDSCH INDIË.

DOOR

de Ingenieurs van het Mijnwezen in Nederlandsch Indië.

X.

ONDERZOEK NAAR DE KOLEN, GEVONDEN LANGS HET STRAND DER MEEUWENBAAI, RESIDENTIE BANTAM,

DOOR

AKWASI BOACHI.

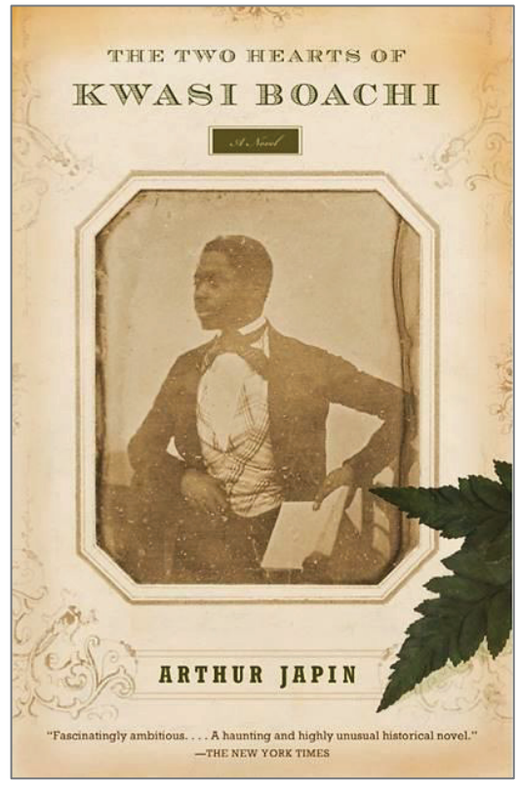


Fig. VI.24. Left: Boachi's 1855 report on coal in SW Java report in the 'Natuurkundig Tijdschrift voor Nederlandsch-Indie'. Right: Cover of the historic novel by A. Japin (1997, 2000) about Kwasi Boachi's life, who became 'a black man with a white heart'.

Home leave 1856, discharge from Mijnwezen and return as planter, 1857

Boachi returned to the Netherlands on leave in March 1856. After meeting with King Willem III, it was decided that he would be honorably discharged from his position of mining engineer in the Netherlands Indies. Due to the perceived discrimination at the Bureau of Mines, the Dutch Government offered him a small, life-long monthly pension as compensation.

Bij besluit van den 27sten September 1857, nº 60, heeft Zijne Majesteit goedgevonden, den buitengewonen ingenieur van de 3de klasse voor de mijnen in Nederlandsch Indie, *Aquasie Boachi*, thans met verlof in Nederland, op het daartoe door hem gedaan verzoek, eervol uit 'slands dienst te ontslaan, en hem tevens te verleenen den titulairen rang van ingenieur voor de mijnen in Nederlandsch Indie.

Fig. VI.25. Newspaper notification about the granting of requested 'honorable discharge' of Aquasi Boachi as mining engineer in the Netherlands Indies in 1857.

Aquasi Boachi returned to the Netherlands Indies in late 1857, but in a new role as a planter. He developed tea and coffee plantations at several locations on Java (Madiun and the Sukaraja and Soekasari plantations near Bogor), but all appeared to be commercial failures. He had three children with Javanese women.

Prince Ir. Aquasi Boachi died at his Bantar Peteh estate South of Bogor on 9 July 1904, at age 77.

VI.4. Early regional geological surveys (~1875-1920)

As noted above, little geologic work was generally included in the survey reports by mining engineers of the *Dienst van het Mijnwezen* during the mid-late 1800s. A new era with major improvements in the quality of geological content in *Mijnwezen* work started with Ir. R.D.M. Verbeek in the 1870s, and was followed in the late 1800s by the works of R. Fennema, J. Hooze, M. Koperberg and N. Wing Easton. This improvement in geological skills of Delft mining engineers can probably be linked to the presence in Delft of a new German geology professor, H. Vogelsang, between 1862 and 1874.

45. Rogier D.M. VERBEEK (Doorn 1845- The Hague 1926)

R.D.M Verbeek is the undisputed founding father of the regional geology of Indonesia. He spent his entire career on mapping and surveying large parts of the Netherlands Indies in late 1800s- earliest 1900s. Verbeek championed regional mapping when many others were focused on evaluations of coal and mineral deposits. Verbeek became world-famous for his thorough and timely study of the 1883 eruption of Krakatau volcano.

Verbeek was almost the opposite of a prospector. He always argued that a regional geological framework would make exploration for economic minerals a lot more efficient. Verbeek may actually have tried to avoid indications of coal and minerals, because having to evaluate them would take time away from his regional geological agenda. Examples are the Lebong area of West Sumatra and the Jampangs of SW Java, areas that he mapped and in which profitable gold-silver mining ventures were developed later. These deposits had either not been noticed by him, or were deemed to not be of economic interest and not worthy of investigation.

Fig. VI.52. Left: Rogier Verbeek, as a student around 1865. Right: Verbeek in retirement around 1920 (from Wing Easton 1927).

Rogier Diederik Marius Verbeek was born on 7 April 1845 in Doorn, the Netherlands. He studied mining engineering at the *Polytechnische School* of engineering in Delft from 1861-1865, graduating with a doctorate in September 1866. This education included one year at the *Konigliche Sachsische Bergakademie* in Freiberg, Saxony, Germany, from October 1865- August 1866 (in 1922 he would receive an honorary doctorate from this school). He credited Professors Hermann Vogelsang (Delft) and Bernhard von Cotta (Freiberg) as his principal teachers of geology (Verbeek, 1910).

Rogier D.M. Verbeek should not be confused with his contemporary colleague Reinier (R.D.) Verbeek, also a mining engineer, but who focused on economic mineral exploration/exploitation in West Sumatra, in particular the resurrection of the Salida gold mines. Rogier Verbeek on the other hand reportedly tried to avoid economic mineral deposits, as he would be obliged to spend time on economic evaluations, which would take time away from his personal interest, general geologic reconnaissance (Van Bemmelen, 1949).

Dienst van het Mijnwezen, Netherlands Indies, 1868

After a mandatory year of visiting various mining provinces in Europe, Verbeek left for The Netherland Indies in December 1867, arriving in Batavia after a 5-month sailboat journey in April 1868. This would be the start one of the longest careers (34 years) of anyone at the *Dienst van het Mijnwezen* (Bureau of Mines of the Netherlands Indies), which lasted until 1901.

Verbeek became famous for his pioneering extensive, well-documented geological studies and mapping exercises in West and South Sumatra (with descriptions of the coal fields of Sawahlunto, Ombilin basin), SE Borneo (with Pengaron coal mines), the 1883 Krakatoa eruption, the 1898 Java-Madura mapping with Reinder Fennema, the 1904 Ambon mapping and the 1908 Moluccas survey.

Verbeek produced voluminous geological monographs on SE Kalimantan (1875), West Sumatra (1875), South Sumatra (1881), the Krakatau 1883 eruption (1885), Bangka and Belitung: fieldwork in 1894-1895 (Verbeek 1897), Java and Madura (Verbeek and Fennema 1896), Ambon (1899) and finally the *Molukkenverslag* (Moluccas Report) (1908).

SE Borneo (Kalimantan) coal mines, 1868-1870

Verbeek's first assignment in the Netherlands Indies was a two-year stint at Pengaron in SE Kalimantan, from August 1868- September 1870, as the Technical Head of the government-operated *Oranje Nassau* coal mine operations. The mine is located at the mountain front of the Meratus Range and the margin of the Barito basin. Whenever mine operations allowed, Verbeek would go on geological exploration trips in the area.

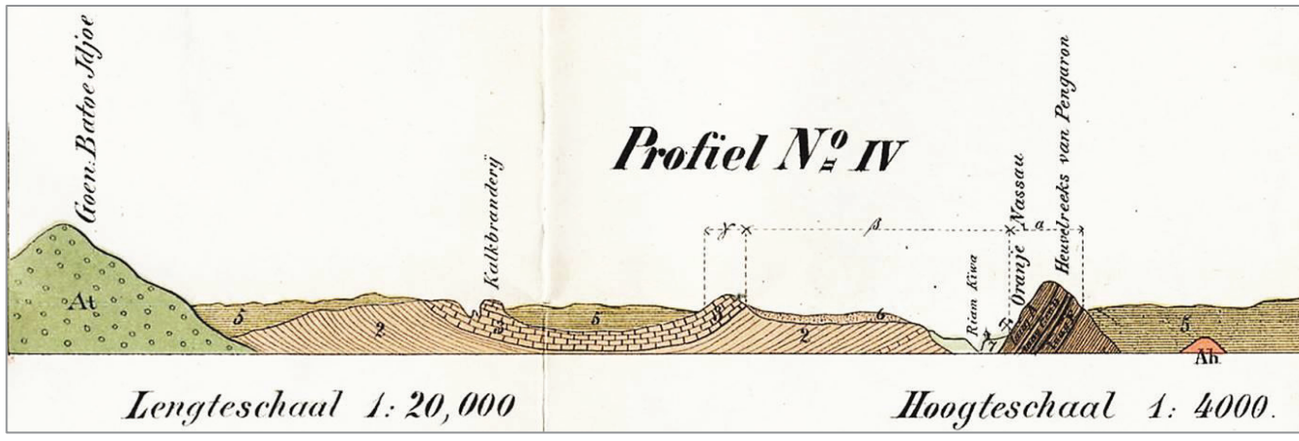


Fig. VI.53. Geological cross-sections in the Pengaron coal mine area, Barito Basin, SE Kalimantan (Verbeek 1875).

This is when Verbeek discovered the first Eocene limestones with larger foraminifera *Nummulites* (Verbeek 1871, 1874). These are widespread across the Alpine-Himalayan Tethys belt, but had not been reported from the Indonesian region before.

A series of paleontological companion papers by Boettger, Geyler and Von Fritsch on Borneo fossils collected by Verbeek in SE Kalimantan was published in 1875 in *Palaeontographica*.

Geology of Java and Madura, 1881-1893

In February 1881 Verbeek was officially charged with geological investigations of Java. It started with a survey of the Bayah coalfield in SW Java in 1881. This was followed in 1882 by determination of the continuation of Eocene coal beds in eastern direction, including a technical evaluation of the coal beds of Gunung Walat near Sukabumi. Verbeek's conclusion was that the SW Java coals were not attractive for development. During parts of these surveys Verbeek was assisted by R. Fennema and the newly arrived Ir. J.W. Retgers.

Verbeek's involvement in the Java Survey was interrupted by a trip to the Netherlands to finalize and supervise the publication of his Sumatra West Coast book in late 1883-June 1883, followed by his investigations and report writing on the catastrophic 1883 eruption of Krakatau volcano from August 1883-1884 (see below).

The results of the ~10 years of Java mapping and surveying were documented in the classic major volume *Geologische beschrijving van Java en Madoera* (Geological description of Java and Madura), with R. Fennema, which was published in 1896 with an oversized atlas of geologic maps. It was the first comprehensive geologic description of Java and Madura, and a major improvement over the earlier work of F. Junghuhn. Verbeek and Fennema were the first to recognize several areas with Paleogene sediments, identified all three Pre-Tertiary basement complexes on Java, and documented the locally great thickness of Tertiary sediments.

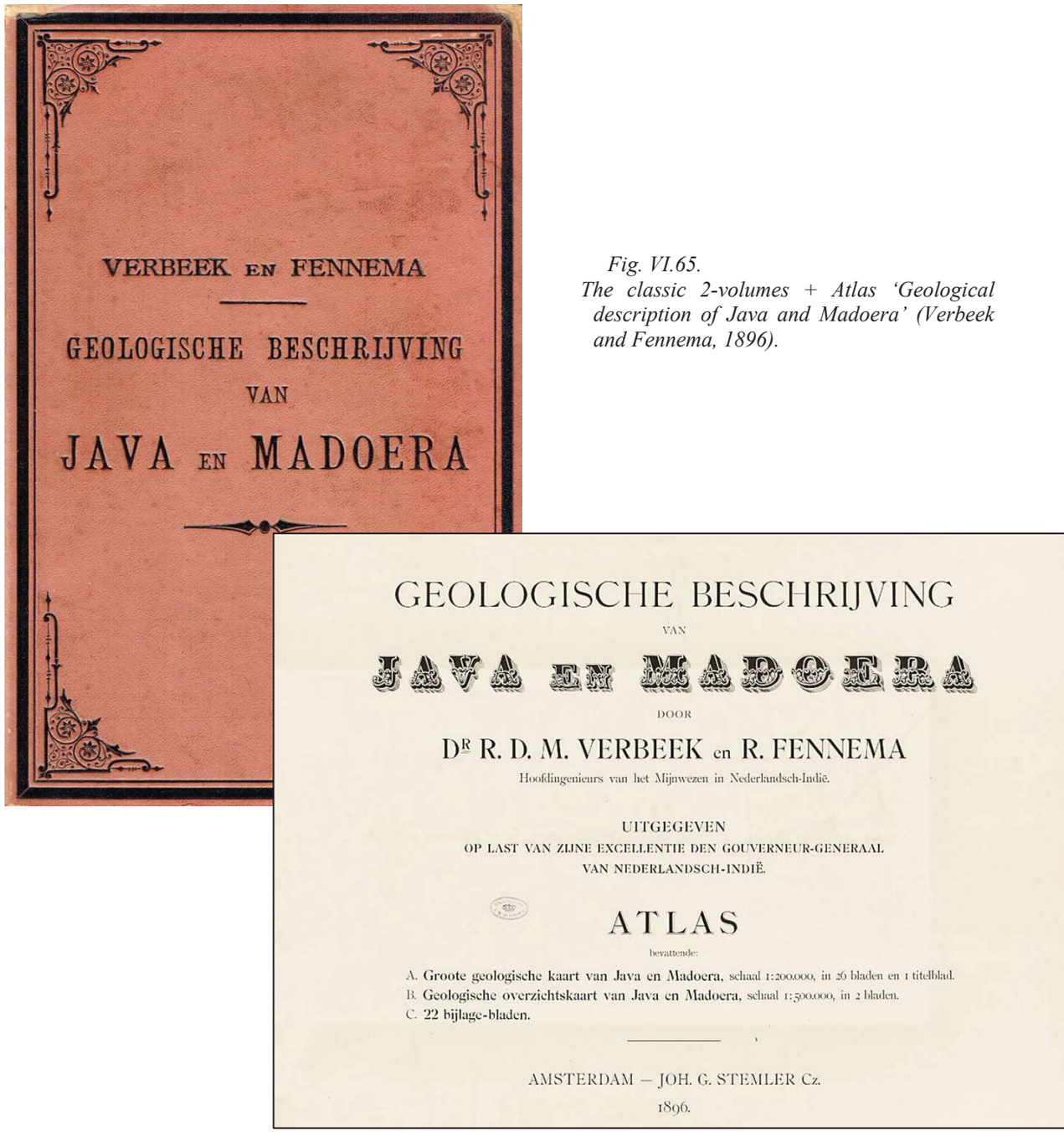


Fig. VI.65.
The classic 2-volumes + Atlas 'Geological description of Java and Madoera' (Verbeek and Fennema, 1896).

Geology of Bangka and Belitung, 1894-1895

From July 1894 until early 1895 Verbeek surveyed the geology of Bangka and Belitung (documented in Verbeek 1897; Fig. VI.72). These islands were known primarily for its Quaternary fluvial-alluvial deposits with detrital cassiterite tin placers, and locally known as *kaksa*. Despite an extended search, Verbeek found no in-situ cassiterite in the underlying granites and therefore he (wrongly) rejected the theory that the detrital tin was derived from erosion of the underlying granites.

