

PIONEERS AND MILESTONES OF INDONESIAN GEOLOGY

1-SCIENTIFIC EXPLORERS



J.T. VAN GORSEL

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

1 - Introduction, Scientific explorers

J.T. van Gorsel

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Geological Engineering - Institut Teknologi Bandung
Bandung
2022



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ISBN 978-623-297-201-8

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Printed in Bandung, Indonesia

First Edition 2022

Published and Printed by:



Gedung Perpustakaan Pusat ITB
Lantai Basement, Jl. Ganesa No. 10
Bandung 40132, Jawa Barat
Telp. 022 2504257/022 2534155
e-mail: office@itbpress.itb.ac.id
web: www.itbpress.itb.ac.id
Anggota Ikapi No. 034/JBA/92
APPTI No. 005.062.1.10.2018

Cover Volume 1: View of 'the burning mountain' (probably Banda Api, Banda Sea, Moluccas) in the 1700s, with Dutch sailing ships (engraving by Jakob van der Schley, in the book 'Historic travels across the world' by A.F. Prevost d'Exile, 1747).

PREFACE

This book is dedicated to the many heroic geoscientists and naturalists, who explored remote parts of the Indonesian region and risked their health and their lives in the quest of knowledge.

The first generation knows;
The second generation remembers;
The third generation forgets.

This book is about the *'First generations'* of geologists and mining engineers who worked in the Indonesian region, virtually all of whom have now passed away. Most of them, and their work, are largely forgotten. The author considers himself a member of the *'Second generation'* which still remembers. I met and studied under some of the First generation, and I have been a life-long collector of geoscience publications about the Indonesian region. This book was written for the *'Third generation'*, those who know little about the work of the first generations, which probably includes most of the younger geoscientists today.

This book aims to preserve some of the histories of the pioneering geoscientists and their contributions to the geology of Indonesia, before they are forgotten forever. It is a collection of thousands of very short stories and mini-lessons in geology. It is in four volumes and contains chapters on almost 250 'pioneers', ranging from G. Rumphius to F. Junghuhn, R.D.M. Verbeek, R.W. van Bemmelen and J.A. Katili, as well as many other names that are less familiar today.

The book(s) may be read at different levels, depending on interest. For some, it may merely be a picture book with many interesting historic images. More interested readers will find remarkable and often dramatic personal histories, as well as historic background around new geologic discoveries. Many young geologists may enjoy learning about how geology was conducted before computers. For the most serious readers, who like to pursue additional information on subjects of interest, ample references are provided. After all, the real geological data is in primary sources like original field reports, not in compilations like this or in digitized maps and remote sensing products.

In addition to compiling published data, I also relied on my personal experience with the geology of Indonesia, starting in university in Amsterdam in the late 1960s, and continuing since 1975 with multiple work assignments in Indonesia during my career as a petroleum geologist/micropaleontologist. As a Dutch national, it was no problem reading the older geological literature, which is mainly in Dutch or German. I also had opportunities to access unpublished materials in archives in Bandung, the Netherlands, Germany, Switzerland and Poland, and was able to establish contacts with surviving relatives of several deceased geologists for additional personal information and photographs.

Writing this book has been a full-time effort over the past 2.5 years, since it was first suggested by students of several Indonesian universities, who came to my presentations in September 2018. It was a welcome project to stay productive during the Covid-19 pandemic lockdowns of 2020-2021.

For those wondering why this history is significant, it is good to remember these two famous sayings:
- *"Those who cannot remember the past are condemned to repeat it"* (G. Santayana, 1905);
- *"If I have seen further it is by standing on the shoulders of giants"* (Isaac Newton, 1676).

JTvG, Houston, September 2021

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I. INTRODUCTION

I.1. Introduction and Summary

This book is an introduction to the early history of geoscience of the Indonesian region, described mainly through 238 mini-biographies of early geoscientists, mining engineers and naturalists who made significant contributions to our knowledge. They are placed in historic context, and pictures are painted of the often difficult circumstances in which they had to work. But it is not just a collection of ‘human interest’ stories. Students will find plenty of ‘mini-lessons’ on Indonesian geology and history, and it is hoped that geoscientists in the Indonesian region will be inspired to check some of the ‘classics’ discussed here.

The Indonesian region has long been known as a scientific paradise, which has attracted thousands of Earth scientists, zoologists, botanists, anthropologists, linguists and others. World-class geoscientists from dozens of nations came to study the geology of this large part of SE Asia, which represents the convergence zone of the Asian and Australian continents. It has long served as a present-day model for the tectonic processes that created Earth’s great mountain belts, and played a significant role in the development of prominent tectonic theories such as Plate Tectonics.

Some of the geologic work from the Dutch colonial period was the main source of information for foreign oil and mining companies when they were allowed back in Indonesia after the late 1960s. It led directly to the confirmation of one of the world’s largest copper-gold districts (*Ertsberg, Grasberg*) in West Papua, the large *Pinang* coal deposit in East Kalimantan, oil field discoveries in the Salawati Basin of West Papua, etc.

Many of the foreign geoscientists came to the Indonesian region motivated by scientific interest. Others were seeking financial gain from its economic minerals, coal and oil. Almost all made worthwhile contributions to geoscience in the process. Their histories are full of ‘larger-than-life’ characters, almost all ‘adventurers’, often ‘anti-social’, workaholic, ambitious, proud, but above all, physically and mentally tough men. It took special character and determination to survive the physical and mental challenges during extensive periods of geological fieldwork in remote, and often unhealthy, uncomfortable and hostile areas of the Netherlands Indies. Many lives ended prematurely through tropical diseases, accidents or violence. Several of the specialists discussed in this book never visited the region, but contributed to our knowledge through analyses of rock and fossil samples that were collected here.

This book of *Pioneers and Milestones* may be viewed as the ‘human interest’ and ‘historic background’ companion to (1) the actual geoscience literature of Indonesia (books, journals, maps) and (2) the comprehensive annotated *Bibliography of the geology of Indonesia* (2011-2018) (Fig. I.1). It is subdivided into 4 volumes and 20 chapters (I-XX), with 238 chapters of personal histories and accomplishments of ‘pioneering’ geoscientists, prospectors, miners, entrepreneurs and educators from the early 1800s to the 1960s. For listings of chapters and names of ‘Pioneers’ see the Tables of Contents above.

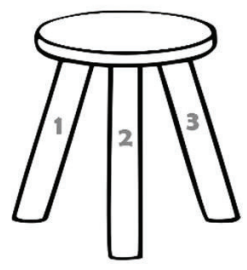
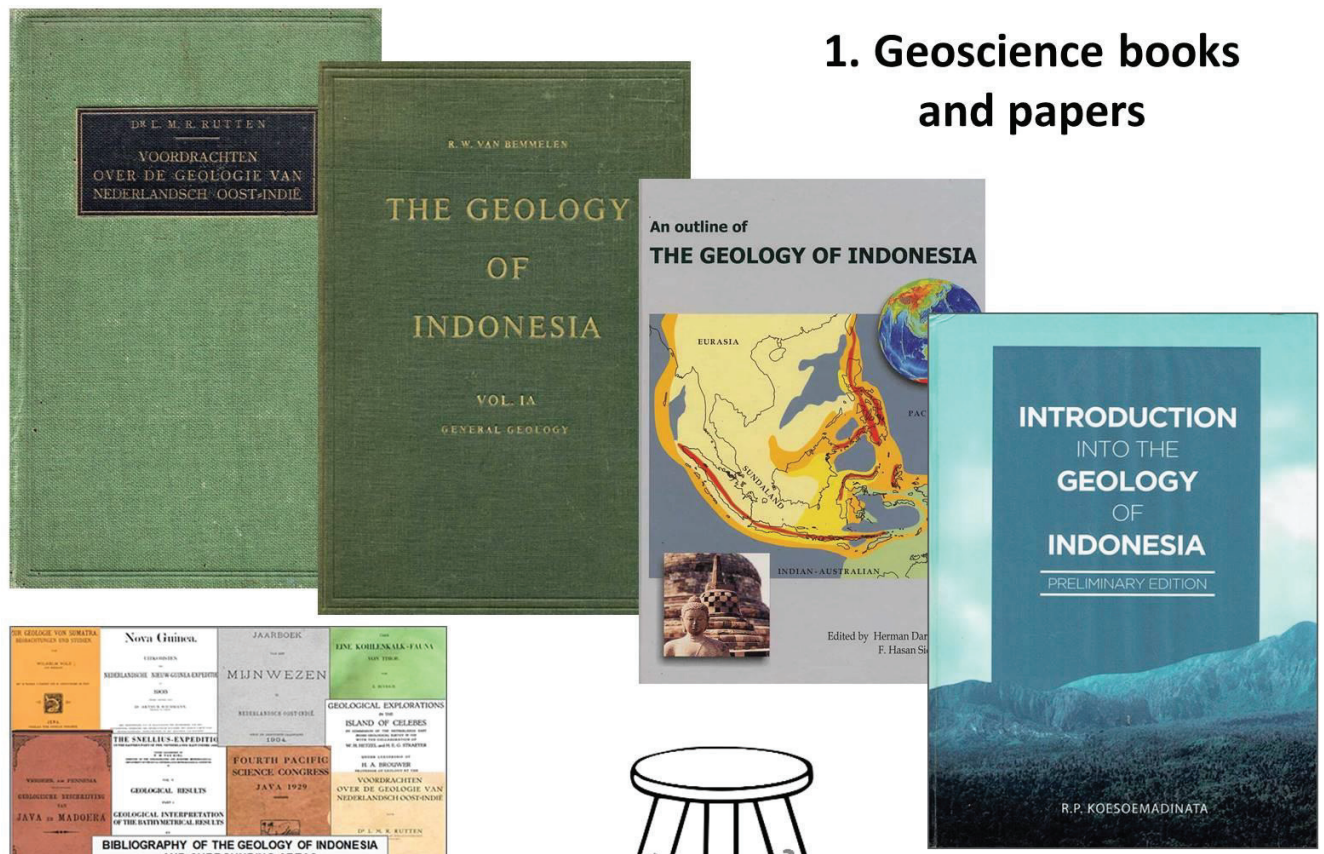
The time period covered in this book

The time period covered in this book is mainly the Dutch colonial period since the early 1800s, when the country was known as the *Netherlands (East) Indies* (or *East Indies* or *Malay Archipelago* in the English-speaking world). It ends shortly after the Dutch-dominated science world was terminated in the late 1950s, after geoscience activities had already been in decline during the economic depression of the 1930s and was interrupted and further diminished during the Japanese occupation and the independence war of the 1940s.

The Dutch-era geoscience heritage in Indonesia ended after the Sukarno government expelled the last remaining Dutch nationals in 1957-1958 and banned the use of the Dutch language. One possibly unintended consequence of this was that most of the geological know-how in Indonesia was also eliminated. Very few of the Indonesian students had completed training in geology at the newly established Department of Geology of the University of Indonesia in Bandung (now *Institut Teknologi Bandung/ITB*), and the non-Dutch foreign replacement professors and industry scientists had little or no prior experience in Indonesian geology (and were generally unable to read Dutch reports without translation). It is probably the main reason why many geoscientists in Indonesia know relatively little of their own early geoscience heritage.

This book ends with brief discussions of the post-Dutch transition period of the 1950s-1960s and of a few of the early pioneers of the post-1960s modern era. The history of the exponential growth of industrial and academic activities in Indonesia since the 1970s needs to be described in a separate book.

1. Geoscience books and papers



2. Literature list



3. History and people

Fig. I.1. Learning about the Geology of Indonesia is like a three-legged stool:
 (1) The actual geoscience literature (exemplified here by 4 key textbooks);
 (2) An inventory of all published literature (Bibliography, www.vangorselslist.com);
 (3) The history of geological discovery and lives of pioneering geoscientists (this book).

II.3. The start of geological investigations in the Netherlands Indies, early 1800s

In the beginning, until the mid-1800s, the knowledge of the geology in the Netherlands Indies was virtually zero. During the two centuries when the Dutch East Indies Company (VOC) operated in the Indonesian region there was little or no official interest in natural sciences of the region, unless it led to some competitive or financial advantage. One of the main reasons was that the Dutch initially had no interest in exploiting the colony's mineral resources, as the Netherlands was traditionally a country of traders, without a history of mining.

Increased interest in the natural history of the Netherlands Indies came when the colony was briefly controlled by Britain (1811-1815), when the Netherlands was occupied by Napoleonic France. During this time Sir Thomas Stamford Raffles and Thomas Horsfield created interest in the archeology, history and nature.

Except for a few of the German and Swiss naturalists of the Natuurkundige Commissie (see Chapter II.3 below), until the mid-1800s there were no academically trained geologists or mining engineers in the Netherlands Indies. This was because:

1. The science of geology was still in its infancy (mining engineering was an older, closely related discipline),
2. Geologic education came to the Netherlands much later than in nearby countries, like Germany, France, Britain and Switzerland. This should not be surprising because there are virtually no rock outcrops and other geological features in the Netherlands, which meant a lack of interest, research opportunities and job prospects.
3. One problem faced by the first generation of mining engineers/geologists that came to Indonesia in the 1850s was that there were no words in the Dutch language for common geological terms and mining engineering concepts (a similar problem existed when geology started to be taught in the Indonesian language in the 1950s-1960s).

Two visiting Austrian and German geologists commented on the state of affairs in Indonesia around 1860:

- Austrian *Ferdinand Hochstetter* came to Java in 1858 as part of the *Novara Expedition*. He visited the *Mijnwezen* office in Buitenzorg (Bogor) and was a guest of its leader, Cornelis de Groot. He remarked that De Groot and his eight mining engineers faced an almost impossible task, surveying a very large territory by a group of people from a country that had no mining industry or culture, and not even had a language with words for practical mining terms. Also, there was no pool of reasonably educated native people that could easily be trained as support staff.
- the famous German geologist *Ferdinand von Richthofen* visited Java in 1861 as part of the Prussian *Ostasiatischer Expedition* and examined some of its geology with Franz Junghuhn. He wrote in his report on the geology of the Indonesian Archipelago (in German): *To my knowledge not a single formation has been properly identified and not a single rock has been studied in detail* (In Bericht uber einen Ausflug in Java, 1862).

3. On some TERTIARY MOLLUSCA from MOUNT SÉLA, in the ISLAND of JAVA. By H. M. JENKINS, Esq., F.G.S., Assistant-Secretary of the Geological Society. With a DESCRIPTION of a new CORAL from
1. Bibliography of Javan Geology.—Until very recently the Island of Java, notwithstanding its having been a Dutch colony for more than a century and a half, was almost a *terra incognita* to the geologist, the only familiar fact relating to its geology being that it possessed a large number of volcanos, some of very great size. Even now, very little has been published concerning its geology and palæontology, although several collections of rocks and fossils have been brought or sent from thence to Europe.

Fig. II.6. British geologist H.M. Jenkins in 1864 in the *Quarterly Journal of the Geological Society of London*, lamenting the lack of geological knowledge of the Netherlands Indies.

Still, by the late 1800s all that was known of the geology of the Indonesian region was that there were volcanoes, and that there were some areas with Tertiary sediments on Java, but >90% was still 'blank' territory (Fig. II.7).

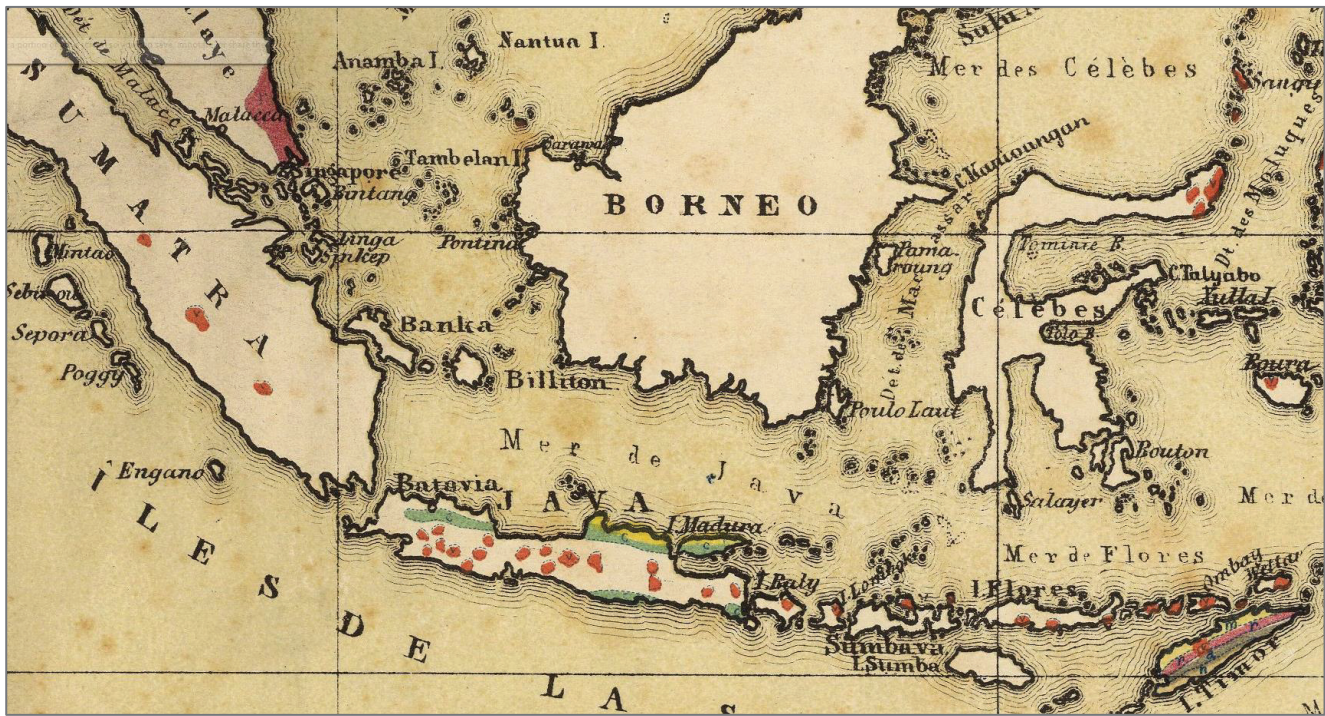


Fig. II.7. Until the mid-1800s the geology of the Indonesian region was mostly unknown, as depicted by the white areas on this Geological map of the World, 8 (J.M. Ziegler, Zurich 1875).

So, before the late 1800s, the only interest in rocks was when they were of interest for mining of economically or strategically valuable minerals like gold, silver and coal. The *Dienst van het Mijnwezen van Nederlandsch Oost Indie* (Bureau of Mines, Geological Survey) was created in 1850, and for many decades was staffed exclusively by Dutch mining engineers, with limited geological backgrounds (or interest). They also had a clear mandate to focus on practical work of potential economic interest, not scientific investigation. Nonetheless, useful geologic observations were made by these mining engineers during the 1800s coal and mineral exploratory surveys.

Geology as a profession was not really practiced in the Indonesian region until around 1900. Prior to that, the only geologic mapping worthy of the name was by Rogier Verbeek in the late 1800s. The 'glory days' of geological mapping and surveying in the colonial period were between ~1910 and 1932. Most of it was associated with the *Dienst van het Mijnwezen* (Bureau of Mines), especially after the formation of a Geological Service Department in 1922 and the move from Batavia to state-of-the-art facilities in Bandung.

During the 1930s, geological mapping programs were much reduced due to budget cuts triggered by the global financial crisis. Then everything came to a nearly complete halt from 1941 until about 1970, from the Japanese occupation through the first 20-25 years of the Republic of Indonesia.

Challenges of early geologists/mining engineers

The conditions of geological reconnaissance/surveying fieldwork in the Indonesian region 100-170 years ago were very different from today:

- In the 1920s more than 90% of the country outside Java was covered with primary jungle (Rutten, 1927); today it is probably less than 20%;
- Roads, bridges and other transportation infrastructure were much less developed than today. Travel by plane or helicopter was not an option;
- Topographic maps and aerial photos did not exist for many regions; traverses and geologic maps of areas of interest had to be surveyed by the explorers themselves;
- Many local tribes had not been 'pacified';
- Potentially dangerous wildlife was more common;
- Medication and prevention against infections, malaria and other diseases was much less advanced;
- Lightweight waterproof camping gear and clothing were much less developed;
- Communication equipment like radios and telephones were virtually non-existent.

Geologists in those days therefore had to be mentally tough and in excellent physical health, to survive the sometimes months' long fieldwork in remote, rugged, uninhabited terrain. Needless to say that most of the successful geologists of the early days possessed these characteristics.

Life expectancy of the early explorers

Many of the European geological explorers and surveyors gave their lives in 'The Indies' and never returned to their homelands. Premature deaths were caused by:

1. Tropical diseases (Akkeringa at age 35 from typhoid contracted in Borneo, Schwaner presumably from malaria, etc.); Between March and May 1922 three young mining engineers, all hired by the *Dienst van het Mijnwezen* in 1912, died of tropical diseases: Dr. Ing. W. Dieckmann (Martapura), Ir. G.W. Mallee (Amsterdam) and Ing. H.G. von Steiger (Tarakan).
2. Accidents (R. Fennema drowned on Poso Lake in Sulawesi, W.H. de Greve Sr drowned in the Indragiri River in Sumatra, etc.);
3. Native hostilities (murder of naturalist Macklot in 1832 in West Java at age 32. In the Banjarmasin district of SE Kalimantan all *Mijnwezen* personnel associated with the coal mines were killed during a local uprising in 1881. Etc.
4. But by far the highest numbers of deaths of European geoscientists occurred during the Japanese occupation in 1942-1945 and the '*Bersiap* period' of late 1945-1946.

Professors of geology and mining engineering in the Netherlands in the early 1900s therefore warned their students that a career in 'the Indies' was likely to reduce their life expectancy.



Fig. II.8. An old drawing of near-vertical beds of Early Miocene limestone at Gunung Bongkong, Rajamandala area, West Java (Martin, 1911).

The main periods in Indonesian geology and related sciences are:

1. 1600s- 1700s: the period of the VOC: no interest in natural sciences, except Rumphius;
2. Early-1800s: start of the time of naturalist explorers and global oceanographic expeditions;
3. 1850- ~1895: start of survey activities of the newly established *Bureau van het Mijnwezen* (Bureau of Mines), while the Netherlands Indies government gradually expanded control of territories outside Java. Although focused on coal and economic mineral evaluations, the first significant geologic studies were conducted, in particular by R.D.M. Verbeek;
4. Around 1895: start of ‘gold rush’ in all parts of the Netherlands Indies, triggering an acceleration in geological survey activity in response to demands from minerals and petroleum industries. Also an increase in pioneering academic geological expeditions to territories outside Java;
5. 1905- early 1930s: a period of significant expansion of geological mapping and studies, with many new hydrocarbon and metals discoveries. A systematic mapping program of Sumatra and Java was started by the government geological survey in the 1920s. There was an increase in industry, government and academic reconnaissance surveys into Eastern Indonesia and New Guinea. The 1920s and 1930s were probably the most productive and most prestigious period for geoscience during the colonial era;
5. Early 1930s- 1958 decline and end of the Dutch colonial geoscience in Indonesia. Survey and research activity started to slow significantly during the Great Depression of the 1930s, but came to an almost complete standstill between 1941 and 1949 (World War II, Indonesian Revolution years);
6. 1950-1970: very low levels of geoscience research and publishing. A slow but promising restart of geoscience education and research in the early 1950s was terminated in 1958 when the government of the Republic of Indonesia cut the last remaining Dutch influence by nationalizing Dutch-owned businesses, banning Dutch language publications, and expelling all Dutch nationals;
7. 1970-2018: A coup by the Indonesian military in the late 1960s led to the re-opening of the country to foreign investment, and triggered significant increases in exploration and research, and an exponential growth in resource-related and academic geological publishing after 1970.