The Verbeek (1897) Bangka book also contained a remarkably accurate assessment of the occurrences and the nature of the '*billitonites*' found near the base of the tin-bearing alluvial sands. He argued that these 'glass bullets' were probably of extra-terrestrial origin, possibly from lunar volcanoes (see also below).

Radiolaria from chert in the folded metasediments of Belitung were studied by Dr. G.J. Hinde from England and deemed to be of 'likely Paleozoic' age.

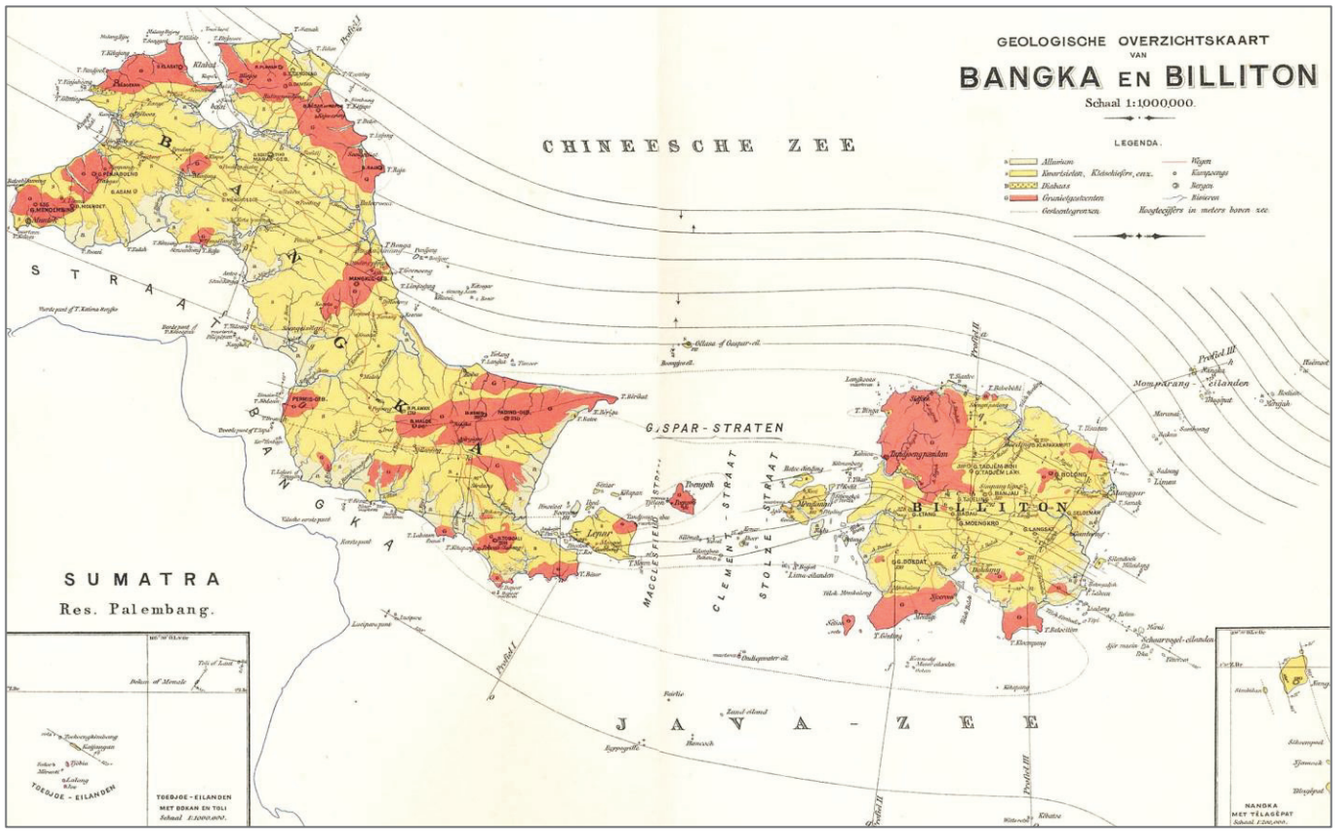


Fig. VI.72. Geologic map of Banka and Belitung (Verbeek 1897). Both islands are composed of Late Paleozoic- Early Mesozoic folded meta-sediments (yellow) and Triassic- Jurassic granites (red), cut by tin-bearing alluvial valleys.

Book writing and home leave, 1895-1896

From May 1895 until January 1897 Verbeek was in the Netherlands. At first, he worked on the completion of his large reports on Java-Madura (Verbeek and Fennema, 1896) and Bangka-Billiton (Verbeek, 1897). This was followed by one year of vacation.

Verbeek declined promotion to Head of Geological Survey, 1898

After his return to Batavia in 1898, Verbeek was now the most senior person at *Mijnwezen*, with 30 years of service. As per government policy, Verbeek was promoted to Head of the *Dienst Mijnwezen* (Bureau of Mines of the Netherlands Indies) from 1898-1901. However, although he appreciated the salary and the job title, Verbeek-the-scientist had no ambition to assume the Management position. He succeeded in delegating the administrative duties to Ir. D. de Jongh (while keeping the title and salary of Head of *Mijnwezen*) and continued to do geological field work instead.

47. Reinder FENNEMA (Sneek 1849- Lake Poso, Sulawesi 1897)

R. Fennema was a mining engineer, volcanologist and early oil well driller with the Dienst van het Mijnwezen in the late 1800s. He drowned in Lake Poso in 1897, Sulawesi, after a boating accident in bad weather during a geological survey.

Reinder Fennema was born on 21 October 1849 in Sneek, where he also grew up. He studied mining engineering at the *Polytechnische School* (Technical University) in Delft, receiving his geological education from Prof. H. Vogelsang, with whom he took multiple geological excursions. He graduated in 1872 and did the mandatory practical follow-up year at the *Bergakademie* (Mine Academy) in Clausthal, in the Harz Mountains of Lower Saxony (now Germany).

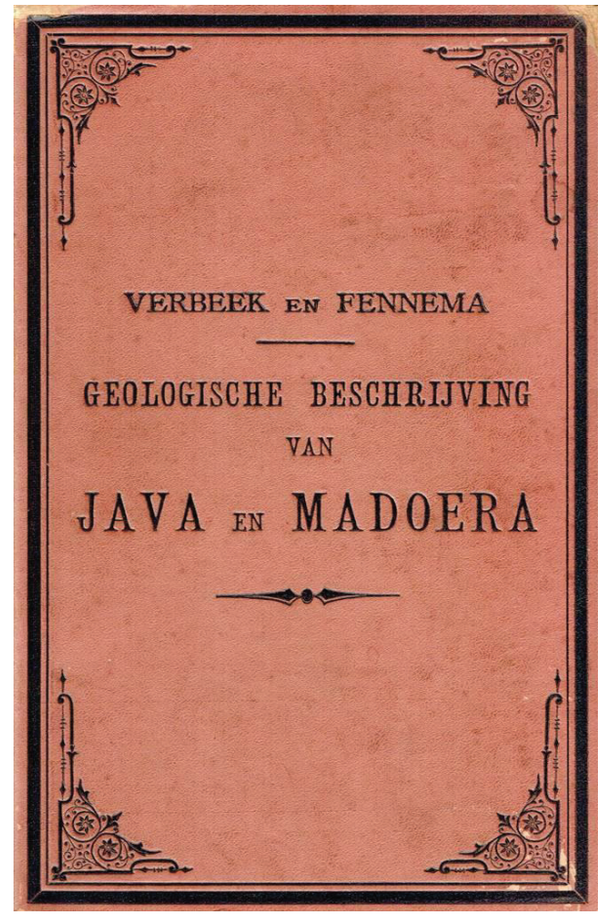


Fig. VI.92. Portrait of Ir. Reinder Fennema (Jaarboek Mijnwezen, 1903).
Fig. VI.93. Cover of the classic 2-volume 'Geologic description of Java and Madura' by Verbeek and Fennema (1896).

Dienst van het Mijnwezen, 1874-1897

In April 1874 Fennema arrived at the *Dienst van het Mijnwezen* (Bureau of Mines), at that time located in Weltevreden (Jakarta), as *Ingenieur 3e klas*. Much of his 23-year career there was spent on surveying and geological mapping of parts of Sumatra and Java.

In July of the same year, Fennema was seconded to the geological mapping project of Sumatra's West coast, led by R.D.M. Verbeek. Fennema's tasks included work on cinnabar and tin ore occurrences and reconnaissance mapping of the Padang Highlands in 1875-1878. After a stint of overseeing the drilling of water wells in Central and East Java from 1878 until 1880, Fennema led an investigation into coal fields around Bukit Sunur near Bengkulu, West Sumatra in 1880-1881 (Fennema 1885).

After an extended sick leave in the Netherlands from June 1882, Fennema returned to the Indies in October 1884. In 1886 he started work with R.D.M. Verbeek on his geological investigations of Java.

Role in North Sumatra oil discoveries of Royal Dutch, 1887-1890

From October 1887 until April 1890 Fennema was instrumental in the success of tobacco planter A.J. Zijlker's pioneering oil well drilling in the Deli-Langkat area near the NE coast of Sumatra. Fennema provided technical assistance and equipment from the *Dienst van het Mijnwezen*. This led to the discovery of the *Telaga Said* oil field and the founding in June 1890 by Zijlker of the *Koninklijke Nederlandsche Maatschappij tot exploitatie van petroleumbronnen in Nederlands Indie* (= 'Royal Dutch') (Fennema, 1890). This company would grow into the large multinational *Royal Dutch/Shell* oil company after Zijlker's death, via a series of acquisitions and mergers in the early 1900s.

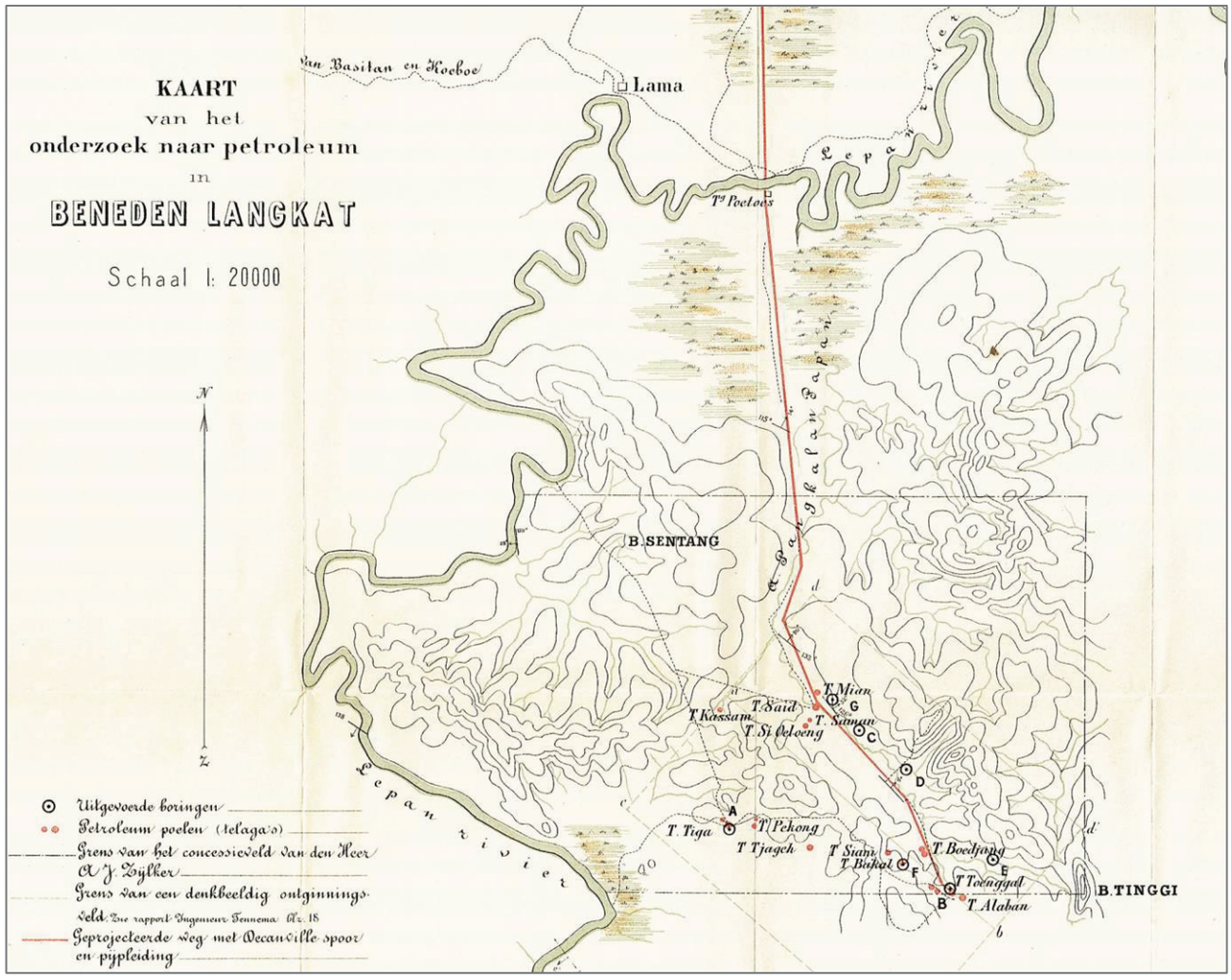


Fig. VI.94. Map of the petroleum survey work and drilling on the concession of A.J. Zijlker, showing locations of 18 oil seeps and 6 shallows wells drilled by Mijnwezen personnel, and a proposed pipeline route in (red line; Fennema, 1890). The drilling work and business plans that Fennema prepared for Zijlker were key to the success of Zijlker's oil exploration, and thus to the birth and survival of the Royal Dutch Petroleum Company.

In his report of 1890 (p. 15-16) Fennema described how the oil seeps around *Telaga Toenggal* and *Telaga Said* in Zijlker's concession were located on the crest of an anticlinal structure, which was trending parallel to the axis of Sumatra and with flanks that were generally dipping less than 25° (Fig. VI.95).

It is not clear if that this meant that Fennema was already aware of the *Anticlinal theory of oil accumulations* in the late 1880s. If he did, the message was not received by Kessler and his *Koninklijke Olie,* the company that was built on Fennema and Zijlker's success of the crestal wells on the *Telaga Said* anticline. They drill many more wells in the 1890s, but all off-structure and all unsuccessful, nearly bankrupting the company (at this time after Fennema and *Mijnwezen* were no longer involved). It was not until the geological evaluations of C. Schmidt and C. Porrro in North Sumatra around 1900 that drilling anticlines became the dominant strategy in oil exploration in the Netherlands Indies.