Geosciences during Early Independence and after the 1950s

The last of the ‘old school’ geoscientists discussed in this book were active during the 1950s and 1960s, i.e., until the last of the Dutch geologists that were still around were forced to leave Indonesia in 1958 (mainly due to the conflict over West New Guinea, which was still under Dutch control). A very small group of first-generation Indonesian geologists was tasked with rebuilding the geoscience education system and support industrial exploration and exploitation.

The late 1950s and 1960s were economically and politically challenging times in Indonesia and, not surprisingly, were a low point in geoscience research of Indonesia. Much of the Dutch/European know-how and experience had died or left, due to the developments in the 1940s and 1950s, and a handful of young Indonesian geologists with relatively little experience were left to rebuild what was once an internationally respected ‘powerhouse’ of geology and geophysics.

Much progress has been made since the 1960s, but this part of the history of Indonesian geology and geologists since the 1960s is for someone else to write (see also Volume 4).

Diversity (or lack thereof)

From today’s perspective it may seem remarkable that virtually all ‘Pioneers’ in this book are (1) white, (2) European (and two Americans and one African-Dutch), and (3) male. Females were deemed unsuited to the hardships and dangers of geological fieldwork. The four females discussed in this book are all paleontologists.

A remarkable, if not embarrassing, fact is the absence of native Indonesian academically-trained geoscientists during the Dutch colonial era (except Chinese-Indonesian Tan Sin Hok).

III. THE EARLY NATURALIST EXPLORERS (1600s- 1800s)

III.1. Overview

Before ~1870 there were no true academically-trained geologists in the Netherlands Indies (or in the Netherlands for that matter). However, there were various medical doctors, biologists and chemists that worked as 'naturalists', and investigated the plants and animals of the Netherlands Indies, but also often made some notes on geography, volcanoes, occurrences of coal and minerals, and on rocks and fossils.

During the first two centuries of Dutch presence in the Indonesian region, they virtually ignored its natural world, unless it could deliver products of commercial interest. One of the few western naturalists in the Netherlands Indies during the time of the *Vereenigde Oostindische Compagnie* (VOC) was G. Rumphius in the 1600s, a VOC merchant in Ambon. Rumphius' work was supported (or tolerated) by the VOC, because they realized that it might lead to the discovery of plants that could be useful for medicinal or other purposes.

The 1800s and early 1900s became the 'golden age' of naturalists, traveling on lengthy expeditions to virtually all unexplored regions of the globe, many of them inspired by the travels of the German naturalist Alexander von Humboldt in the Americas in the early 1800s.

In the early 1800s naturalists started to journey into many of the remote regions of the Netherlands Indies, probably partly inspired by two naturalists that were active on Java during the 'British Interregnum' from 1811 until 1816: (1) British Governor Thomas Stamford Raffles (*The history of Java*, 1817) and (2) American surgeon Thomas Horsfield (*The natural history of Java*, 1817).

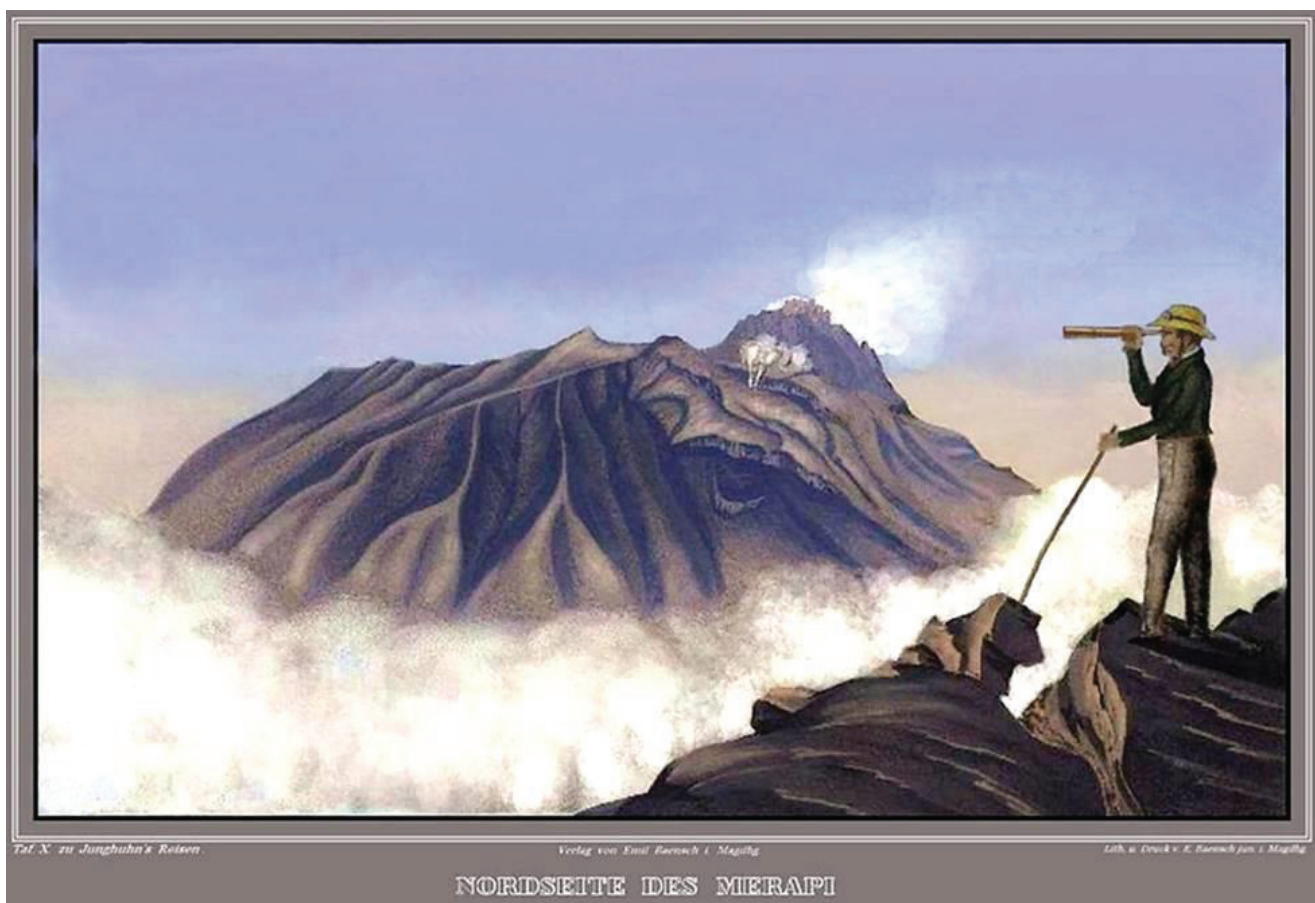


Fig. III.1. The Merapi volcano in Central Java, seen from the Merbabu volcano in the North (Junghuhn, 1845). This is one of several 'romanticized' lithographs made from a Junghuhn sketch, with Junghuhn himself added into the scene).

Remarkably, most of the early naturalist explorers in the Netherlands Indies were German and Swiss nationals. Most of them were sponsored by the *Natuurkundige Commissie in Oost-Indie* (Commission of Natural Sciences in the East Indies) *Commissie* members were tasked with collecting plant, animal and rock specimens for the *Rijksmuseum van Natuurlijke Historie* (National Museum of Natural History) in the early and mid-1800s. The

1. Georg E. RUMPHIUS (Hanau, Germany 1627- Ambon 1702)

German-born Georg Rumphius was the first to engage in systematic studies of the natural history of Indonesia in the 17th century. He was a merchant of the V.O.C. (Dutch East Indies Company) and a self-taught naturalist (primarily a botanist), who was stationed on Ambon from 1654 until his death in 1702 and spent most of his time describing the natural world of Ambon and surrounding islands. This included some of its rock formations and fossils, so he has also been called 'the first geologist in the East Indies'.

Georgius Everhardus Rumphius, whose original name was *Georg Eberhard Rumpf*, was born in late 1627 in Wolfersheim, North of Hanau in Hessen (now SW Germany). He mastered Latin and Greek at young age, attended the *Gymnasium* (a hybrid between a high school and university) at Hanau, probably from 1639-1644 (Buijze, 2006).

In 1645, Rumphius was recruited as a mercenary soldier for the Venetian army. However, the ship he embarked on first headed to Brazil and was intercepted by Portuguese pirates. Rumphius temporarily ended up in Portuguese military service for three years, and this is where he first learned of the remarkable natural world of the *East Indies*.

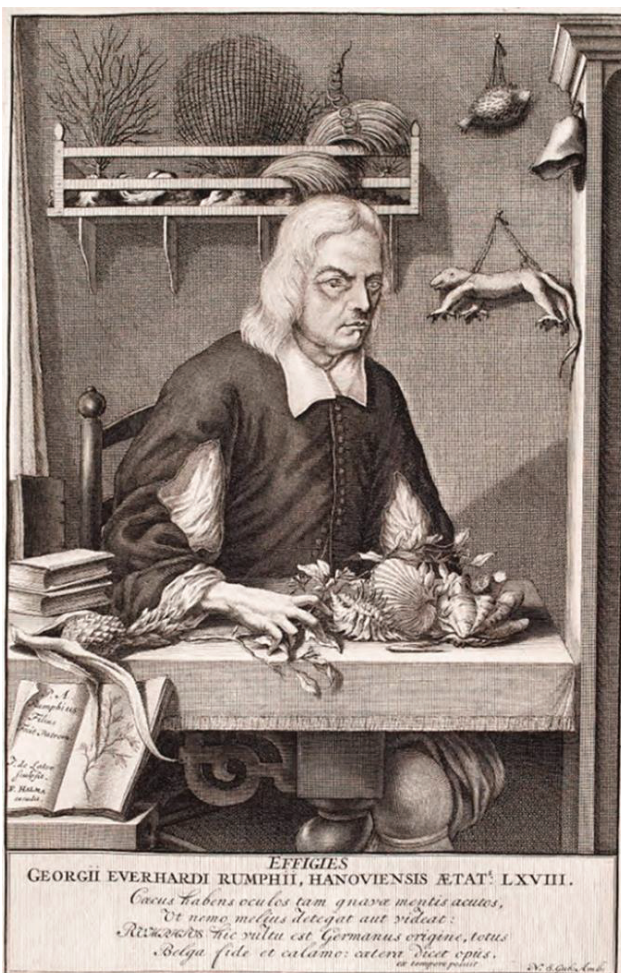


Fig. III.2. Portrait of Rumphius at work in Ambon, reportedly drawn from life by his son Paulus in 1696.



Fig. III.3. First page of volume 3 of the 'Rariteitkamer' (1705), on 'minerals, rocks and other rare objects'.

To the East Indies as VOC employee, 1652

After returning to Hanau some time after 1649 Rumphius enlisted as a midshipman for the VOC in December 1652. He arrived in Batavia in July 1653, and was assigned to the garrison at *Kasteel Victoria* on Ambon Island, where he arrived in late 1653 or in 1654. Rumphius would spend the rest of his life on Ambon.

For the first 3-4 years Rumphius was a military engineer for the VOC, engaged in the construction of fortifications, etc., but in 1657 he was accepted in civilian service of the VOC. Initially he was *Onderkoopman* (merchant/agent), based in Laricke (SW Ambon). From 1660-1670 he was *Koopman* in Fort Amsterdam in Hila (NW Ambon). After he became virtually blind in 1670, he lived in Ambon City.

III.2. The British Interregnum (1811-1816)

In 1811, towards the end of the Napoleonic occupation of the Netherlands from 1795 until 1815, the British took control of Java and other Dutch-controlled parts of the East Indies. The territories of the East Indies were officially returned to the Netherlands in 1816.

From a scientific point of view, the British took better care of the East Indies colony than the Dutch merchants had until then, especially during the long period of neglect in the final decades of the VOC in the late 1700s.

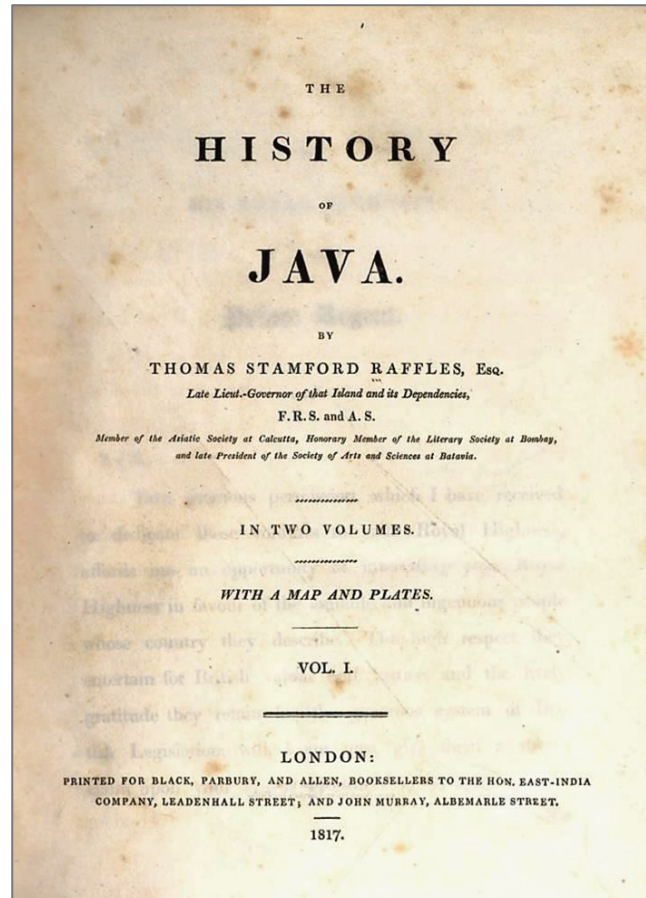


Fig. III.10. Portrait of Sir Thomas Stamford Raffles, as Lieutenant Governor of the British enclave of Bengkulu in 1819.
Fig. III.11. Cover of the well-known book by Lt. Gov. T.S. Raffles (1817) on the cultural and natural history of Java.

The British Lieutenant-Governor of Java, Sir *Thomas Stamford Raffles* (1781-1826), governed the Netherlands Indies from 1811-1816. He rekindled interest in the archeology, history, and the natural world of Java with his book *The History of Java* (1817; Fig. III.11). Under his guidance, a first cataloguing of ancient Hindu and Buddhist antiquities on Java took place. At the same time Raffles supported American physician-naturalist Thomas Horsfield in his pioneering studies of the botany, zoology and geology of Java.

Besides being a patron of science, Raffles-the-Administrator was also an empire builder. During his few years on Java, he fielded military expeditions to break the power of local rulers, like the Sultan of Yogyakarta (assault of the craton of Yogyakarta by British troops in 1812) and the Sultan of Palembang (wresting control of Bangka Island and claim it for Britain). Today, Sir T.S. Raffles is best known as the Founder of the British settlement of Singapore in 1819.

2. Thomas HORSFIELD (Bethlehem, USA 1773- London 1859)

Thomas Horsfield was the first American scientist to work in SE Asia in the early 1800s and the first naturalist to travel across Java and study many of its rocks. He is known mainly for his pioneering work on the botany, zoology and geology of Java and Bangka Island, before and during the British Interregnum. He was trained as a physician, but had a broad interest in the natural world.

Thomas Horsfield was born on 12 May 1773 in Bethlehem, Pennsylvania, USA (at that time was still *British North America*). He received a medical degree at the University of Pennsylvania in 1798, with a thesis on the toxic effects of the poison ivy plant. This started his interest in plants, especially plants with medicinal properties.

In October 1799 Horsfield started work as a ship surgeon on the American merchant ship *China*, on which he made his first brief visit to Batavia in 1800. In 1801 he returned to Java, now as a surgeon in the Netherlands East Indies Army in Batavia.

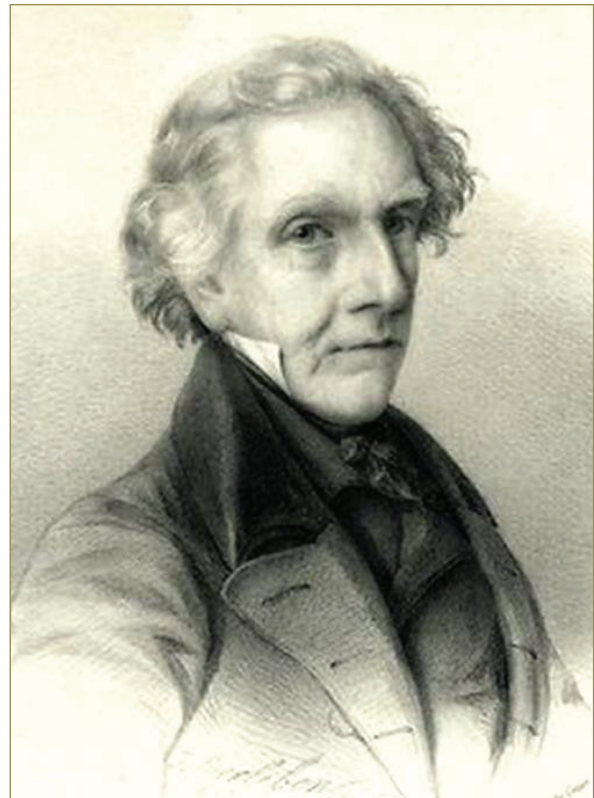


Fig. III.14. Left: T. Horsfield as a young naturalist (www.currentconservation.org/issues/thomas-horsfield-1773-1859/).

Fig. III.15. T. Horsfield later in life, probably in London in the 1840s (National Portrait Gallery, London).

Java studies, 1801-1815

From 1801 to 1819, Horsfield traveled extensively in various parts of the Netherlands Indies, initially during his employment as a government physician. During this time, he further developed his interests in the natural world.

After 1804, the *Bataviaasch Genootschap van Kunsten en Wetenschappen* (BGKW; Batavian Society of Arts and Sciences) provided Horsfield with financial assistance for his natural history travels, and drafting assistance for botanical drawings. His mission for the BGKW was to study the flora of Java, especially species with medicinal properties. During this time Horsfield produced the first botanical descriptions of over 60 medicinal plants of Java and assembled an extensive herbarium collection of 2196 plant species from Java, mainly of mountain flora.

During the British interregnum of 1811-1815 Horsfield developed a relationship with Governor Sir Thomas Stamford Raffles, who hired him to work for the English government to study the natural world and potential resources of Java and later also on Bangka Island. On the advice of Raffles, the herbarium that Horsfield had assembled during his previous years of sponsorship by BGKW, and which was expected to become part of the BGKW collections, was sent to the Linnaean Society of London instead in 1811.

4. Salomon MULLER (Heidelberg 1804- Freiburg im Breisgau 1864)

Salomon Muller (officially spelled Müller) was one of the German naturalists, who traveled extensively through many remote parts of the Netherlands Indies between 1826 and 1837. He discovered coal deposits in SE Kalimantan and identified the different zoogeographic provinces of the eastern and western Indonesian Archipelago before A.R. Wallace (mainly famous for his Wallace Line).

Salomon Muller was born in Heidelberg in April 1804. He was trained as a zoologist (mainly ornithology) and botanist.

Naturalist in the Netherlands Indies, 1826-1837

Salomon Muller arrived in Batavia in June 1826, together with two fellow naturalists from Heidelberg, Heinrich Boie and Heinrich C. Macklot, all as members of the *Natuurkundige Commissie in Nederlandsch-Indie*. Muller was originally hired to be a *Preparateur*, but, as more and more of his colleagues died, he became an independent naturalist. They were tasked by C.J. Temminck, the Director of the Leiden Museum of Natural History, to collect plant and animal specimens in the Netherlands Indies for the museum.

Salomon Muller's travels focused on ethnography, botany, zoology and geography, and unfortunately contained little geologic information, although he may be credited with the discovery of coal in SE Borneo (Muller 1844), and he reported on (uneconomic) gold and copper occurrences on Timor (Wichmann, 1902).



Fig. III.34. View of the deck of the corvette Triton on its journey to New Guinea in 1828 (painting by P. van Oort, after an engraving in Salomon Muller 1844) (Navy Museum, Den Helder).

(www.maritiemdigitaal.nl/index.cfm?event=search.getdetail&id=103002064).

Between 1828 and 1830 Muller and Macklot traveled as members of the *Natuurkundige Commissie* with the expedition to the SW coast of New Guinea (1828) and Timor aboard the navy corvette *Zr. Ms. Triton*, for zoological, ethnologic and geographic studies of then unexplored parts of the Netherlands Indies.

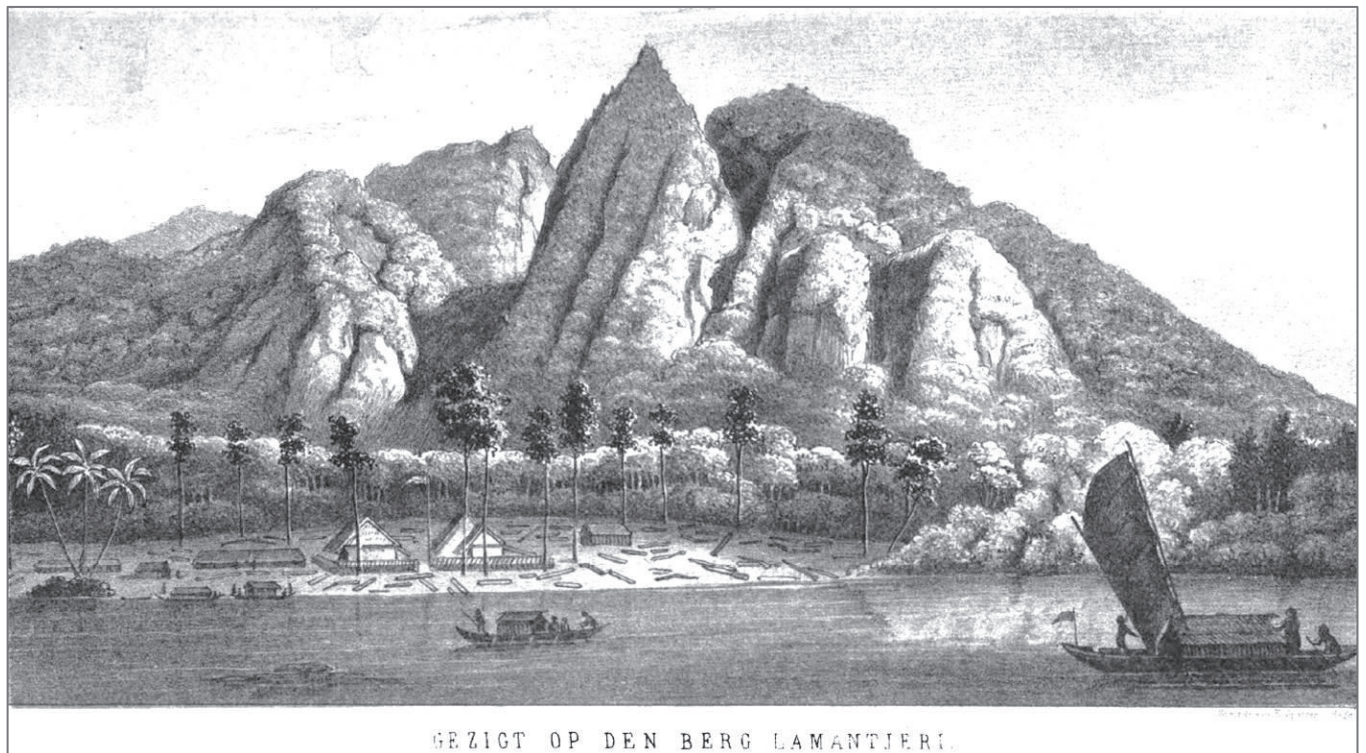


Fig. III.35. 'View of the mountain Lamantjeri', Triton Bay, SW New Guinea, in 1828 (Muller, 1857). This probably shows folded Tertiary limestone at the southern front of the Lengguru foldbelt; East of Kaimana). This was the site of the first, but short-lived Dutch government settlement in New Guinea, named Fort Du Bus.