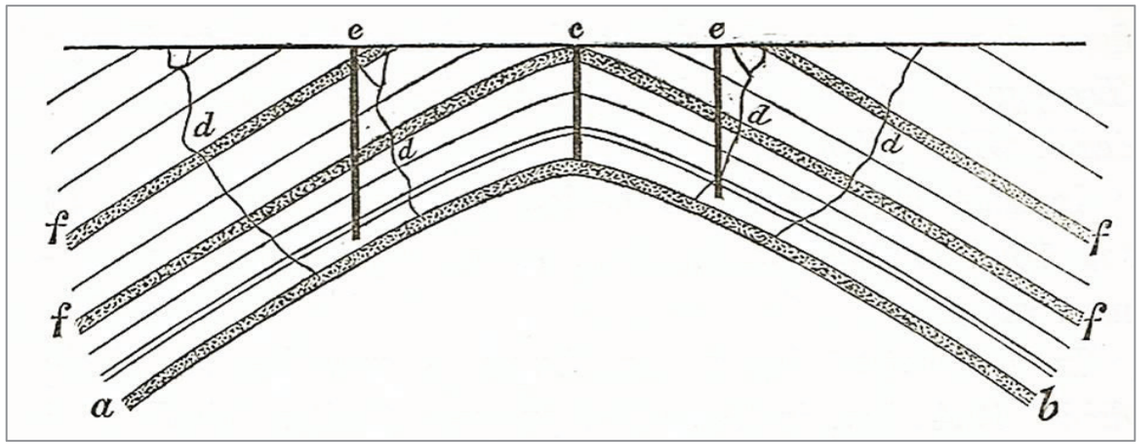


Fig. VI.95. Schematic cross-section, showing anticlinal structure and wells at the Telaga Said-Telaga Toenggal anticline in Langkat, NE Sumatra. Horizon a-b is the main oil-bearing reservoir. Beds labeled f are permeable beds that intermittently leak oil, fed by cracks labeled d (Fennema, 1890).

In 1895 Fennema published a paper on the 1894 eruption of Galunggung volcano in West Java.

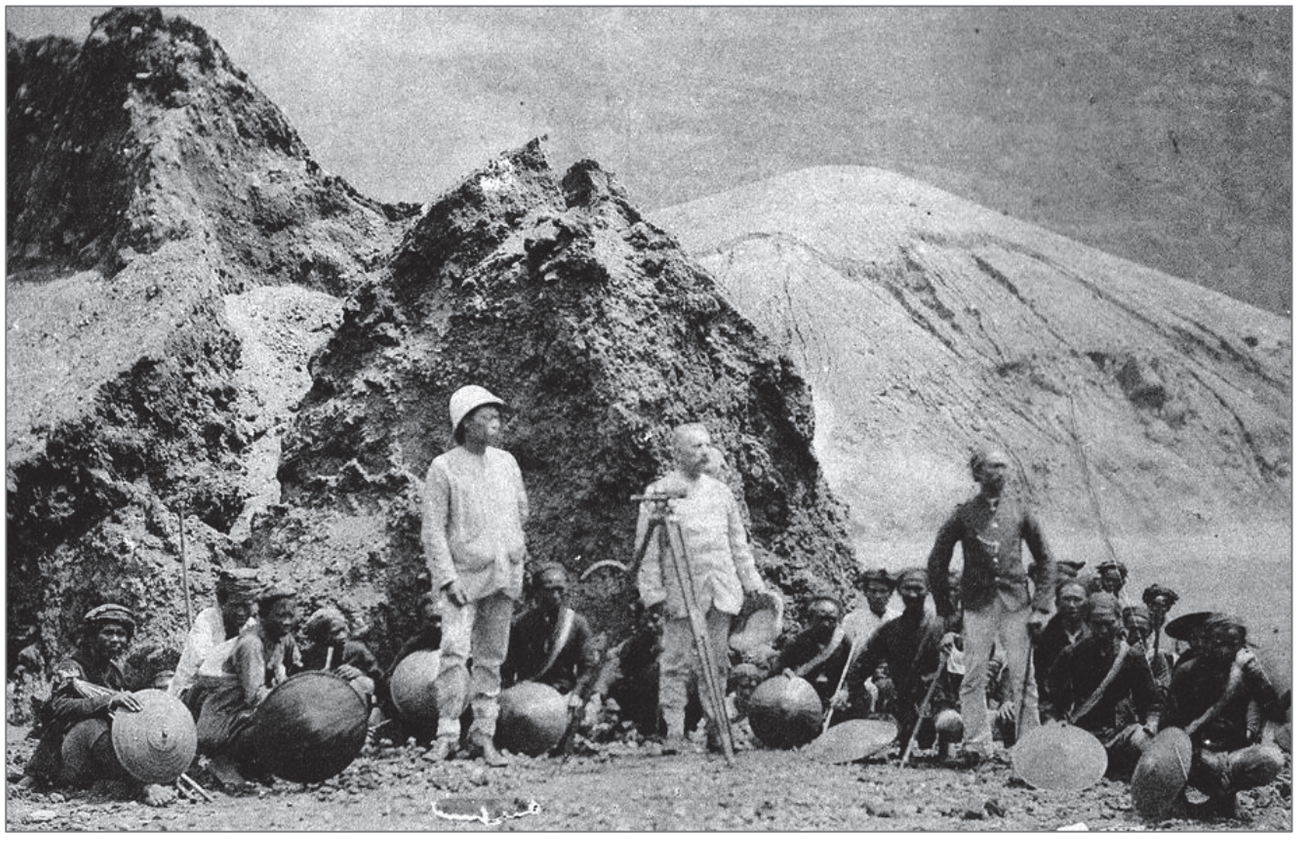


Fig. VI.99. Visit to the crater of the Galunggung volcano, West Java, on 20 November 1894, shortly after an October eruption (Fennema standing in center).

Java- Madura geological mapping with R. Verbeek, 1888

After the 2.5 years of interruption by the North Sumatra petroleum work, Fennema returned to the Java geologic mapping project led by R. Verbeek in 1890. He would spend a total of 5.5 years on the Java project and the results were published in the monumental 2-volume work and Atlas of Verbeek and Fennema (1896) *Geologische beschrijving van Java en Madoera* (Geological description of Java and Madura). It was published in Amsterdam, in both Dutch and French editions (see also the R.D.M. Verbeek chapter). The work received widespread kudos and rewards (Fig. VI.97).

Tobler's later work in Sumatra, this work for the *Koninklijke* was never published, except for a summary in Tobler (1904).

Sumatra petroleum geology mapping 2, 1903-1904

After a short break in Switzerland in the summer of 1903 Tobler worked for 8 months on contract with the *Petroleum-Maatschappij Moeara Enim*, from September 1903- May 1904, to produce detailed geological maps of their petroleum-producing anticlines in the Muara Enim area of South Sumatra (Figs. VI.117-VI.119). This was a few years before *Moeara Enim* merged with the *Koninklijke*. Unlike most oil company geological work during this era, and probably due to its visionary Director J.W. Ijzerman, Tobler was allowed to publish the results of this pioneering work in great detail (Tobler, 1906).

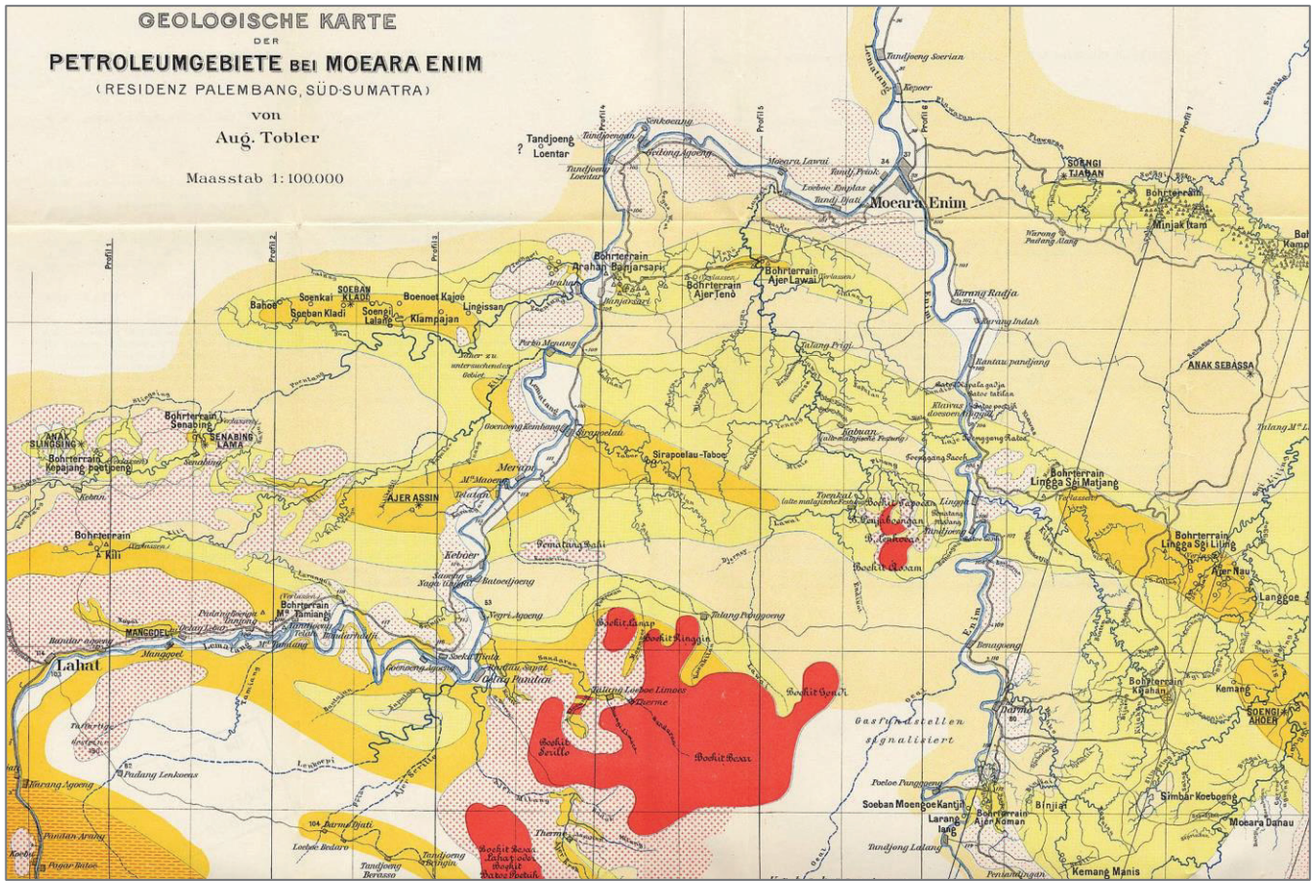


Fig. VI.117. Part of Tobler (1906) surface geology map of the Muara Enim area, SW Palembang Basin, South Sumatra.

Fig. VI.118. Profiles 1 and 2 across the Kampung Minyak- Minyak Hitam oilfield, showing oil reservoir horizons in green and gas caps in red (Tobler, 1906)

Cover Chapter VII: Geological field party in North Sumatra, with armed escort, ~1915.

VII. *DIENST VAN DEN MIJNBOUW* (BUREAU OF MINES- 2), 1923-1950s

This chapter deals with the Bureau of Mines/Geological Survey of the Netherlands Indies during the peak of its staffing and scientific output during the 1920s and early 1930s. This period was followed by the gradual decline during the economic depression of the 1930s, the destruction during the Japanese occupation and the slow recovery after 1945.

Reorganization of 1922, name change from Mijnwezen to Mijnbouw

In November 1922 the *Dienst van het Mijnwezen* (Bureau of Mines of the Netherlands Indies) underwent a significant organizational change, during the leadership of Ir. P. Hovig. It was re-named to *Dienst van den Mijnbouw in Nederlandsch-Indie*, and now assumed the management (instead of just technical assistance) of all government mining ventures, like the tin mines on Bangka, the coal mines at Sawahlunto, Bukit Asam and Pulau Laut and the Tambang Sawah gold mine. These mines were previously independent organizations within the *Departement van Gouvernements bedrijven*.

A separate Geological Survey Department (*Opsporingsdienst*) was formed within the *Dienst van den Mijnbouw*, which was separate from the tin and coal mines and from the geotechnical and regulatory departments that had also been parts of *Mijnwezen*. Since ~1920 there was also a Volcanological Survey Department. This organization structure, despite several name changes, more or less persists until today in the Bureau of Mines/ Geological Survey of Indonesia in Bandung.

VII.1. The era of systematic geologic mapping (1927-1930s)

Not long after the 1922 reorganization, systematic geologic (re-)mapping programs were started. This was a change from the old *Mijnwezen* philosophy, which focused on areas of economic interest. Mapping programs started in Sumatra (*Sumatra Kaarteering*; 1927-1933) and Java (*Java Kaarteering*; ~1928- ~1941).

Geologic mapping of Indonesia

Today 1:250,000 scale geological maps are available for all parts of Indonesia. However, it took a rather long time (1996) to reach this stage. This is understandable considering the size of the country, the logistical difficulties in the early days (no air travel, security issues, no reliable topographic maps, etc. etc.), and generally inadequate funding to support the numbers of geologists required to map a country the size of Netherlands Indies/Indonesia.

Four main periods may be distinguished:

1. Before the late 1800's: only occasional, small maps produced in conjunction with areas of economic interest;
2. late 1800'- early 1900's: regional mapping around areas of (commercial) interest. Most of the early regional maps were by Rogier Verbeek, followed by mapping projects in the early 1900's by A. Tobler (Sumatra), N. Wing Easton (Kalimantan) and J. Zwierzycki (Sumatra, New Guinea). Later significant mapping was carried out by K. Musper, W. Leupold, etc.;
3. 1928-1941: First systematic geologic mapping programs by the *Dienst van den Mijnbouw*. Initially the programs focused on South Sumatra and Java, but they were never completed during the colonial period, due to budget reductions in the 1930's and the Japanese Invasion in early 1942;
4. 1942-1970: Virtually no mapping activities, at first mainly due to political and safety conditions and later mainly to lack of budgets and adequately-trained staff;
5. 1971-1995: Restart of systematic geological mapping programs by the Geological Survey, Bandung, during 'Repelita I', much of it headed by Rab Sukamto. Several regions were mapped with foreign assistance, from the US Geological Survey (USGS), the British Geological Survey (BGS; Sumatra) and the Australian Bureau of Mineral Resources (BMR; Irian Jaya and Kalimantan). Several of the map sheets on Java were 'farmed out' to universities (ITB, Padjadjaran, Gadjah Mada).

The 1:250,000 scale mapping program for all of Indonesia was officially declared completed by January 1996.

Van Waterschoot van der Gracht, W.A.J.M. (1915)- Rapport over de opsporing van delfstoffen in Nederlandsch-Indie, krachtens opdracht bij Kon. Besluit van 9 Juni 1913, No. 54, Landsdrukkerij, The Hague, 110p.

Klompe, Th.H.F. (1957)- The status of geological mapping in Indonesia and adjacent areas. Indonesian J. Natural Science (Majalah Ilmu Alam untuk Indonesia) 113, p. 127-138.