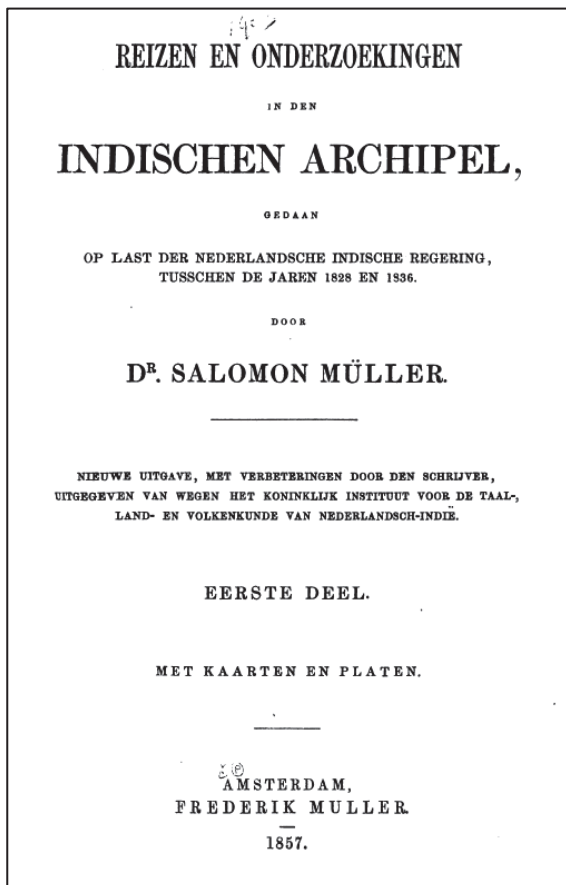


Fig. III.36. Cover page of volume 1 of S. Muller's main work 'Travels and investigations in the Indies Archipelago, commissioned by the Netherlands Indies government between 1828 and 1836' (Muller, 1857).

Timor 1828-1829

From late 1828 *Commissie* naturalists S. Muller, H. Macklot and C. Schwaner were dropped off by the Navy ship *Triton* in Kupang and stayed on Timor Island for over a year until November 1829, making trips into the largely unknown parts of the interior (Amarasi, Molo, Miomaffo, etc.). Several in the party died of fevers. Most of their collections were zoological and botanical specimens.

The *Commissie* members also investigated the rumored occurrences of copper and gold ores in the interior of the island, but they deemed them to be of little importance. Unfortunately, most of the ‘mineralogical’ observations were made by C. Macklot, whose notebooks had all been destroyed during the uprising near Krawang, West Java, in 1832. Muller (1844) published a simple map of distribution of rocks on West Timor, which was largely based on Macklot’s findings (see also below).

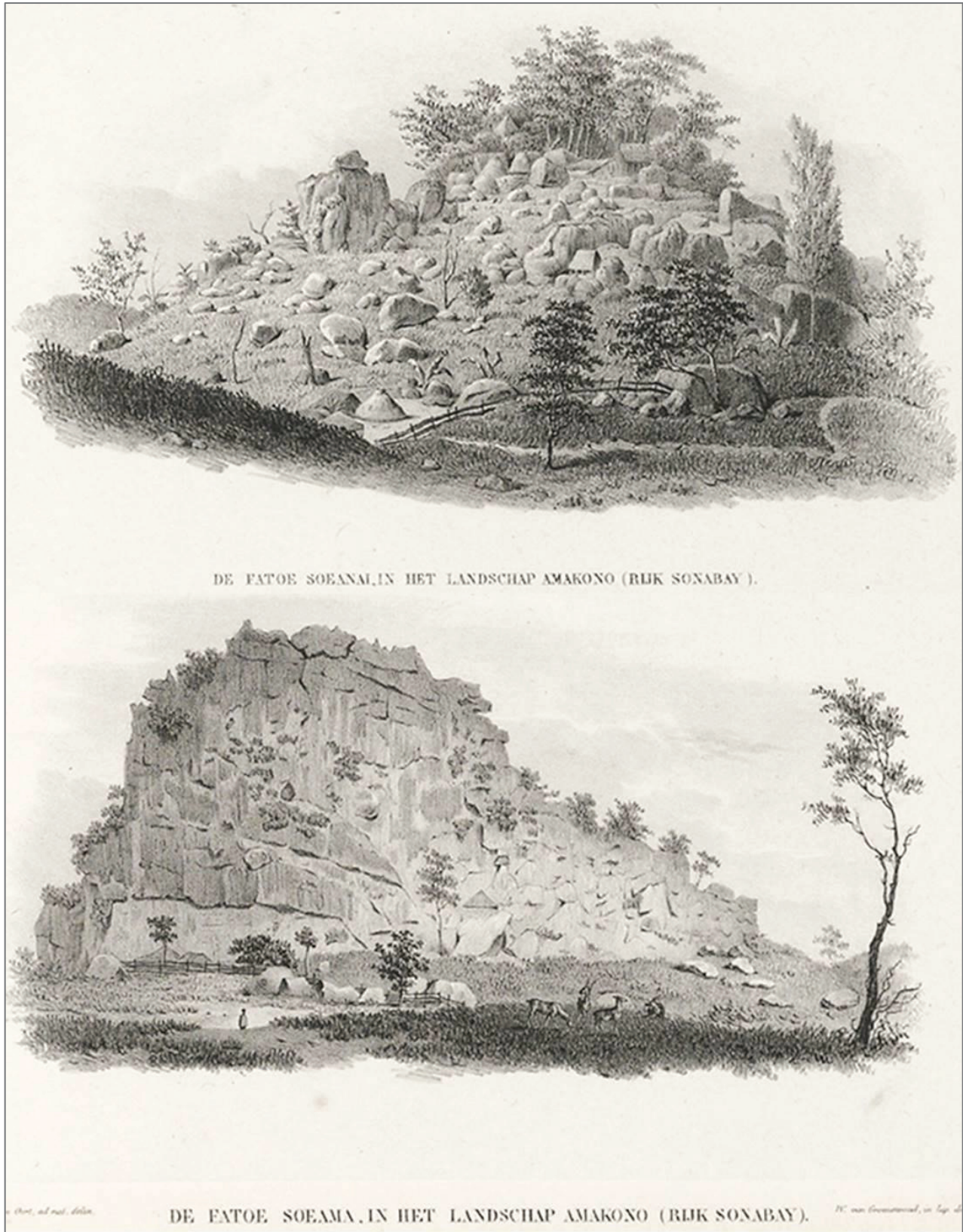


Fig. III.37. Two ‘Fatu’ limestone hills on Timor (Permian or Triassic limestone cliffs; Muller, 1844).

Chapter IV- Cover. Oblique aerial view of ice-capped Mt. Juliana (Puncak Mandala) in the Central Range of West Papua. In foreground Tertiary New Guinea Limestones, thrust to the South. Behind it are several glacial terminal moraines (middle right of photo) (Star Mountains Expedition 1959; from Verstappen 1964).

IV. GEOLOGIC-GEOGRAPHIC EXPEDITIONS FROM ~1900

A major change in geological professionalism took place in the late 1800s in the Indonesian region, with the first wave of activities by professionally-trained geologists and physical geographers. Before this, scientists were mainly 'naturalists' and museum specimen collectors, while prospecting for coal and other mineable commodities had been led by mining engineers. All of them had limited expertise in geology.



Fig. IV.1. Rocky coast near the village of Banda Elat, Kai Besar (photo by member of the Siboga Expedition 1899-1900. (Special Collections, University of Amsterdam).

Besides a boom in mining and oil-gas ventures in the 1890s, there was a remarkable wave of academic geologists (mostly German) that organized geographic-geologic expeditions to various parts of the Netherlands East Indies. Most of these scientific journeys were to remote unexplored areas:

- A. Wichmann New Guinea and East Indonesia, 1888 and 1903; University of Utrecht;
- K. Martin Moluccas Expedition, 1891-1892, University of Leiden;
- W. Volz North Sumatra, 1898, 1904-1906;
- G. Molengraaff Borneo Expedition, 1893-1894;
- G. Boehm Moluccas Expedition, 1900-1901;
- K. Deninger First (1907) and Second (1911) Freiburger Molukken Expedition;
- L. Selenka Central Java Trinil Expedition, 1907-1908);
- J. Wanner Timor Expedition 1911 with C.A. Haniel and O.A. Welter;
- J. Elbert Sunda Expedition of the Verein für Geographie Frankfurt in 1909;
- P. and F. de Sarasin Sulawesi Expeditions, 1893-1896 and 1902-1903,
- E.C. Abendanon Central Sulawesi traverses, 1909-1910.

Relatively little of the geologic research in poorly known, remote parts of the Indonesian region was carried out by Dutch or Dutch-sponsored geologists, with the exception of academic initiatives, like the Borneo Expedition of G. Molengraaff in 1894, the Moluccas Expedition of K. Martin in 1891-1892, the Timor Expedition of G. Molengraaff and H.A. Brouwer in 1910-1912 and the Seram Expedition of L. Rutten in 1917-1919.

This was partly due to the virtual absence of a geologic- paleontologic scientific tradition in The Netherlands and Netherlands Indies, and partly the conscious decision by the colonial government, realizing that the staffing levels of the Bureau of Mines were insufficient for geological scientific surveying or mapping if there were no economic drivers (e.g., Van Waterschoot van der Gracht, 1915).

Expeditions support by the 'Treb Maatschappij', 1893-1934

Many of the scientific expeditions to remote parts of the Netherlands Indies were funded or co-funded by the *Maatschappij ter Bevordering van het Natuurkundig onderzoek der Nederlandsche kolonien* (Society for the Promotion of Natural History research the Dutch colonies), based in Amsterdam. Later it became known mainly as the *Treb Maatschappij*. Major expeditions (partly) sponsored by the Treb Maatschappij include:

- *Central Borneo Expedition* in 1893-1895 (Molengraaff and Nieuwenhuis);
- *Siboga* oceanographic expedition in 1899-1900;
North New Guinea expedition in 1903 (Wichmann);
- Three *South New Guinea* expeditions: 1907, 1909-1910 (Lorentz), 1912-1913 (Fransschen Herderschee);
- *Timor* expedition in 1912 (G. Molengraaff);
- *Ceram* geological expedition of 1917-1919 (L. Rutten);
- *Buru* Expedition in 1921-1922 (Henny and Toxopeus);
- *Snellius* Expedition in 1929-1930 (P. Kuenen geologist);
- *Mimika* Expedition in 1934 (Bijlmer), etc.

IV.1. Sumatra expeditions by W. Volz (1897- 1906)

The first significant geological work on Sumatra was done from the mid-1870s by Verbeek, but this was mainly limited to West and South Sumatra. North Sumatra remained largely unknown until the travels by German geologist Wilhelm Volz around 1898 and 1905, as an earlier expedition by Junghuhn to the Batak regions in 1847 did not yield much geological information.

17. Wilhelm T.A.H. VOLZ (Halle, Germany 1870- Markkleeberg 1958)

W. Volz was a German geographer- geologist, who early in his career and partly on private initiative, undertook three expeditions to remote regions of North Sumatra around 1900. His reports include the first descriptions of geology, paleontology, geography and people of North Sumatra.

Wilhelm Theodor August Hermann Volz was born on 11 August 1870 in Halle an der Saale, Saxony, eastern Germany, as son of a geography teacher. He grew up in Potsdam. From 1890-1895 he studied geography at the universities of Leipzig, Berlin and Breslau, finishing with a dissertation on the Triassic coral fauna from St Cassian in Tirol under Professor F. Frech at the University of Breslau (now Wrocław). One of his professors in Berlin was the famous China explorer Baron Ferdinand von Richthofen.

In 1899, after his first North Sumatra expedition, Volz submitted his report on the Geology of North Sumatra to the University of Breslau as *Habilitationsschrift* (a report to qualify for academic appointments), while he was assistant at the Geological- Paleontological Institute of the university . He stayed on in Breslau as *Privatdozent* from 1899-1904.

Geologic- geographic explorations of the Netherlands Indies, 1897-1906

Early in his career Volz undertook three expeditions to Sumatra between 1897 and 1906. Many of these areas of Sumatra were poorly known around 1900, and some were characterized by Volz as 'tiger paradise':

1. 1897-1898 travels to the NE coast and Batak Lands around Lake Toba in North Sumatra (Volz, 1899);
2. From November 1899-January 1901 Volz traveled to the Netherlands Indies as a consultant for the *Mijnbouw-en Industrie-Syndicaat* of entrepreneur August Janssen (Amsterdam). At the recommendation of Prof. H. Bucking, Volz did surveys for coal in SE Kalimantan (Pengaron, Pulau Laut), Java and South Sumatra, and for gold in the Padang Highlands of West Sumatra (Volz, 1904);
3. From May 1904- May 1906 Volz returned to North Sumatra, to the Batak and Gajo Lands, sponsored by the *Humboldt-Stiftung* of the Royal Prussian Academy of Sciences in Berlin (Volz, 1909, 1912). On the way back from Sumatra, Volz visited Trinil, Java, in June 1906, as part of the preparations for the imminent excavations by the German Selenka Expedition.



Fig. IV.2. Left: Dr. Wilhelm Volz at the start of his third Sumatra expedition in Medan in 1904 (from Leibniz-Institut für Landeskunde, www.digiporta.net).

Right: Prof. W. Volz in Leipzig around 1930 (from Leibniz-Institut für Landeskunde, www.digiporta.net).

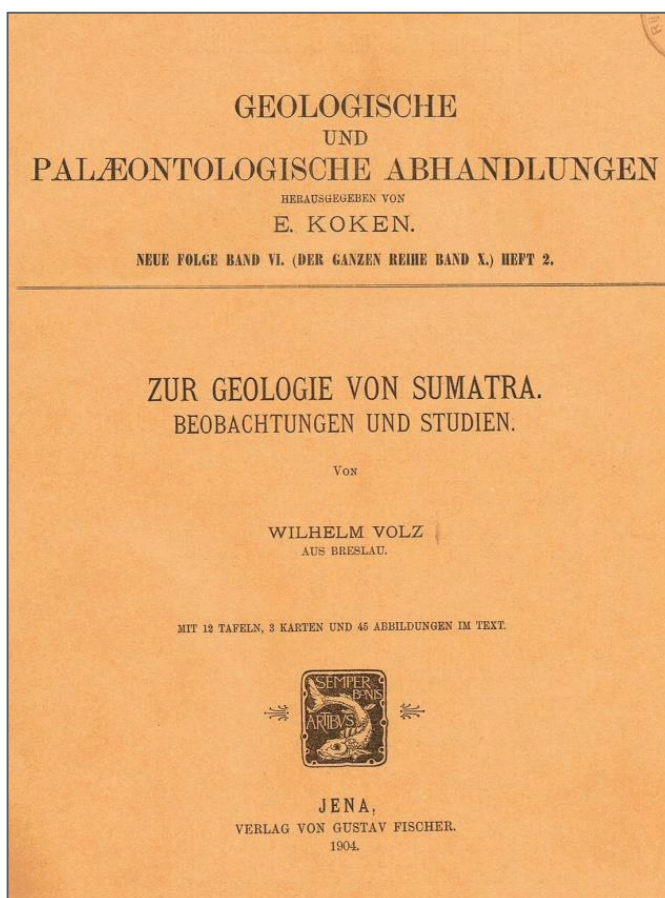
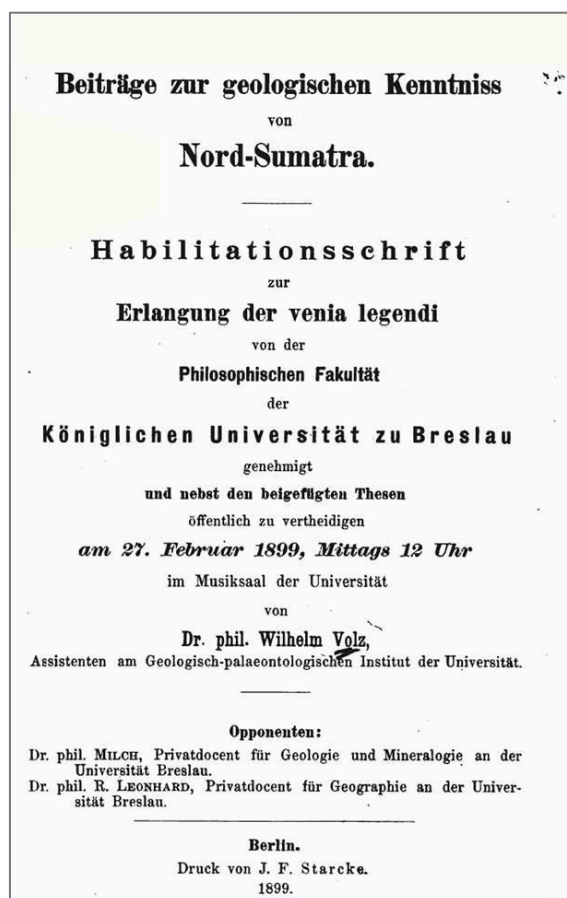


Fig. IV.3. Left: Volz (1899) Habilitation thesis of the Geological knowledge of North Sumatra after the first expedition. Right: Cover of the Volz (1904) study on the geology of Sumatra, after his first two expeditions.

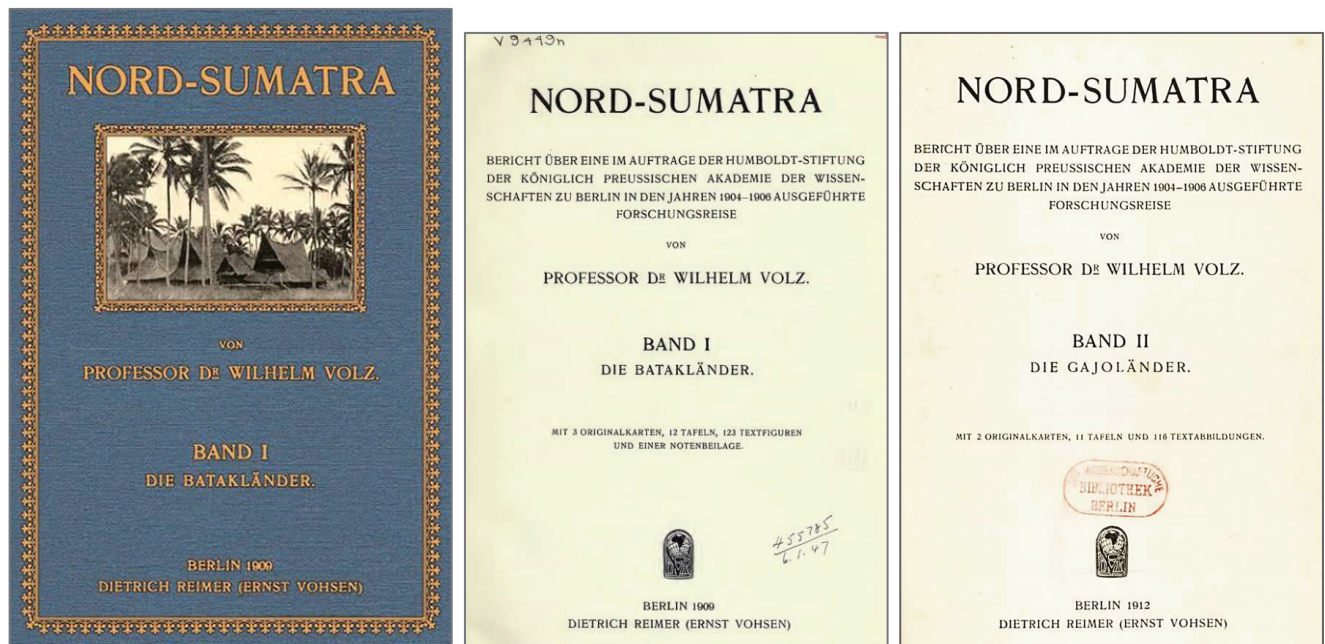


Fig. IV.4. The Volz (1909) book on his third Sumatra expedition (1904–1906), to the Batak Lands of North Sumatra.



Fig. IV.5. Wilhelm Volz in 1905, at his campsite on the slope of the Sinabung volcano, Batak Lands (Coll. Tropenmuseum TM-60042120)

Volz, as Paleontologist

In addition to his geologic-geographic work Volz was also the first to describe several new species of Permian and Triassic index fossils, including:

- Triassic molluscs: *Daonella sumatrensis*, Carnian, from headwaters of the Kualu River (Volz, 1899) (Fig. IV.6);
- Middle Permian fusulinid foraminifera: *Sumatrina annae* n.gen., n.sp., from Bukit Besi near Lake Singkarak (Volz, 1904; commonly assigned to *Neoschwagerina*) (Fig. IV.7);
- Permian corals: *Lonsdaleia frechi* (also assigned to *Waagenophyllum* or *Wentzelloides*) and *Lonsdaleia fennemai* (both in Volz, 1904).