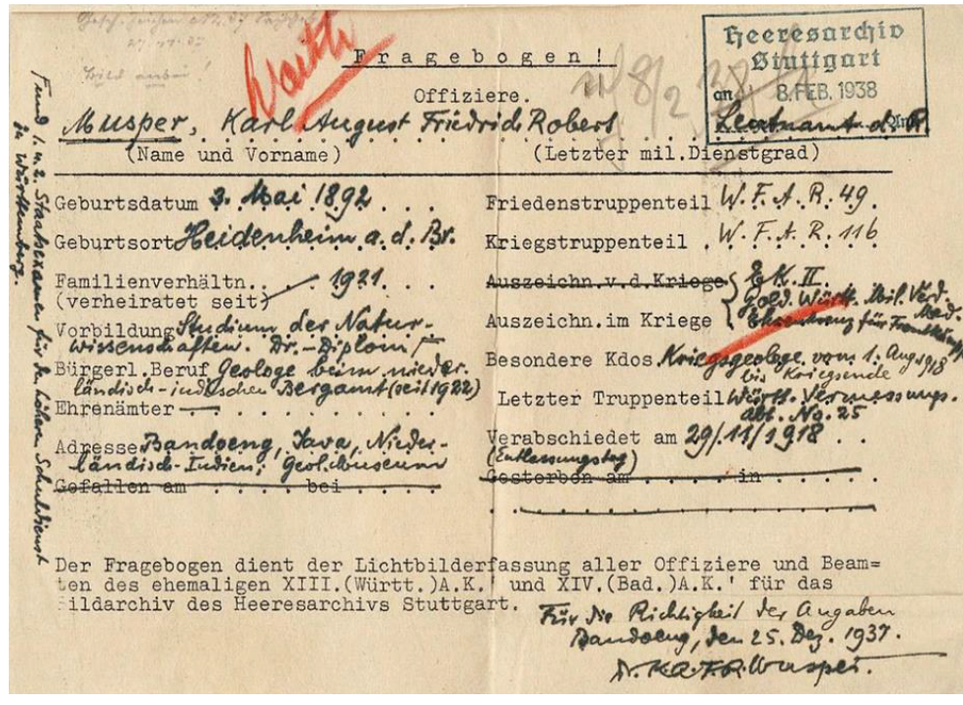
Hartono, M.H.S. (1979)- Geological mapping in Indonesia: the state of the art. Bull. Geol. Res. Dev. Centre 1, p. 1-6.

Sukamto, R. (2000)- The knowledge of Indonesian geology: challenge and utilization. Geol. Res. Dev. Centre, Bandung, Spec. Publ. 22, p. 1-65.

65. K.A. Friedrich R. MUSPER (Heidenheim 1892- Surinam 1943)

K.A.F.R. (Fritz) Musper was a German geologist with the Dienst van den Mijnbouw (Geological Survey) in Bandung from early 1922 until his arrest and dismissal on 10 May 1940. He is a significant, but underappreciated contributor the knowledge of the geology of Indonesia. Despite personal tragedies, he left a remarkable legacy of well-documented, high quality pioneering geological mapping work in Central and South Sumatra in the 1920s- 1930s.

Karl August Friedrich Robert Musper was born in Heidenheim an der Brenz (Wurtemberg), Germany, on 3 May 1892. He studied geology in Munich and Tubingen. Interrupting his studies of geology at the University of Tubingen, Musper was called to serve in the German Army as a 'war geologist' at the end of World War I, from August- November 1918. After demobilization he finished his geology studies in June 1919, with a thesis on the Jurassic of SW Germany, entitled *Der Brenztaloolith, sein Fossilinhalt und seine Deutung*.



Heeresarchiv Stuttgart
am 8. FEB. 1938

Fragebogen!

Offiziere.

Musper, Karl August Friedrich Robert
(Name und Vorname)

Leutnant d.R.
(Letzter mil. Dienstgrad)

Geburtsdatum 3. Mai 1892
Geburtsort Heidenheim a. d. Br.
Familienverhältn. 1921
(verheiratet seit)
Vorbildung Studium der Naturwissenschaften. Dr.-Diplom
Bürgerl. Beruf Geologe beim niederländisch-indischen Bergamt (seit 1922)
Ehrenämter
Adresse Bandoeng, Java, Niederländisch-Indien, Geol. Bureau
Gefallen am bei

Friedenstruppenteil W.F.A.R. 49.
Kriegstruppenteil W.F.A.R. 116
Auszeichn. v. d. Kriege E.K.II. Württ. Mil. Verd. Med.
Auszeichn. im Kriege Ehrenurkunde für Frontkämpfer
Besondere Kdos. Kriegsgeologe vom 1. Aug. 1918 bis Kriegsende
Letzter Truppenteil Württ. Versuchsanstalt für Kraftfahrwesen abt. No. 25
Verabschiedet am 29/11/1918 (Entlassungstag)
Gestorben am in

Der Fragebogen dient der Lichtbilderfassung aller Offiziere und Beamten des ehemaligen XIII.(Württ.)A.K. und XIV.(Bad.)A.K. für das Bildarchiv des Heeresarchivs Stuttgart.

Für die Richtigkeit der Angaben
Bandoeng, den 25. Dez. 1937.
Dr. K.A.F.R. Musper.

Fig. VII.69. K.A.F.R. Musper in 1918 as a young German Army officer (from Hauptstaatsarchiv Stuttgart).
Fig. VII.70. Questionnaire for Stuttgart Army Archive, filled out by Fritz Musper in December 1937 (from https://www.leo-bw.de/..).

From 1919 until 1921 Fritz Musper was Assistant in the *Geologisch-Palaeontologisch Institut* at Tubingen, which was also the home of the well-known vertebrate paleontologist Friedrich von Huene. During his time at the University of Tubingen, Musper authored several papers on the geology and paleontology of SW Germany and the Jura Mountains, while still living in his native Heidenheim.

Dr. Karl August Friedrich Robert Musper

Geboren te Heidenheim den 3 Mei 1892.
Gehuwd met Luise Bründler. te Heidenheim den
Vader August. Moeder Helena Moser.

Fig. VII.71. The header of the 'Stamkaart' of the Ministry of Colonies, a Dutch government chart that recorded the dates and places of Musper's assignments (https://www.nationaalarchief.nl/onderzoeken/archief/....).

Geological Survey of the Netherlands Indies, 1922-1940

There were few job opportunities for geologists in economically depressed Germany immediately after World War I, so Musper took the opportunity to join the *Dienst van den Mijnbouw* (Geological Survey) in the Netherlands Indies. A 5-year contract as *Tijdelijk Geoloog (*'Temporary geologist') was signed on 30 June 1921 and Musper and his wife Luise arrived in Batavia in January 1922. Soon after arrival they moved to the remote village of Taluk on the Indragiri River of Central Sumatra, which at that time served as the base for the *Mijnbouwkundig-Geologisch Onderzoek lndragiri en Pelalawan* survey (Central Sumatra Mapping Project).

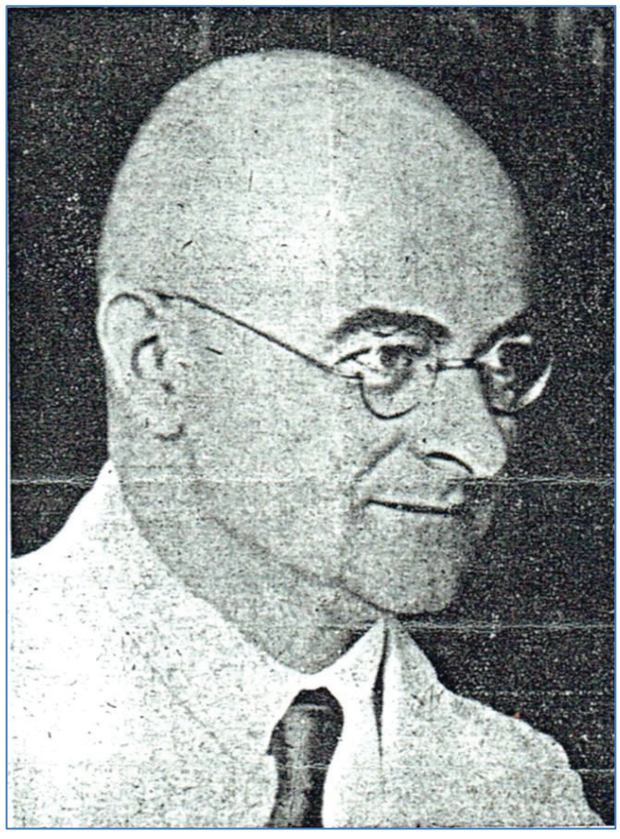


Fig. VII.72. Dr. K.A.F.R. Musper during his time in Bandung (from memorial by A. Bentz, 1948).
Fig. VII.73. Fritz Musper (right) in the early 1930s in Bandung with Jozef Zwierzycki (left), his Chief in the Java mapping project (Duyfjes Collection, Leiden).

Central Sumatra mapping, Taluk, 1922-1926

The first ten years of Musper's career were with the *Sumatra kaarteering* (Sumatra Mapping Project), led by Dr. J. Zwierzycki. From March 1922 until October 1926 (almost 5 years!), Musper and his family were based in the extremely remote, small settlement of *Taluk*, on the Indragiri (Kuantan) River in the SW corner of the Central Sumatra Basin, and surrounded by jungle.

At that time the geology of Central Sumatra was still mostly unknown. There were virtually no roads (the road from Pakanbaru to Taluk would be completed only in 1933), and most of the paths were elephant paths. There were no reliable topographic maps for most of the area, so topography had to be surveyed by members of the geological survey team as well. It took several days of travel from Taluk to reach the nearest western-trained medical doctor.

It proved hard to find laborers from the scarce local Central Sumatra population that could assist with the geological field surveys, so they had to be recruited from elsewhere. In the *Indische Courant* of 9 January 1926 it was reported that the mapping in eastern Central Sumatra had to be stopped temporarily due to labor shortages caused by a smallpox epidemic in the area.

During most of this time, Musper was the principal geologist with the *Mijnbouwkundig-Geologisch Onderzoek Indragiri and Pelawan* mapping-surveying project. For parts of this period *Mijnbouw* engineers H.J. van Lohuizen (1922-1923) and J.E. Loth (1924-1926) worked with him from Taluk, while the Head of Sumatra mapping J. Zwierzycki periodically visited the field areas for ‘inspection journeys’

Tragedy in Taluk, 1924

Personal tragedy struck in November 1924 in Taluk when Musper's first wife Luise attempted suicide by poisoning. She apparently had difficulty coping with the lonely life in this remote part of the tropics, with her husband often away for weeks or months on fieldwork journeys. A two-day boat trip down the Indragiri River to rush his dying wife to the nearest western-trained medical doctor at the Swiss-owned *Air Molek* rubber estate (marked as *Onderneming A. Molek* on the map of Fig. VII.74; also spelled Ayer Moelik or Ajer Moelik) proved too late. She died soon after arrival and was buried in the small cemetery of the plantation (Keppner, 2006).

In October 1925, while still in Taluk and left alone with 2-year-old daughter Lore, Musper re-married 'remotely' with a Swiss-German nurse Elsa S. Romang, whom he knew from his home town Heidenheim and who arrived in Taluk in December 1925.

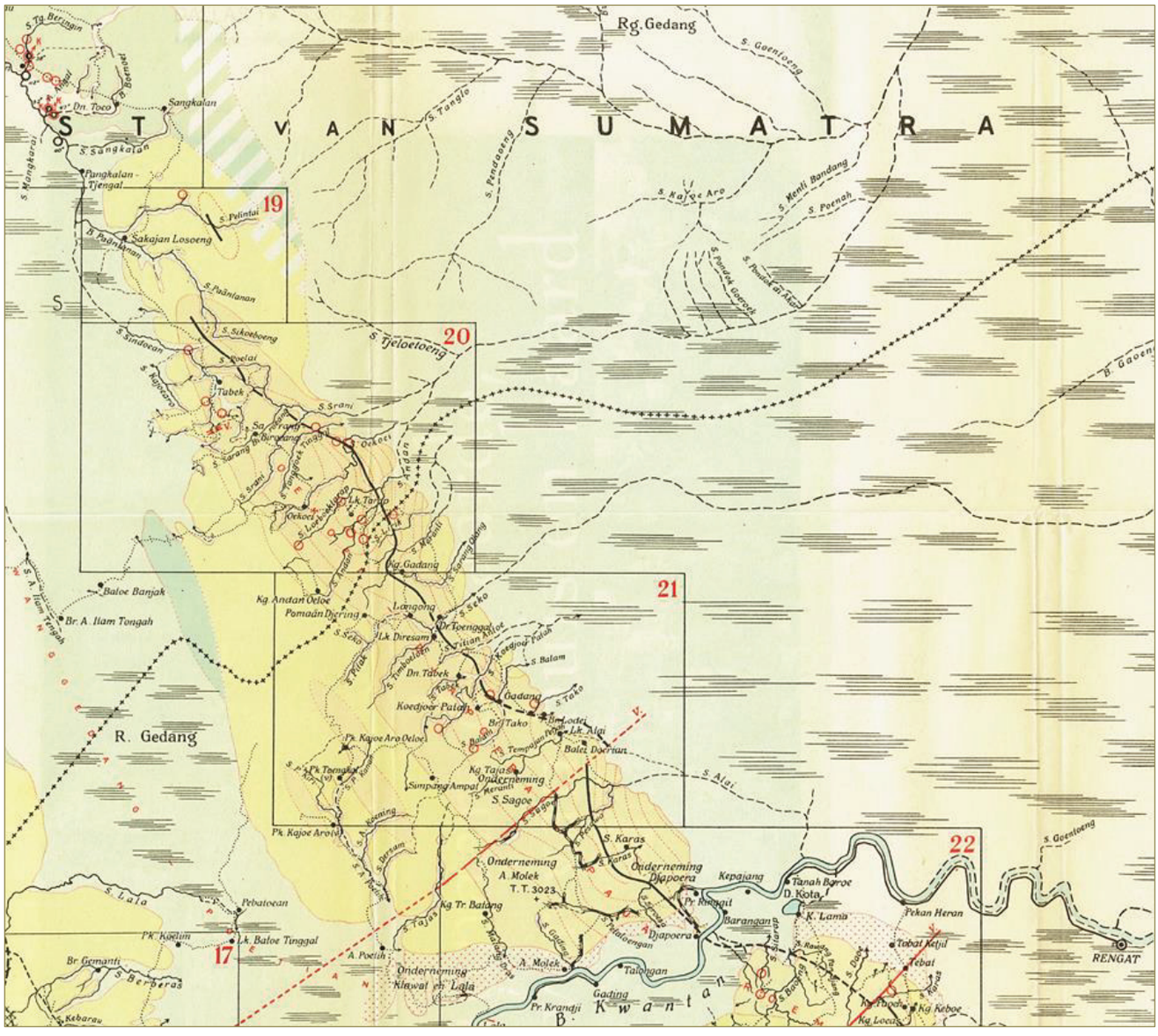
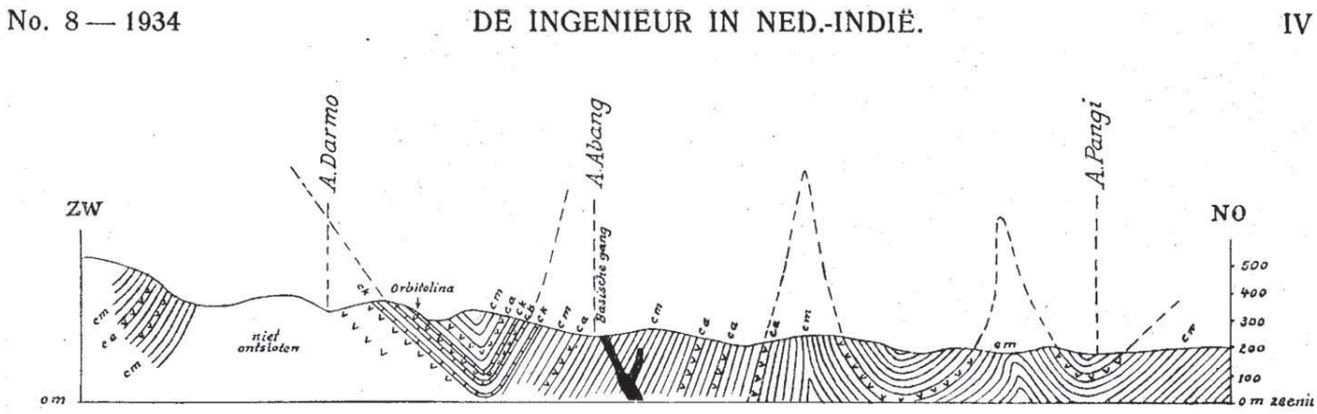


Fig. VII.74. Part of the Indragiri and Pelalawan geological map of Musper (1928; original at 1:200,000). It shows the NW-SE trending Lirik- Japura anticline, straddling the Kwantan (Indragiri) River. This anticlinal trend was first mapped by F. Musper and this map was probably used by NKPM/Stanvac for an application for an oil concession and for drilling the discovery wells of oil fields Lirik (1939), Japura and Ukui (1941), on culminations on this anticlinal trend.