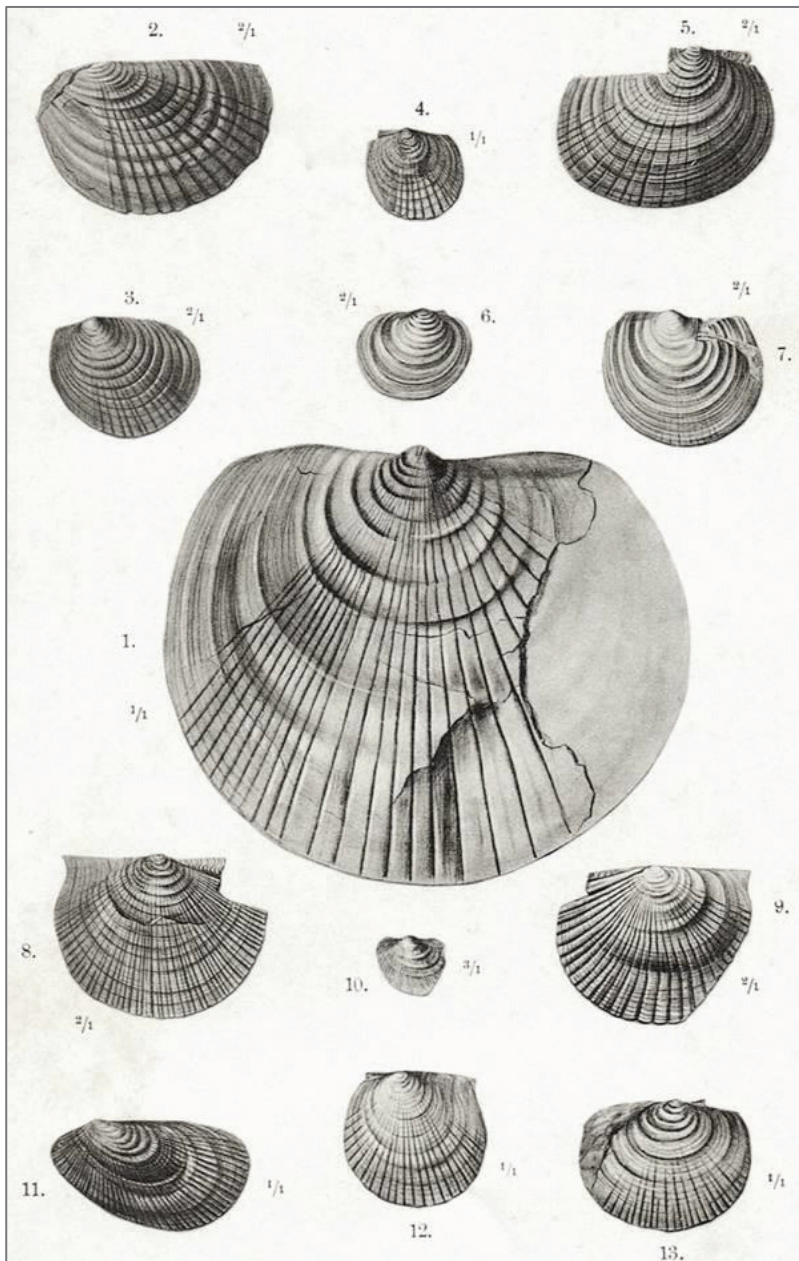
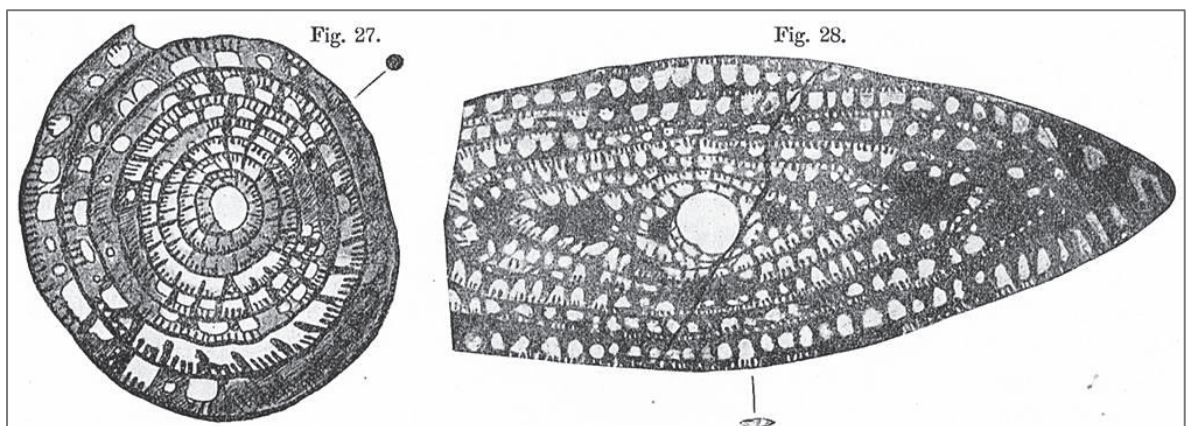


Fig. IV.6.
Middle-Late Triassic bivalve molluscs
Daonella (1-3) and *Halobia* (4-13).
With new species *Daonella sumatrensis*
(2-3) and *Halobia kwaluana* (8-11)
(Volz, 1889).

Fig. IV.7.
Axial and longitudinal sections of
Permian fusulinid larger foram
Sumatrina annae (Volz, 1904).



For his third and final journey in North Sumatra in 1904-1906, Volz started in Pangkalan Brandan in May 1904, and later undertook surveys from Kota Raja after January 1905 and from Fort de Kock after March 1906. His observations were documented in a thorough 2-volume report *Nord Sumatra* (Volz, 1909, 1912), which covers travel, geology and people of the region.

IV.2. Moluccas expeditions (1888- 1920)

In the late 1800s-early 1900s, many German and Dutch academic geologists were drawn to The Moluccas, as it became clear that the geology of Eastern Indonesia was much different from Western Indonesia, but there were similarities with the 'Tethys Belt' that carried from the European Alps to the Himalayas.

18. C.E. Arthur WICHMANN (Hamburg 1851- 1927)

C.E.A. Wichmann was one of the first three geology professors in the Netherlands and was the founder of the Geological Institute at the University of Utrecht. He made significant early expeditions and contributions to the geology of Indonesia, in particular on the petrography, geology, geography and volcanoes of Eastern Indonesia and the distribution of earthquakes.

Carl Ernst Arthur (Arthur) Wichmann was born in Hamburg on 9 April 1851, where his father ran a boarding school. He studied geology and mineralogy at the University of Leipzig, under the famous mineralogist Ferdinand Zirkel from 1871 until graduation in 1874. He stayed on as Assistant to Zirkel in the Mineralogical Institute until he was called for military service in 1876-1877.

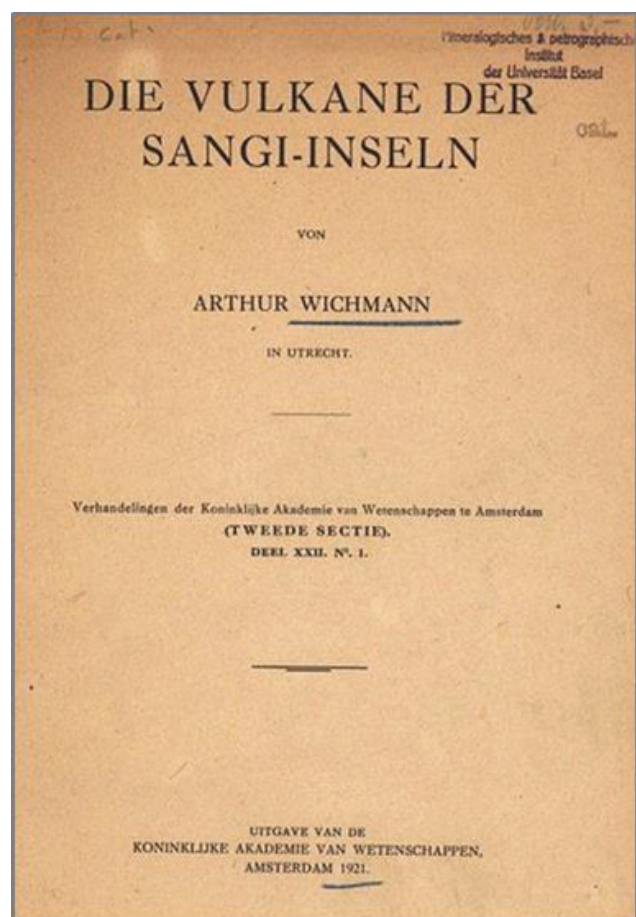


Fig. IV.12. Left: Portrait of Prof. Arthur Wichmann in 1901 (from Vissers, 2004).

Fig. IV.13. Cover of the Wichmann (1921) paper on 'The volcanoes of the Sangi Islands'.

Professor of Geology in Utrecht, 1877-1921

Addressing the absence of geology education in The Netherlands (except as a secondary subject in the Mining department of the Delft Technical University), a new law was passed in 1876-1887, which directed that three of the state universities appoint a professor of geology and mineralogy. This led to the appointments of three young German geologists: 26-year-old *Karl Martin* in Leiden in 1877, 36-year old *Friedrich J.P. van Calker* in Groningen in 1877, and 27-year old *Arthur Wichmann* in January 1879 as the first Professor for Mineralogy and Geology at the University of Utrecht.

Wichmann built the Geology department of the University of Utrecht from virtually nothing. For many years the department was a 'one-man show', first under Wichmann and after 1921 under L. Rutten, until December 1929, when J.I.J.M. Schmutzer was appointed as Professor in Mineralogy.

North New Guinea Expedition of 1903

In January- September 1903 Wichmann led the 'North New Guinea Expedition' of 1903. This was the first official Dutch scientific expedition to what today is named West Papua. It was mainly a reconnaissance survey along the North coast, from Cenderawasih Bay to Humboldt Bay and Sentani Lake, using the navy survey vessel *Zeemeeuw*.

The expedition was sponsored by the '*Maatschappij ter Bevordering van het Natuurkundig Onderzoek der Nederlandsche Koloniën*' (also known as *Treub Maatschappij*). The results of this expedition were described and published in a series of volumes in the journal *Nova Guinea* (Wichmann, 1909-1917).

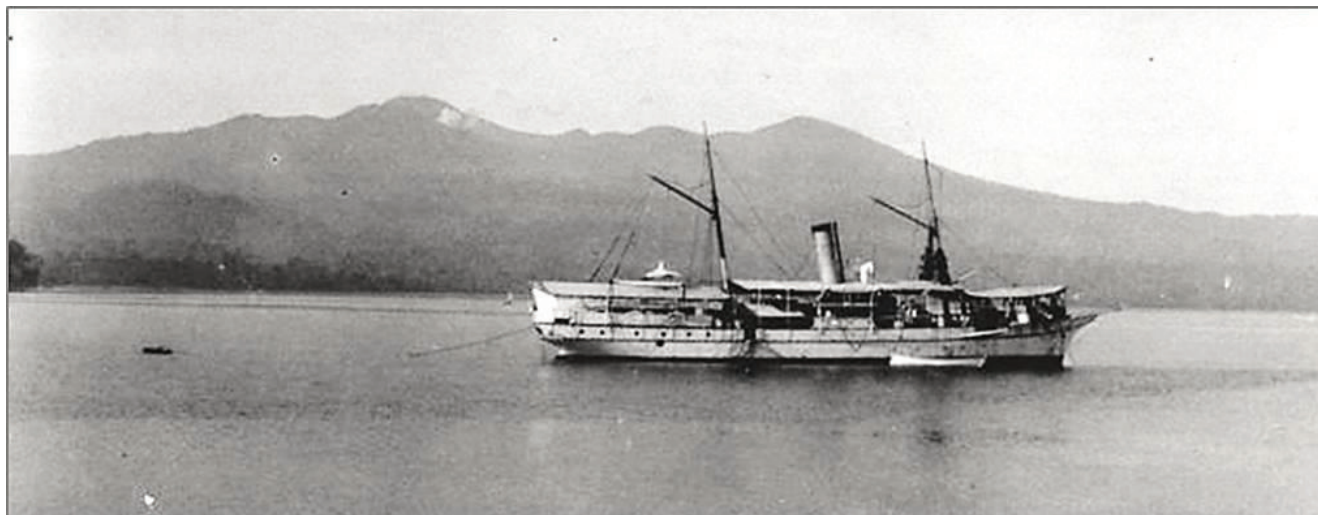


Fig. IV.15. The Expedition ship *Zeemeeuw* in the Bay of Manado, North Sulawesi, used during the North New Guinea Expedition of Wichmann (1903). The volcanoes Lokon and Empung are in background (Coll. Tropenmuseum).



Fig. IV.16. Field camp of the Wichmann Expedition to northern New Guinea in 1903 (Coll. Tropenmuseum TM-60012047).