Home leave and South Sumatra Mapping Project, 1929-1932

From April 1929 until February 1930 Musper returned to Germany and Switzerland on home leave. During this trip their third child Helmut was born in Zurich. Upon return to Bandung Musper was promoted to *Geoloog- 2de Klasse*. He rejoined the *Sumatra Kaarteering* (Sumatra Mapping Project), which was led by J. Zwierzycki and was now active in South Sumatra. Musper worked in the South Palembang and Bengkulu basins and completed two new map sheets, *Prabumulih* (1933) and *Lahat* (1937). He also published a thorough description of the Late Mesozoic geology of the Gumai Mountains in a separate paper (Musper, 1937).



Afb. 2. Dwarsprofiel door de „bathyale serie" van het Krijt langs de A. Darmo—A. Pangi (westelijk gedeelte het Goemaigebergte).

Fig. VII.79. Cross-sections of folded bathyal Cretaceous beds in the Gumai Mountains, S Sumatra (Musper, 1934).

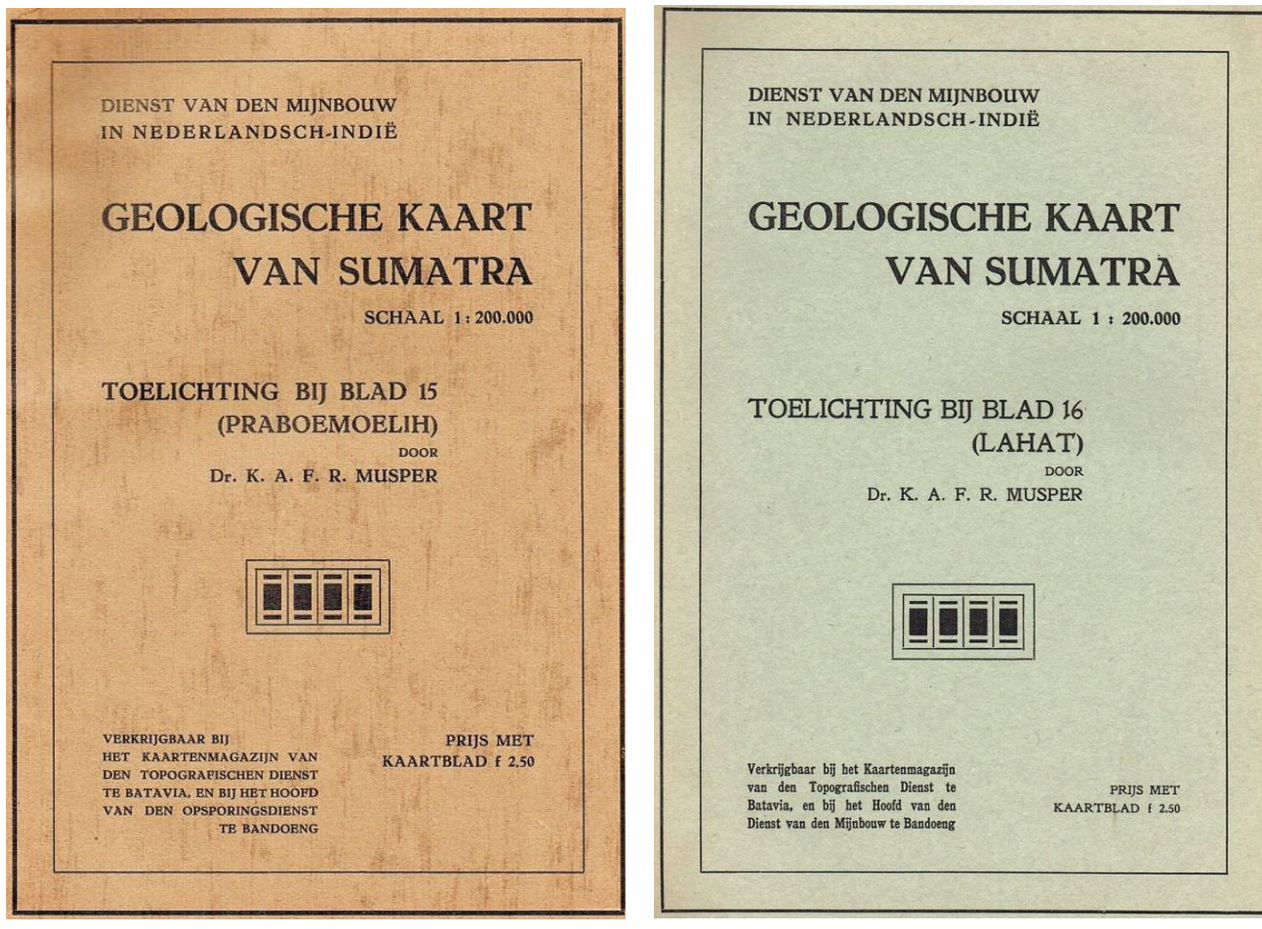


Fig. VII.80. Covers of the Explanatory notes of two Geological map sheets of South Sumatra by Musper (1933, 1937).

69. Reinout W. VAN BEMMELEN (Batavia 1904- Unterpirkach 1983)

R.W. van Bemmelen is commonly viewed as the prime authority on the geology of Indonesia in the late 1940s. He was primarily a structural geologist/volcanologist, who, during his long career published about 200 research papers and 4 books. He was a lifelong advocate of the 'Undation Theory', a now generally discredited tectonic theory.

Reinout Willem (Rein) van Bemmelen was born in Batavia (Jakarta) on 14 April 1904, as the son of Dr. Willem van Bemmelen (1868-1941), who was Director of the Meteorological and Seismologic Observatory of the Netherlands Indies in Batavia from 1898 until 1920. Van Bemmelen Jr's interest in geology and volcanoes may well have been shaped by his father, who was a keen mountaineer, who in his spare time climbed many volcanoes of Java and Sumatra and wrote a book about it, named *Naar hooge toppen en diepe kraters* (To high summits and deep craters).

Before the Van Bemmelen family moved back to the Netherlands in 1920, Rein van Bemmelen had visited the Netherlands only once before, during home leave in 1909. R.W. finished his high school education in Haarlem in 1921. He started his study of mining engineering at the *Technische Hogeschool* (Technical University) in Delft in 1921, under Professors G.A.F. Molengraaff and H.A. Brouwer, finishing *cum laude* in July 1927 with a doctoral thesis on the geology of the Central Betic Cordilleras in Southern Spain, supervised by H.A. Brouwer.

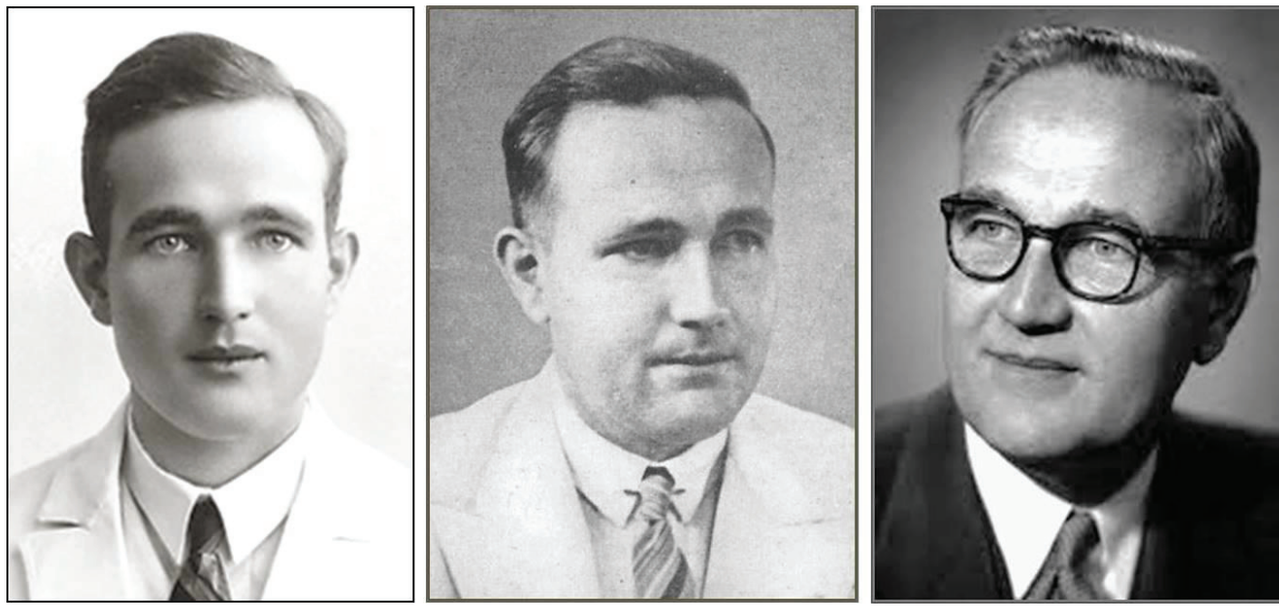


Fig. VII.112. Left: R.W. van Bemmelen as a young man (Coll. RKD- https://rkd.nl/explore/images/172208);
. Center: in the 1930s, while a geologist in Bandung (Persoonlijkheden in het Koninkrijk der Nederlanden, 1938);
Right: Prof. R.W. van Bemmelen probably around 1951 in Utrecht.

The Geological Survey, Bandung 1927-1946

Van Bemmelen returned to his land of birth with the *S.S. Tjerimai* in October 1927, arriving in Bandung in December 1927. This would be the start of a prolific career at the *Dienst van den Mijnbouw* (Geological Survey) until 1946. This career was interrupted twice, first by an extended leave (partly without pay) in Europe from 1934 to April 1936 (see below) and later during Japanese internment from 1943-1945.

The South Sumatra mapping Project, 1928-1933

Van Bemmelen's initial work with *Dienst van den Mijnbouw* was with the *Sumatra Kaarteering* (South Sumatra mapping project), led by the experienced Polish geologist Josef Zwierzycki. This resulted in the publications of two map sheets, *Batoeradja* (1932) and *Kroei* (1933). In 1931 Van Bemmelen alternated working between the Sumatra and Java mapping projects (Jaarboek Mijnwezen, 1931) (Figs. VII.113-VII.114).

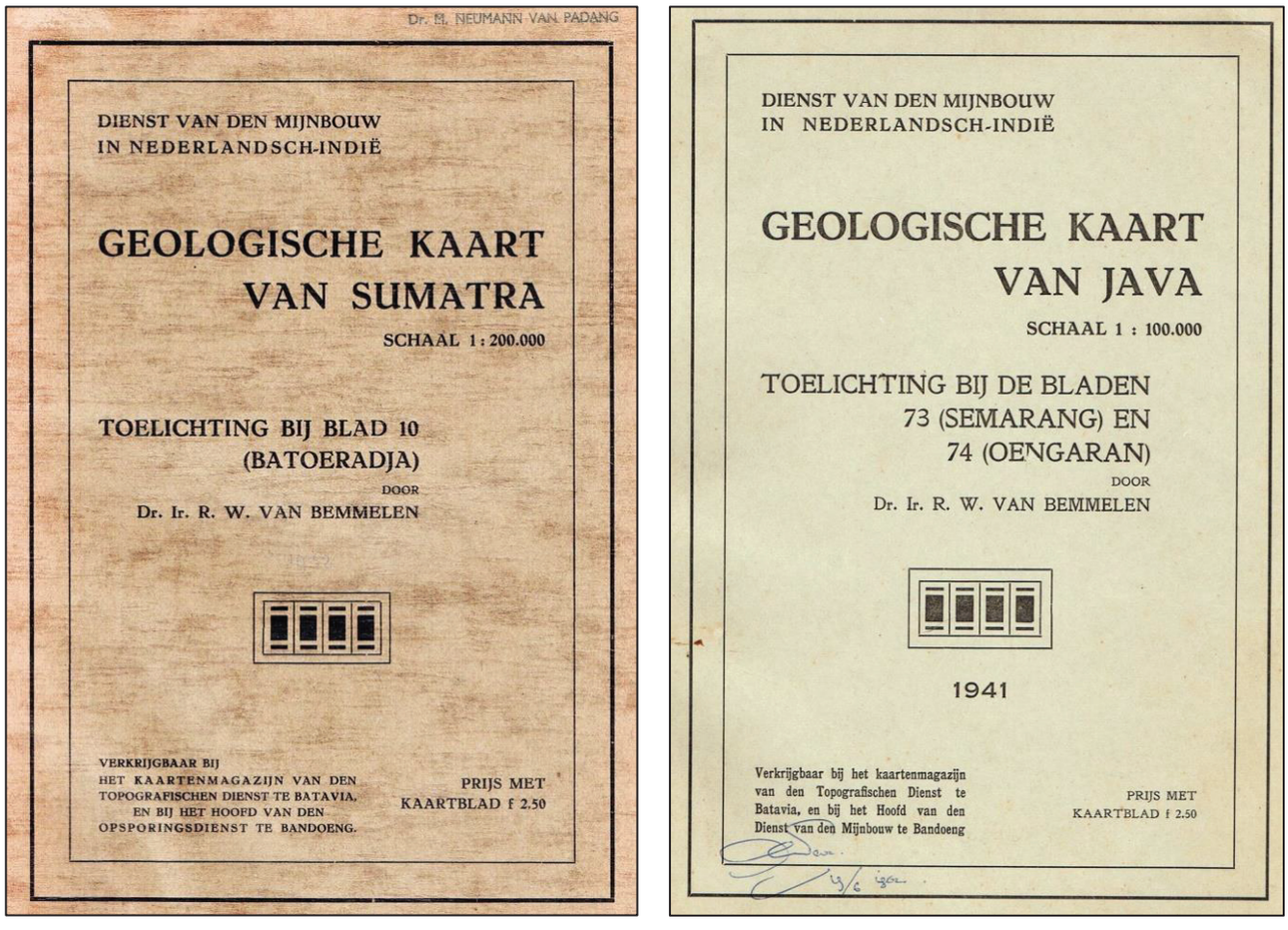


Fig. VII.113. Two of Van Bemmelen's geological map sheets, South Sumatra in 1933 and Central Java in 1941.

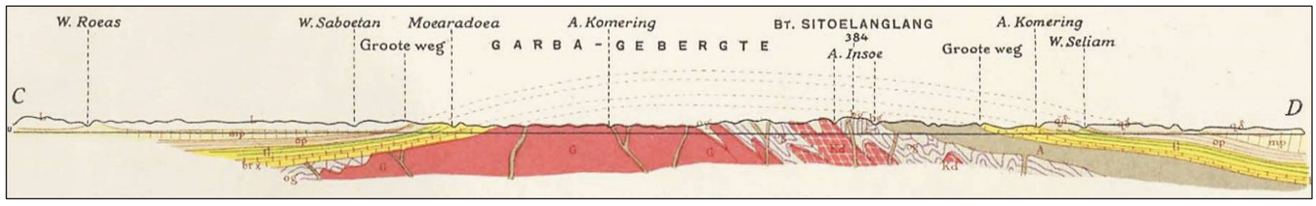


Fig. VII.114. SW-NE geological cross-section C-D, across the young Garba Mountains uplift in South Sumatra, showing a core of Mesozoic granites (G) and Garba Fm. metasediments and basalts (og, bg), unconformably overlain by Oligocene 'Old Andesites' (A) and ~1400m of Miocene sediments (Van Bemmelen 1932).

In December 1930 Van Bemmelen married Ms. Lucie Clara van den Bos in Bandung.

Temporary Leave of Absence, 1934-1936

Due to budget cuts and personnel reduction at *Mijnbouw* during the global financial crisis of the early 1930s, the Sumatra mapping project was halted in December 1933, and was never resumed during the Dutch colonial era. Van Bemmelen was granted 8 months of home leave in the Netherlands after 6 years or service in March 1934. However, instead of returning to the Indies in late 1934 as planned, he was placed on 'non-active status' for budget reasons and was asked not to return to Bandung. He was re-instated on 27 April 1936, more than two years after leaving Bandung. During the two years of forced leave Van Bemmelen studied pedology and soil mechanics at the Technical University of Vienna and embarked on various geologic travels in Europe.

The Java Mapping Project, 1936-1941

After return to Bandung in 1936, Van Bemmelen was re-assigned to the *Java Kaarteering* (Java mapping project), producing three 1:100,000 scale maps: Bandung (1934, unpublished), Karangkobar (1937) and Semarang and Ungaran (1941).

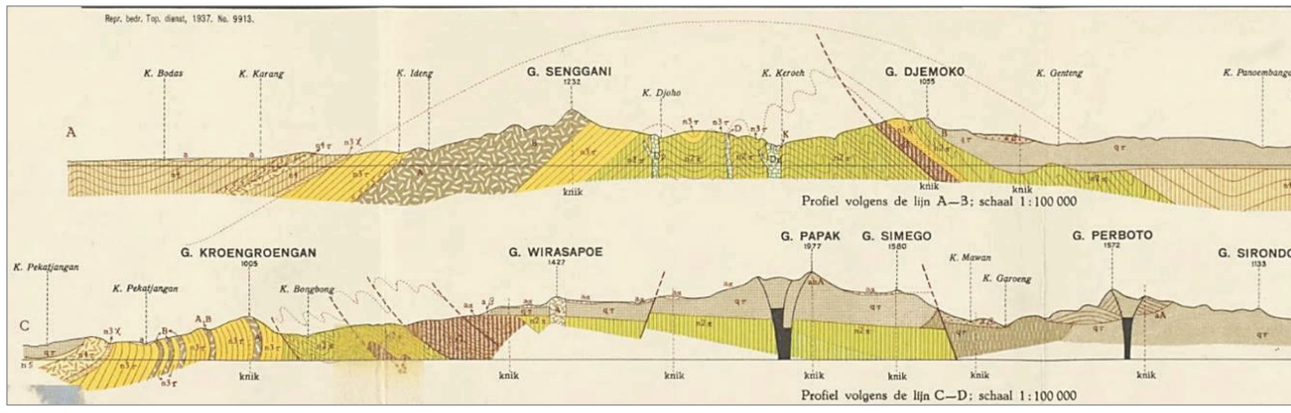


Fig. VII.115. Geological cross-sections in the Karangkobar map sheet, Central Java (Van Bemmelen, 1937, part).

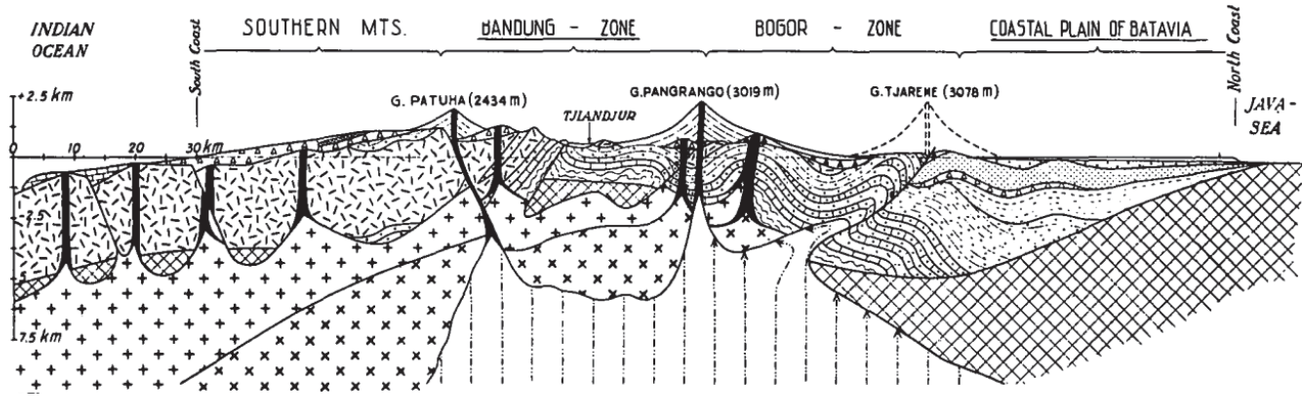


Fig. VII.116. A regional South-to-North cross-section of West Java (Van Bemmelen, 1949). Van Bemmelen was talented in drawing of geological cross-sections and block diagrams, and was not afraid to portray mega-regional interpretations based on limited data.

Head of the Volcanological Survey department, 1941-1942, 1945-1946

Van Bemmelen became Head of the Volcanological Survey Department of the *Dienst van den Mijnbouw* of the Netherlands Indies at two separate occasions. The first time was in July 1941, when he took over from M.E. Akkersdijk, who had briefly held the post since May 1940 when C. Stehn and M. Neumann van Padang were arrested and fired for their alleged German connections. The second time was in late 1945- early 1946, before his repatriation to the Netherlands. During the Japanese occupation, when officially a prisoner of war, he was called to participate in several monitoring trips to the Merapi volcano in Central Java, which went through a period of increased activity.in late 1942- early 1943.

The Japanese occupation, 1942-1945

Just before the Japanese invasion of Java in early 1942 Van Bemmelen was conscripted in the Netherlands Indies Army, where, as a Reserves sergeant he drove military trucks behind the front lines (Van Bemmelen personal account in De Ruiter, 2016, p. 226). After the Dutch surrender, Van Bemmelen became a Japanese prisoner of war on March 26, 1942, but was quickly released (with 6 other geologists-engineers from the *Dienst van den Mijnbouw*) to resume his civilian work with the Geological Survey, but under Japanese guards.

While most other Dutch nationals (especially former officers in the Netherlands Indies Army) were interned in camps, Van Bemmelen managed to continue to work in this old function at the *Dienst van den Mijnbouw* for almost two years (Geological Survey), as a so-called *Nippon worker* or 'trusted prisoner', under Japanese oversight. Most of the prisoners' duties in Bandung were translations of Dutch-language geological reports into English (both from the Geological Survey and from the BPM and NKPM oil companies).

Van Bemmelen went on three monitoring trips to the Merapi volcano in Central Java, in July 1942, April 1943 and June 1943 (Fig. VII.119). Full-time imprisonment in Japanese camps in Bandung and Batavia started for him in October or November 1943. By then most of his colleagues and other Dutch nationals had already been in prison camps for some time.

DIENST VAN DEN MIJNBOUW.

Hoofd van den dienst: Ir. G. J. Wally, 31 Dec. 1941.
Hoofdingenieur ter beschikking. .....

INDEELING.

A. HOOFDKANTOOR VAN DEN DIENST VAN DEN MIJNBOUW TE BANDOENG.

a. Administratie.

Administrateur. Mr. C. A. Thomas.
Commies-redacteur. Mej. L. F. Hendrik.
Kasbeheerder. W. K. Lim, *(wd.)*.
Archivaris. J. J. Bacas.

b. Afdeeling Geologie.

Hoofd van de afdeeling. Ir. W. C. Benschop Koolhoven.
Geologische Kaarteering. Ingenieurs en geologen. Ir. G. Pott; — Dr. C. P. A. Zeylmans van Emmichoven; — Ir. J. G. H. Ubaghs; — Ir. J. Duyfjes; — — Ir. A. H. J. L. van der Burg, *(tw. ingenieur 2e klasse)*; — Dr. S. H. Tan, *(geoloog)*; — Dr. A. L. Simons, *(tw. geoloog 2e klasse)*; — Dr. J. M. Faddegon, *(tw. geoloog 2e klasse)*; — Dr. P. H. Sevensma, *(tw. geoloog 2e klasse)*; — Drs. L. Boomgaart, *(tw. geoloog 2e klasse)*; — Ir. A. H. J. L. van der Burg, *(ingenieur 2e klasse)*.
Geologische ambtenaren 3e klasse. Raden Soenoe; *(tw.)*; — A. F. Lasut, *(tw.)*; — H. A. J. W. van Gorkom, *(tw.)*; — H. Menick, *(tw.)*.
Vulkanologisch Onderzoek. Dr. R. W. van Bemmelen, *(Leider)*; — W. A. Petroeschovsky, *(hoofdopzichter)*.
Paleontologisch Laboratorium. Paleontoloog. Dr. G. H. R. von Koenigswald.
Museum. Hoofdopzichter. E. W. de Kroon.
Teekenafdeeling. Chef-kartograaf. R. F. Swens.

c. Afdeeling Geologisch Technische Onderzoekingen.

Hoofd van de afdeeling. Ir. A. Harting.
Ingenieur. Dr. W. H. Hetzel.

Fig. VII.183. Listing of personnel at the 'Hoofdkantoor' (head office) of the Bureau of Mines in Bandung at the start of 1942 (Regeeringsalmanak, 1942). This is the first time two Indonesians are officially included in the published lists of geological staff, Raden Soeno and A.F. Lasut, both Assistant geologists.

The Japanese Invasion, March 1942

At the Bandung Geological Survey everything changed after the Japanese invasion in March 1942. The Netherlands Indies Army surrendered to the Japanese invading army on 8 March 1942. The offices of the Geological Survey and Museum in Bandung were occupied by the Japanese on 11 March 1942 and this meant the end of Dutch-led geological mapping, surveying and other studies. The main goal of the Japan's invasion of the Netherlands Indies was access to its natural resources, like oil and coal and strategic minerals like bauxite and nickel. The *Dienst van den Mijnbouw* (Geological Survey) now became a vehicle for Japan to obtain information on these resources.

Fig. VII.184. The modified letterhead of the Bandung Geological Survey during the Japanese occupation in 1942. Printing of new stationary was apparently difficult.

The *Dienst van het Mijnwezen* was first renamed *Kogyo Zimushyo* and after 1943 *Chishitsu Chosajo* (Japanese for Geological Survey). For most of the Japanese occupation it was headed by Dr. Nobuo Ikebe, a Japanese micropaleontologist. The Volcanology department was renamed *Kazan Chosabu* and was now headed by a Colonel S. Wada.

Fig. VII.185.
Dr. Ralph von Koenigswald on the steps in front of the Geological Museum in Bandung, around 1943.
The Japanese sign on the building says Dinas Geologi- Chishitsu Chosajo (photo courtesy Geological Museum, Bandung).

All Dutch military personnel (permanent and temporary staff) immediately became prisoners-of-war in March 1942. By October 1942, most other Dutch male civilians had also been interned, except for Dutch nationals 'in critical positions' in Indonesia, who were allowed to remain in their jobs for a while as '*Nippon workers*', under Japanese supervision. These workers had to wear a white arm band with a red ball and Japanese stamps. In several pictures of that era R.W. van Bemmelen is shown wearing the armband (Fig. VII.186). In 1943, in a further tightening of Japanese internment policies, most elderly people, women and children and some of the Chinese and Indo-European citizens were also interned in camps.

Initially some of the Dutch geologisists/mining engineers of the Bureau of Mines continued to work in the office as 'enemy prisoners', under supervision of Japanese soldiers, for 10 cents a day. Most of the work done by these European 'geologist-prisoners' was translation of Dutch geological reports into English. These included Rein van Bemmelen, Ralph von Koenigswald, geochemist W.B.C. (Pim) van Tongeren, J.Th. Kingma, Gerrit Pott (1903-1983), W.C.B. Koolhoven and others.

80. Arie Frederick LASUT (Kapataran, Sulawesi 1918- Pakem 1949)

A.F. Lasut and Soenoe Soemosoesastro were young trainee-geologists at the Dienst van den Mijnbouw when the Japanese invaded Java in 1942. Dutch Leadership at the Geological Survey was removed by the Japanese in March 1942. After the Japanese surrender in August 1945, A.F. Lasut rose to a leadership position. He did not leave much of a geological legacy but was active in training of young Indonesians after 1945 and is viewed as an Indonesian National Hero for his role in the resistance to Dutch return in 1946-1949. Tragically, he paid for this with his young life.

Arie Frederick Lasut (also spelled Lasoet) was born in Kapataran, North Sulawesi, on 6 May 1918. He attended the *Hollandse Inlandsche School* (Dutch-language elementary school) in Tondano. Due to his good academic results, he was selected for the *Hollandsche Inlandsche Kweekschool* teacher academy, first in Ambon (graduated 1933), then in Bandung. A year later he switched to a regular high school (*Openbare Algemeene Middelbare School- B*) in Batavia, where he graduated in June-1937. The next step was the *Geneeskundige Hooge School* (Medical School) in Batavia and the *Technische Hoogeschool Bandung*, but he dropped out of both after one year, reportedly for financial reasons.

HET NIEUWS VAN DEN DAG VOOR NED.-INDIË.

Zaterdag, 9 September 1939.

Mijnbouw.

Werkz. gesteld op maandgeld b/den dienst v/den Mijnbouw H. Menick, thans particulier te Bandoeng, A. F. Lasut, thans tijd. werkz. b/h Departement van Economische Zaken en Raden Soenoe, thans particulier te Soerabaja.

Fig. VII.193. Left: Portrait of A.F. Lasut at young age (Wikimedia). Right: Newspaper notification of the hiring by the Dienst van den Mijnbouw of H. Menick, A.F. Lasut (Lasoet) and Raden Soenoe.