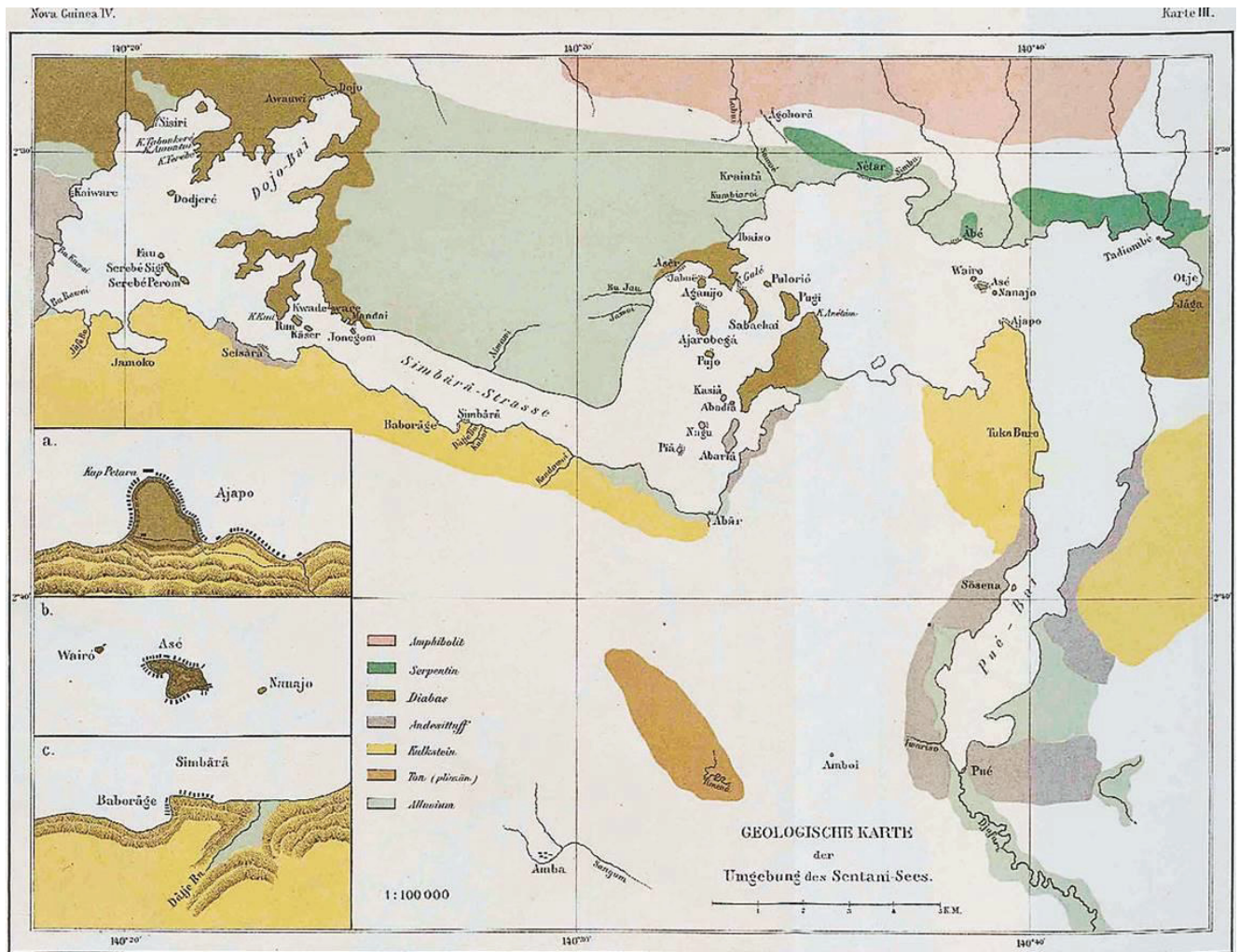


Fig. IV.17. The first geologic map of the area around Sentani Lake in NE Netherlands New Guinea (now Papua). Showing an ophiolite complex of serpentinite-diabase in the North and Tertiary? limestones along the south side of the lake (Wichmann, 1903; published in 1917).



Fig. IV.18. Folded quartzite beds at the NW corner of Napan Bay (SW Cenderawasih Bay; Paleozoic or Mesozoic metasandstones?) (1903 photo by G.A.J. van der Sande during the 1903 Wichmann North New Guinea Expedition (Collectie Tropenmuseum TM-10004568.jpg; also published in Wichmann, 1917).

V.2.1. Siboga Expedition (1899-1900)

The Dutch *Siboga Expedition* was a famous, but mostly marine biological and oceanographic expedition across East Indonesian waters. It left Surabaya on 7 March 1899 and returned on 26 February 1900 (Fig. V.37). It was led by zoologist Professor Max W.C. Weber from the University of Amsterdam and was sponsored mainly by the *Maatschappij ter Bevordering van het Natuurkundig onderzoek der Nederlandsche kolonien* (Society for the Promotion of Natural history research of the Dutch colonies).



Fig. V.36.
The expedition steamship
H.M. Siboga during the
1899-1900 Expedition to
the 'East Indies'.

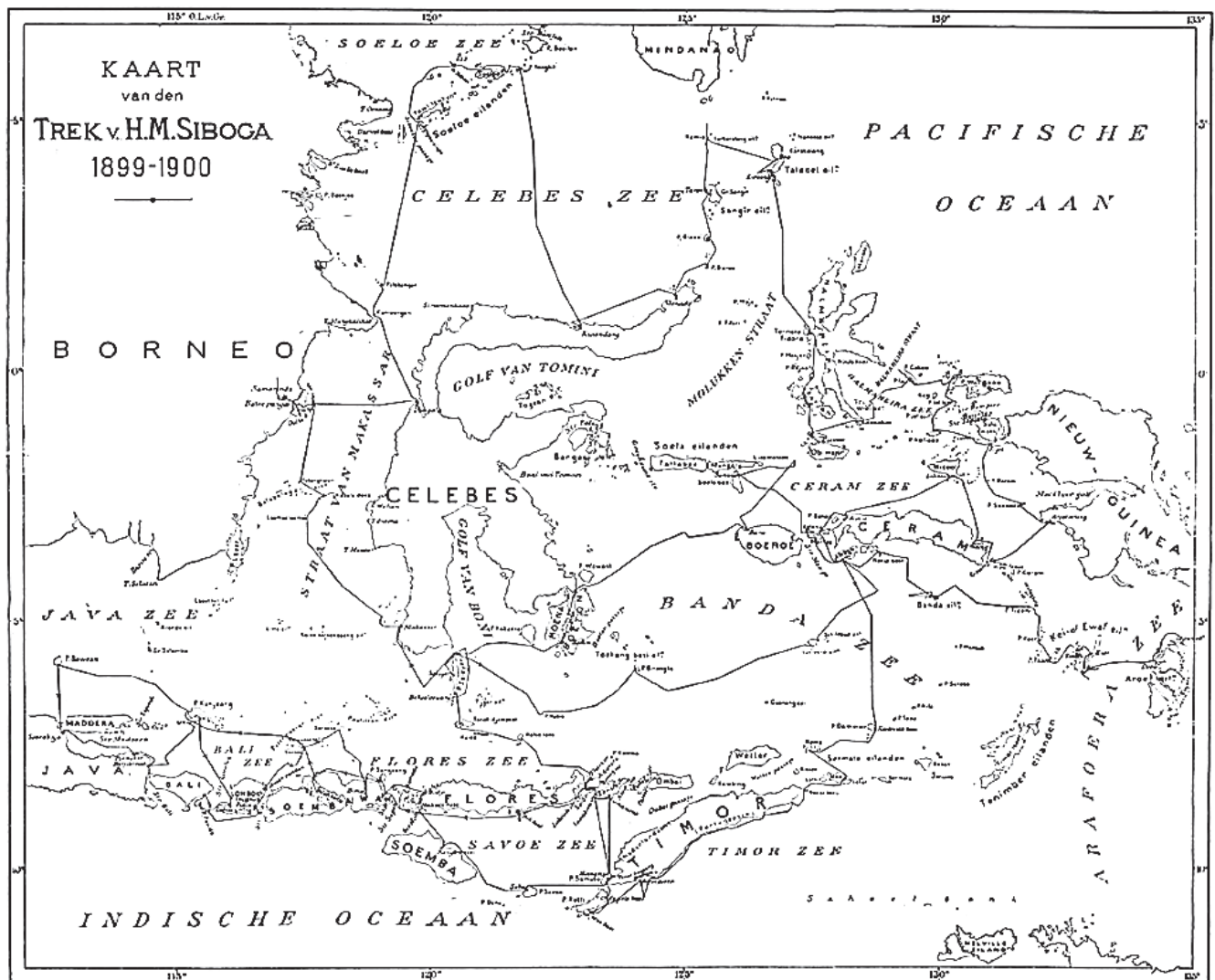


Fig. V.37. Itinerary of the 1899-1900 Siboga Expedition (Weber-van Bosse, 1904).

The expedition was conducted from a converted navy gunboat, the *Siboga*. The primary goal of the expedition was collect marine faunas of Eastern Indonesia. It did not have a geologist on board, but it was important in that it collected numerous deep seafloor sediment samples and it significantly advanced the knowledge of sea floor topography and of hydrographic conditions of the deep basins of Eastern Indonesia. It is only after this expedition that a first decent bathymetric chart of the deepwater regions of the Indonesian Archipelago became available (Tydeman, 1903).



Fig. V.38. The laboratory on the Siboga in September 1899, with four members of the scientific staff. From left H.F. Nierstrasz (zoologist), J.W. Huysmans (draftsman), Prof. Max C.W. Weber (Expedition Leader) and Dr. Jan Versluys (zoologist). (Wikimedia).



Fig. V.39. The H.M. Siboga, anchored in the Bay of Badjo, West coast of Flores (Collections University of Amsterdam).

PIONEERS AND MILESTONES OF INDONESIAN GEOLOGY

1-SCIENTIFIC EXPLORERS

Johannes T. (Han) van Gorsel is a Dutch national, born in Jakarta in 1948, and grew up in the Netherlands after 1950. He studied geology at the University of Amsterdam, where most of his professors had spent early parts of their careers in Indonesia. He finished with Ph.D. on Cretaceous larger foraminifera in 1975.

More than 30 years of his professional career were spent as petroleum geologist with Esso/Exxon (including PT Stanvac Indonesia, ExxonMobil Exploration, Esso U.K., Exxon Ventures C.I.S., Esso Australia), from which he retired in 2010. He worked and lived in Jakarta as geologist/micropaleontologist at three occasions: (1) Robertson Research/Lemigas (1975-1977); (2) PT Stanvac Indonesia (1983-1990); and (3) Esso Indonesia (1990-1991; as Team lead of a Pertamina-Esso Indonesia Hydrocarbon evaluation study of the Wamena Block in Irian Jaya).



Most recently, he was a geologist with the ExxonMobil Asia-Pacific Regional/New Ventures team in Melbourne, Australia (2007-2010), where he was commonly involved in projects at ExxonMobil Indonesia. He taught the first courses in Sequence Stratigraphy in Indonesia in 1987 (for PT Stanvac and IAGI), and co-led geological fieldtrips for IPA to Central- NE Java and South Sumatra in the 1980s. A paper presented at the 1988 IPA Convention on Biostratigraphy in Indonesia became a teaching tool at Indonesian universities.

The first edition of his annotated Bibliography of Indonesia-SE Asia geology was published by IPA in 2009. It was updated with six new editions, which have been available online at www.vangorselslist.com. The current Edition 7 (2020) contains >2850 pages. In 2014 he was Guest Editor of three theme issues of *Berita Sedimentologi* on biostratigraphy of Indonesia, and continues to edit papers for this journal. He likes to think that his personal library is one of the most complete collections of publications on the geology of Indonesia.



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Anggota Ikapi No. 034/JBA/92
APPTI No. 005.062.1.10.2018