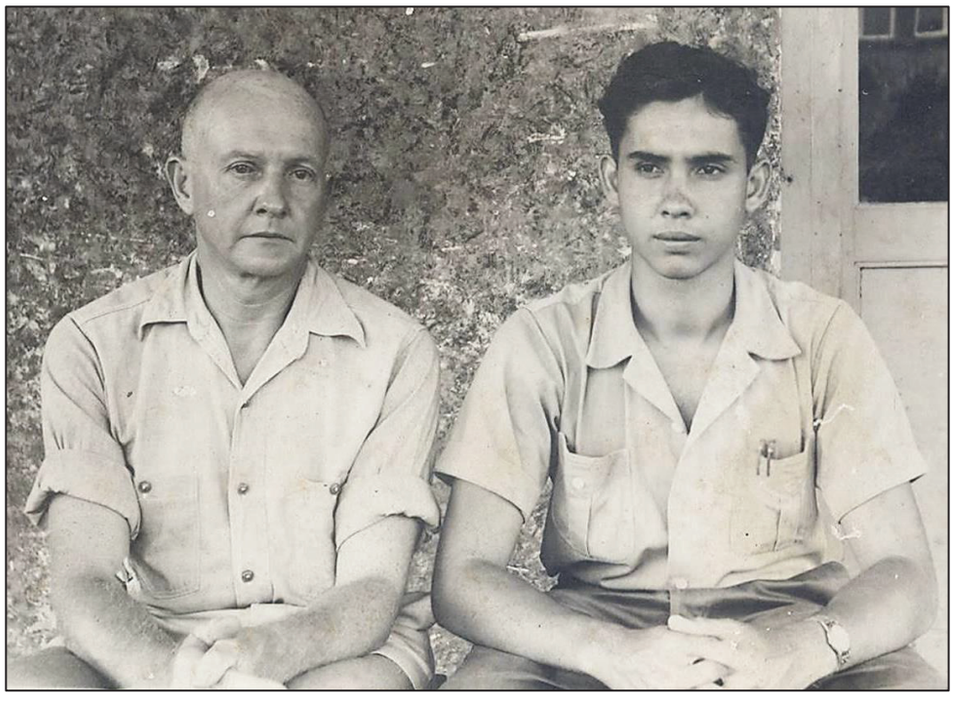


Fig. VII.194. Geological Survey employees Ir. G. Pott and Assistant Geologist Arie Frederick Lasut, during the Japanese occupation in the early 1940s in Bandung (photo courtesy Geological Museum, Bandung).

81. Soenoe SOEMOSUSASTRO (Klaten 1913- Bandung 1956)

Soenoe Soemosusastro (later spelled as Sunu Sumosusastro) was also part of the first group of Indonesians in the training program for Assistant geologist at the Geological Survey in the late 1930s- early 1940s. After Indonesian Independence he briefly became the first Indonesian Head of the Bureau of Mines, from 1950-1952. He returned to university in Bandung for an official geology degree but died before its completion.

Soenoe Soemosusastro was born in Klaten, Central Java, on 5 October 1913. His father was a teacher, who had received an honorary Raden title from the Sultan's palace in Yogyakarta. Soenoe attended the *Hollandsche Inlandsche School*, a Dutch-language elementary school for native Indonesians, the *MULO* and *Algemene Middelbare School*, all in Malang (East Java), finishing in December 1933.

With A.F. Lasut, Soenoe was one of the four participants of the first *Assistant Geologen Cursus* (Assistant Geologist Course) at the *Dienst van den Mijnbouw* (Geological Survey) between 1939 and 1941.

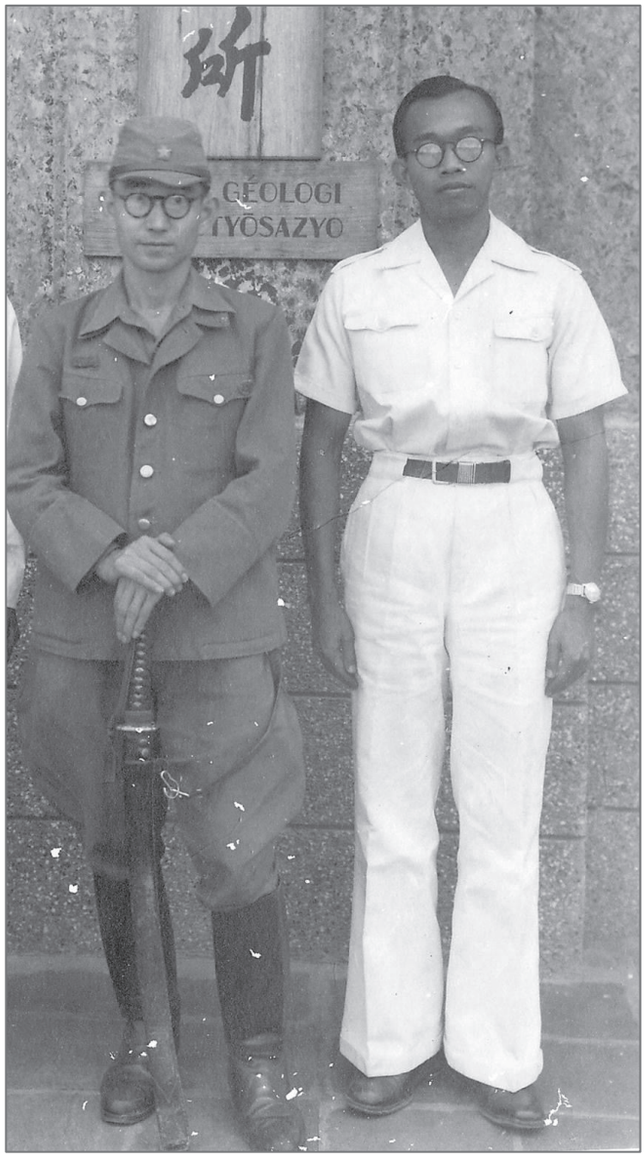
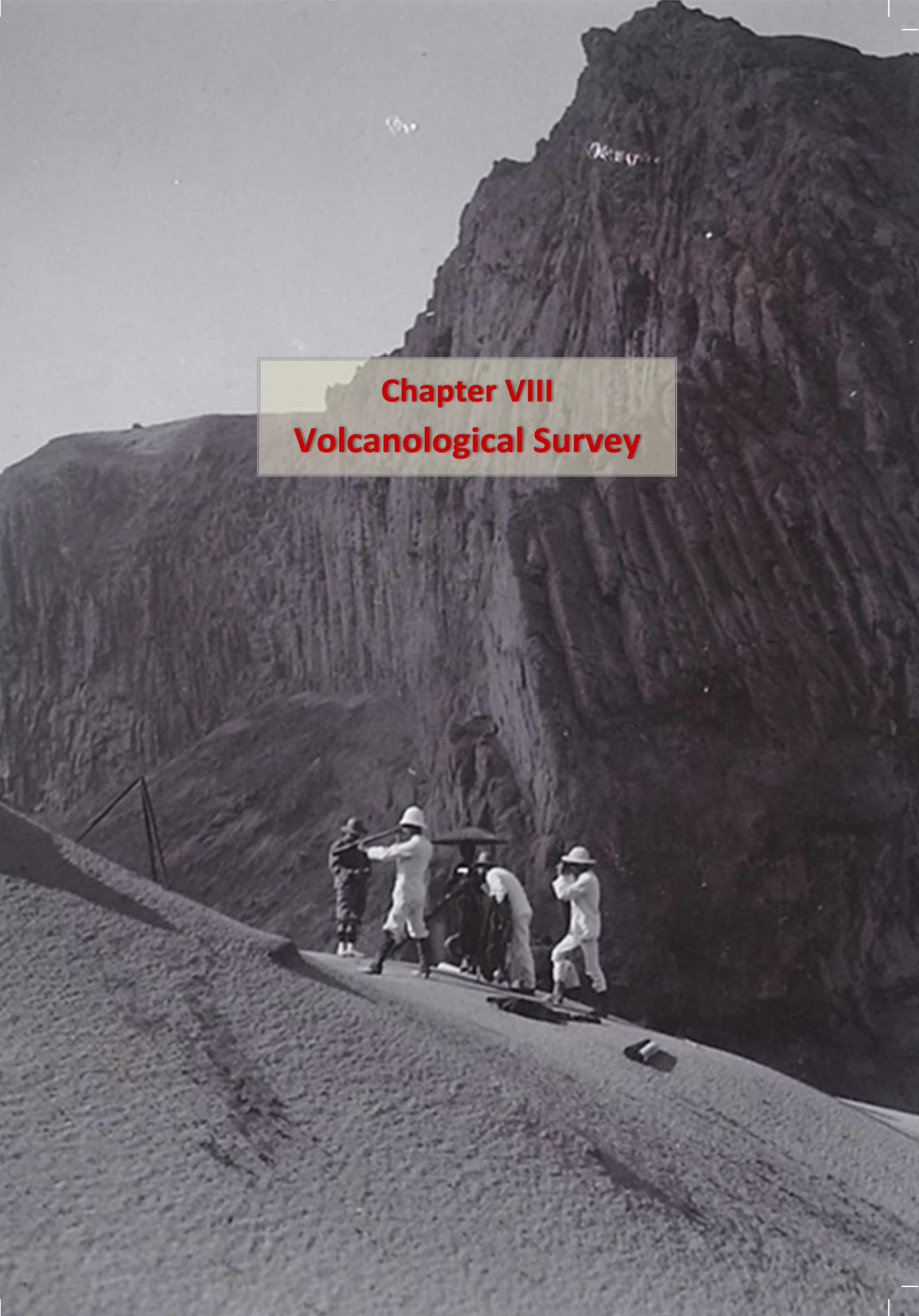


Fig. VII.196.
Soenoe Soemosoesastro at the Geological Survey in Bandung in 1943-1945, with a Japanese soldier guarding the building.
(photo courtesy Geological Museum, Bandung)

Fig. VII.197.
Portrait of Raden Soenoe Soemosoesastro in Bandung (year unknown).

In July-August 1942, when Dutch geologists were interned by the Japanese, but some of them were made to work at the Geological Survey in Bandung, Soenoe and L. Boomgaart teamed up to do one month of geological fieldwork at the North slope of the Muriah volcano in East Java, with the aim of evaluating potash-rich deposits (Dr. G. ter Bruggen teamed up with A.F. Lasut to survey the West slope; Fermin, 1951).

One month after the Japanese surrender, on 28 September 1945, under the assumption that the Japanese were leaving and the Dutch would not return, Soenoe S., A.F. Lasut and others took control of the Bureau of Mines/Geological Survey. However, after the Dutch military regained control over Bandung in early 1946, several of the Dutch former *Mijnbouw* employees also returned and re-assumed leadership.



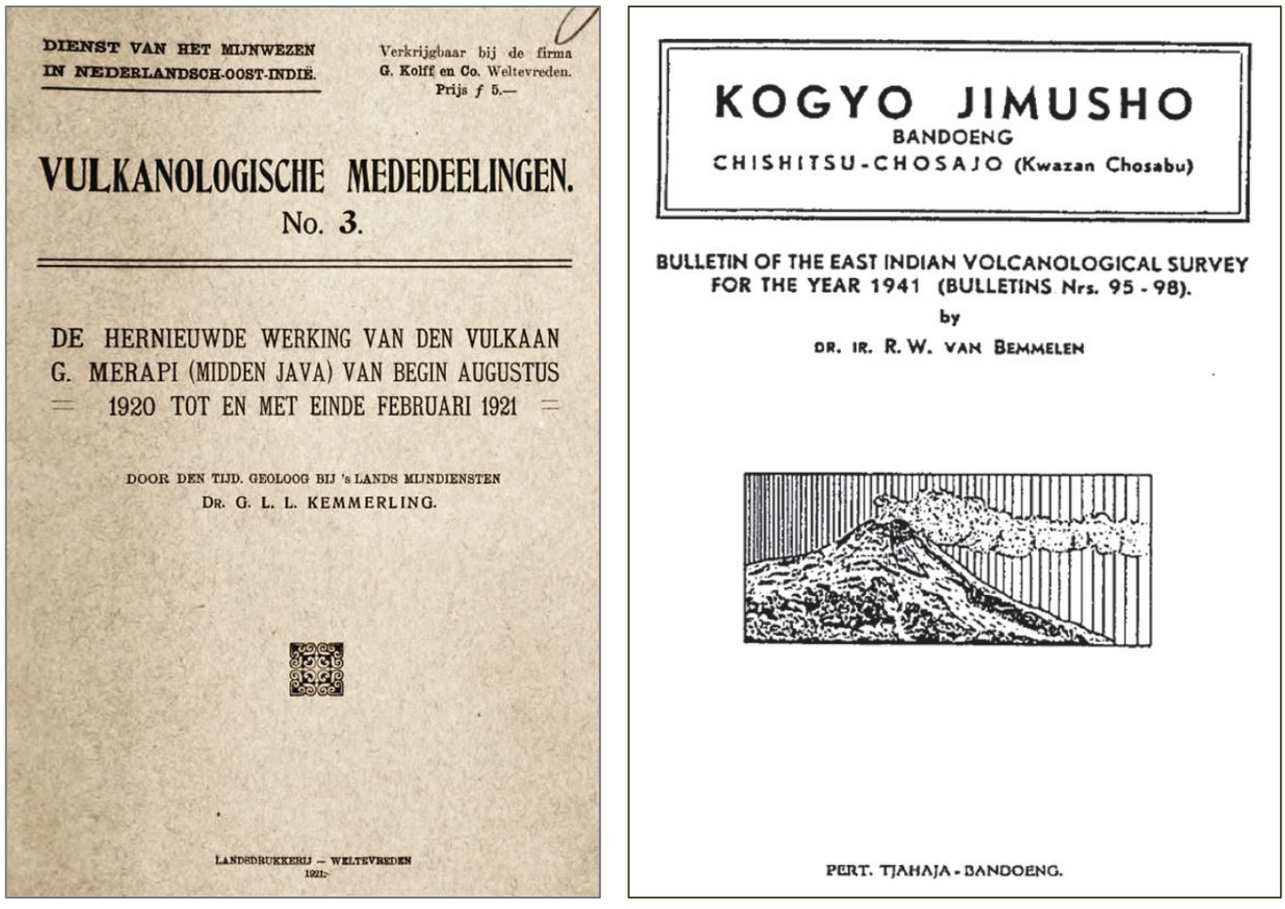
Chapter VIII
Volcanological Survey

The Volcanological Survey of the Netherlands Indies, 1920

In the early colonial days, the monitoring of volcanic and earthquake activities rested mainly with the *Koninklijk Magnetisch en Meteorologisch Observatorium* in Batavia. In 1918, after suggestions by Wing Easton, P. Hovig and B.G. Escher, a 'Volcanological Commission' was formed, tasked with co-ordinating studies of volcanoes and monitoring of volcanic activities.

After the disastrous eruption and subsequent lahars of the Kelud volcano in East Java in May 1919, in which >5000 people were killed, an official government-run *Vulkaanbewakingsdienst* (Volcanological Observation Service) was created as a department within the *Dienst van den Mijnbouw* (Bureau of Mines). It was renamed to *Vulkanologisch Onderzoek* (Volcanological Research) in December 1922.

This group was tasked with both study of volcanoes, the monitoring of volcanic activities and hazard evaluation (see also Kemmerling chapter below). Annual reports of volcanic and earthquake activity in the Netherlands Indies were published since 1921 in the journals *Bulletin of the Netherlands Indies Volcanological Survey* and *Vulkanologische en Seismologische Medeelingen*.


DIENST VAN HET MIJNWEZEN IN NEDERLANDSCH-OOST-INDIË.

Verkrijgbaar bij de firma G. Kolff en Co. Weltevreden. Prijs f 5.—

VULKANOLOGISCHE MEDEDEELINGEN.

No. 3.

DE HERNIEUWDE WERKING VAN DEN VULKAAN G. MERAPI (MIDDEN JAVA) VAN BEGIN AUGUSTUS 1920 TOT EN MET EINDE FEBRUARI 1921

DOOR DEN TIJD. GEOLOOG BIJ 'S LANDS MIJNDIENSTEN DR. G. L. L. KEMMERLING.

LANDSDRUKKERIJ — WELTEVREDEN 1921.

KOGYO JIMUSHO

BANDOENG

CHISHITSU-CHOSAJO (Kwazan Chosabu)

BULLETIN OF THE EAST INDIAN VOLCANOLOGICAL SURVEY FOR THE YEAR 1941 (BULLETINS Nrs. 95 - 98).

by

DR. IR. R. W. VAN BEMMELEN

PERT. TJAHAJA - BANDOENG.

Fig. VIII.7. Left: Cover of No. 3 of the 'Volcanological Reports' series, started by Kemmerling in 1921. Right: The final Bulletin of the 'East Indian Volcanological Survey', prepared during the Japanese occupation (Van Bemmelen, 1943).

b. Vulkanologisch onderzoek te Bandoeng.

Ingenieur 2e kl. Dr. G. L. L. Kemmerling, (*Leider*), (*v.*).
Geoloog 2e kl. Dr. Ch. E. Stehn, (*wd. Leider*).
Ingenieur 3e kl. Ir. M. E. Akkersdijk.
Mijnbouwkundige opzichters 1e kl. A. F. W. Wunsch, (*wd.*); — F. Ecoma Verstege.
Mijnbouwkundig opzichter. W. Petroeschevsky, (*wd.*).
Booropzichter. M. R. Dynowski (*tijd.*).
Mijnbouwkundig opziener 1e kl. E. W. de Kroon, (*wd.*).

Fig. VIII.8. Personnel in the Volcanology Department in Bandung in late 1926 (Regeeringsalmanak, 1927).

84. Berend G. ESCHER (Gorinchem 1885- Oosterbeek 1967)

B.G. Escher worked as a BPM geologist in the Netherlands Indies early in his career, thn became Professor of Geology in Leiden. He wrote several pioneering papers on volcanology and coral reefs/atolls of the Netherlands Indies and came close to 'discovering' the process of crustal subduction under Java in the 1930s, long before it became an integral part of the Plate Tectonics models of the 1960s-1970s.

Berend George (Beer) Escher was born on April 4, 1885 in Gorinchem, as son of a Dutch hydraulic engineer. His mother died two months after his birth. His father remarried in 1892 and in 1898 his famous younger half-brother *M.C. (Maurits or Mauk) Escher* was born, who would become a world-famous graphic designer artist.

Escher grew up in Leeuwarden and went to *Aargauische Kantonsschule* high school in Aarau, Switzerland. He studied geology in Zurich at the *ETH-Eidgenossische Technische Hochschule* (Technical University), as a student of the famous Prof. Albert Heim. He got a doctorate in 1911 with a thesis on Pre-Triassic folding in the Western Alps. After graduating in 1911, Escher became Assistant of Prof. E. Dubois at the University of Amsterdam, and then Curator of geological collections at the *Technische Hogeschool*, Delft.

Netherlands Indies with BPM, 1916-1921

From July 1916 Escher worked in the Batavia office of BPM (Royal Dutch/Shell). He worked on evaluations of areas in NE Java (Rembang zone, 1916), Sumatra, Borneo and Ceram. This is probably when Escher's interest in Netherlands Indies volcanoes, atolls and tectonics started. He repatriated in May 1921 and was replaced by Dr. H.M.E. Schurmann.

In March 1919 he surveyed atolls in the Tukang Besi Islands of SE Sulawesi. Another publication from his oil exploration days was Escher (1920) on the composition of crude oils in the Netherlands Indies. Oils from N and S Sumatra have an asphalt base, and are rich in gasoline, East Kalimantan oils have more paraffin, Tarakan oils are heavy with an asphalt base, while Java oils have paraffin and asphalt base.

Volcano studies

One of Escher's main fields of interest was volcanism and he made significant contributions to volcano studies in the Netherlands Indies. Between 1919 and 1937 he published a series of papers on the Krakatau, Kelud, Galunggung and Merapi volcanoes and on volcanism and caldera formation in the Netherlands Indies in general.

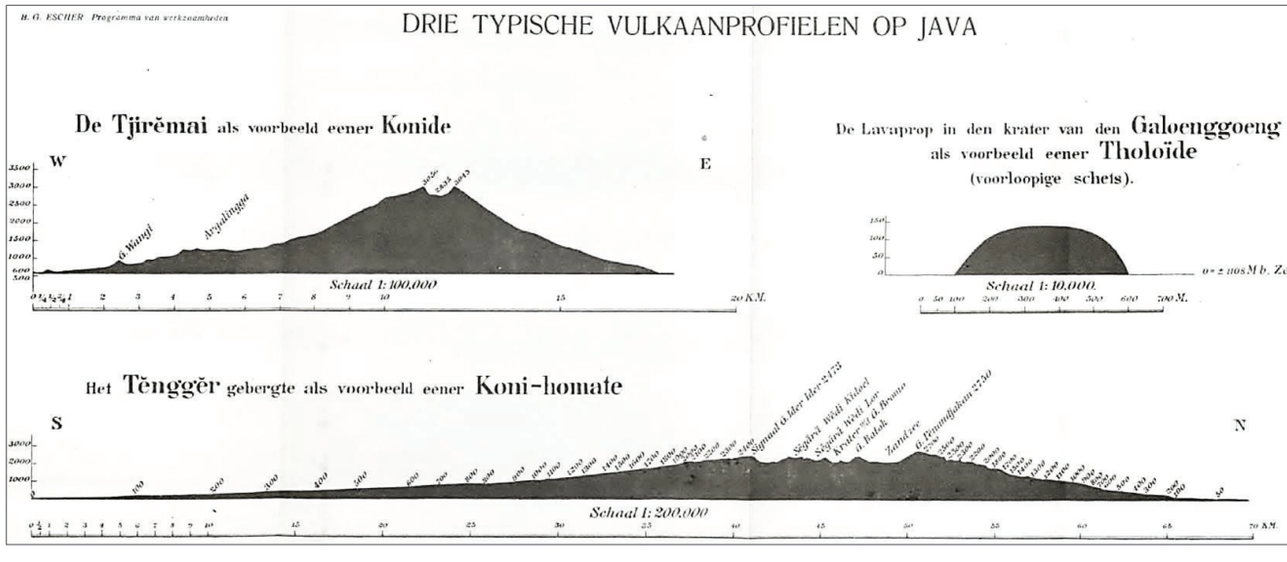


Fig. VIII.25. Examples of three typical volcano profiles on Java (Ciremai, Tengger Mountains and Galunggung lava dome) (Escher, 1919).

In 1918 Escher teamed up with P. Hovig to argue for the creation of a government *Commissie voor Vulkanologie* that would co-ordinate volcano studies and observations, and identify potential hazard risks of volcanoes in the Netherlands Indies (Escher, 1919). He is therefore viewed as a key initiator of the *Vulkaan Bewakingsdienst*, which was created in 1920 within in the *Dienst van den Mijnbouw*, with G. Kemmerling as its first Head. The department was later called *Vulkanologisch Onderzoek* (Volcanological Survey Department).

Close to discovering subduction in the 1930s

In the 1930s Escher was a contributor to the discussions of the significance of Vening Meinesz' belts of negative gravity anomalies and the apparent relationship to the line of volcanoes that ran parallel to it. The cross-sections drawn by Escher in 1931 and 1933 are clearly influenced by Arthur Holmes's theory of Mantle Convection currents, and support Vening Meinesz' initial ideas of significant horizontal movements of crust in the Indonesian region. This was of course criticized by 'fixist' Van Bemmelen (1933 and many other papers), but in these sections of the early 1930s Escher actually came close to discovering the subduction process, an integral part of the generally accepted model of Plate Tectonics of the 1960s (Fig. VIII.35).

The K. Martin memorial volume, 1931

Escher was Chief Editor of the classic milestone volume on the paleontology and stratigraphy of the Netherlands Indies, the *Feestbundel Prof. Dr. K. Martin* (K. Martin commemorative volume). It is a 640-page book that lists of all fossil species recorded from the Indonesian region, organized in 20 chapters by fossil group and age. It is still the only work of its kind (Escher et al 1931; Fig. VIII.36).

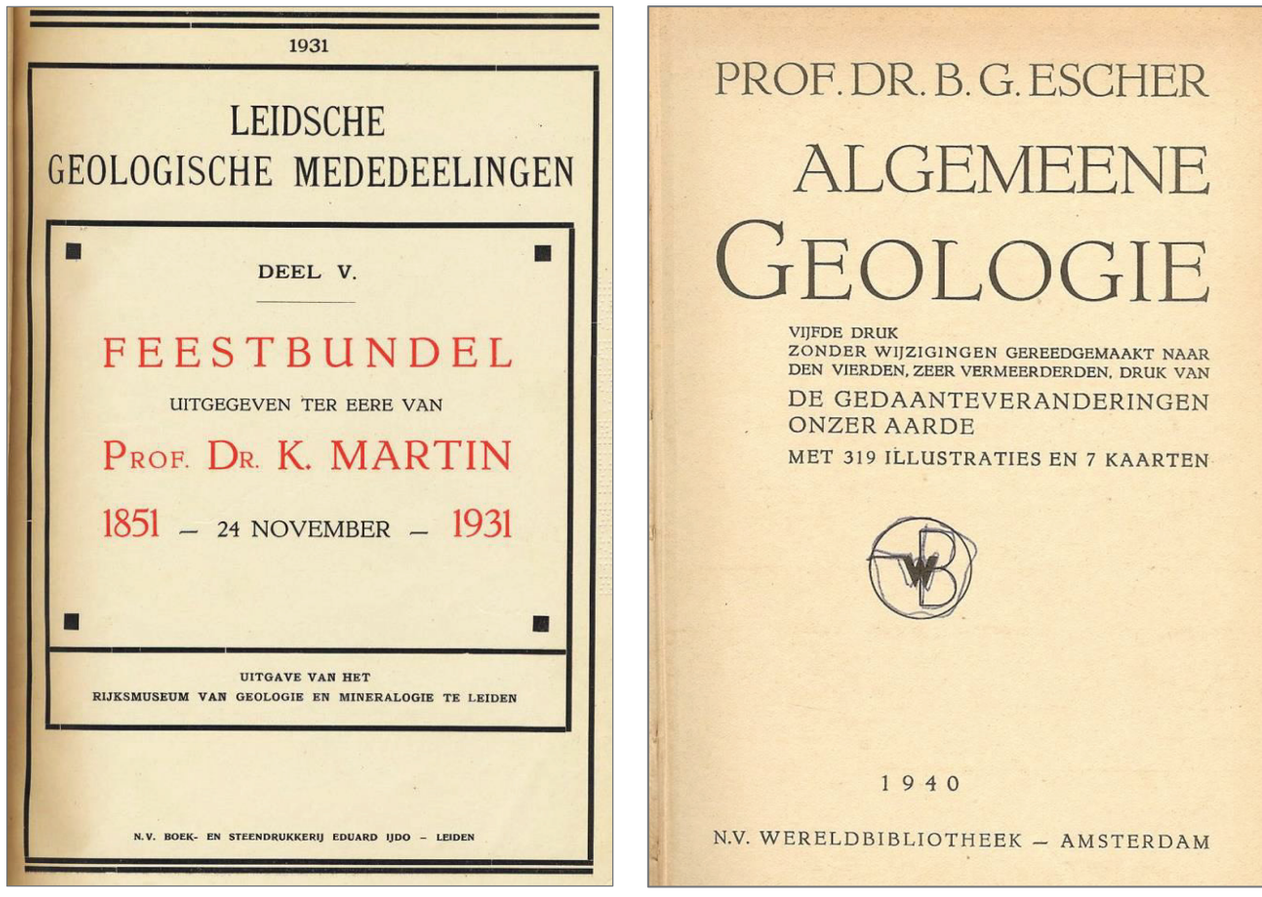


Fig. VIII.36. Left: Cover of the Prof. Karl Martin commemorative volume, edited by B.G. Escher et al. (1931). Right: Cover of Escher's General Geology textbook (1940, 5th edition). The 3rd Edition 'De gedaante veranderingen onzer Aarde' was from 1927.

World War II

During World War II (1940-1945) Escher was one of the professors in Leiden who refused to sign the loyalty agreement that the German Nazis required of University employees. He resigned and after five months in captivity as a hostage in 1942 he went into hiding until the liberation of the southern Netherlands in 1944. In July 1945 Prof. Escher was reinstated and became Dean of the University of Leiden.

In 1955 Prof. Escher retired from Leiden University, moved to Oosterbeek near Arnhem and more or less withdrew from science. He passed away there on 11 October 1967 at age 82.

Escher is author of several successful textbooks, including *Grondslagen der Algemene Geologie* (11 editions between 1916 and 1962, Amsterdam) and *Algemene Mineralogie en Kristallografie* (1935, 1950).

86. Charles Edgar STEHN (Hamburg 1884- Dehra Dun 1945)

C.E. Stehn was 'Mister Volcano' or 'the volcano doctor', the most experienced volcanologist of the Indonesian Volcanological Survey in the 1920s and 1930s. During his 18 years as volcanologist between 1922 and 1940 Stehn made 150 volcanological tours, studied 41 active volcanoes across all of the Netherlands Indies and published 34 papers (Van Bemmelen, 1949). Stehn was probably the best -known geologist/volcanologist in the Netherlands Indies: hundreds of newspaper articles during the 1920s-1930s reported on Stehn's volcano travels and his opinions on hazardous conditions of volcanoes.

Charles Edgar Stehn was born in Altona near Hamburg, Germany, on 10 November 1884. He studied at the University of Karlsruhe from 1905-1910, followed by the University of Bonn from 1911 until July 1914, where he finished with a doctorate under Prof. Gustav Steinmann.

During World War I, from 1914-1918, Stehn served in the German Army as a 'War geologist'. After the war he became Assistant at the University of Bonn from 1919-1921, at first with Prof. G. Steinmann, later with Prof. Johannes Wanner.

Fig. VIII.45. Dr. C. Stehn (center-left), Dr. M. Neumann van Padang (center-right) and Indonesian staff of the Volcanology Department of the Bureau of Mines in Bandung, in the late 1920s or early 1930s (photo Geological Museum, Bandung).

Geologist- Volcanologist in Batavia and Bandung, 1921-1940

C. Stehn arrived in Batavia in November 1921 as Temporary geologist/Volcanologist with the *Opsporingsdienst* of the *Dienst van den Mijnbouw*. Within this was the department of *Vulkanologische Dienst* (Volcanological Survey), which at that time was headed by Dr. G. Kemmerling.

In May 1926, after the departures of Taverne and Kemmerling, Dr. Stehn was appointed as Head of the Volcanology Department. He continued in this role until his misguided arrest in Bandung in May 1940. During this time, he carried out 150 field surveys to 41 volcanoes across all of Indonesia and authored 34 publications (Seibold and Seibold, 1996).

In 1922 and 1928 Stehn studied the stratigraphy of the deposits of the 1883 eruption of the Krakatau volcano in Sunda Straits.

In 1928 he witnessed the first signs of the birth of *Anak Karakatau*, at first as a series of submarine eruptions in 1928 (Fig. VIII.46), then as a new small volcanic island in early 1929 (Stehn, 1929, 1933).

Fig. VIII.46. Volcano monitoring on 'Land Eiland' (Krakatau), in January 1928, to observe the regular submarine explosions in the crater of the Krakatau complex.

Left: C. Stehn (right) and his field assistant F. Ecoma Verstege (left) at the observation post on Lang island.

Bottom left: A telescope and camera to record activities.

Bottom right: A 200m high cloud of steam and ash from one of the submarine eruptions of (Anak) Krakatau (photos C. Stehn, 1928).