BOOK REVIEW

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PIONEERS AND MILESTONES OF INDONESIAN GEOLOGY

by J. T. van Gorsel.

Volume 1- Scientific Explorers

GENERAL COMMENT ON THE 4 VOLUMES OF THE BOOK

Dutch geologist-micropaleontologist J. T. van Gorsel has written four volumes of books titled 'Pioneers and Milestones of Indonesian Geology' (ITB Press, Bandung, 2022). The coverage of the books' content extends across the vast landscape of Indonesian geology and related geosciences. The author dedicates many pages to detail the many thorough investigations of the enormous archipelago, from the time of the VOC until the early days of Indonesian Independence. Such a region is teeming with attractive opportunities for anyone from any background; from those seeking fulfillment from scientific exploration to ambitious businessmen in search of fortune in trade, oil, and mining. Missionaries and politicians alike have also greatly benefited from what this nation has to offer.

The massive work contains over 1500 pages and is subdivided into four hardcover, A4-size volumes (Figure 1):

Vol. 1 - Scientific explorers

Vol. 2 - Geologic Survey, Volcanology, 1850 - 1950's

Vol. 3 - Paleontology and other specialists

Vol. 4 - Petroleum and mining industries, Post-1945 Restart

The books are filled with over 2000 colorful illustrations and stunning photographs, including artworks. The books span about 300 to 400 pages each.

As the world's largest archipelagic state, Indonesia boasts five principal islands and over 300 smaller island groups (Darman and Sidi, 2000). Renowned as a geoscientific paradise, the nation's complex geology arises from the convergence of the Asian and Australian continents. This unique geological setting has served as a living laboratory for studying tectonic processes, significantly contributing to the development of plate tectonics theory. Indonesia's geological prominence has attracted world-class geoscientists eager to deepen our understanding of planet Earth.



Figure 1: *Front and side cover of the 4 volumes of the Pioneers and Milestones of Indonesian Geology by J. T. van Gorsel.*

Van Gorsel's volumes contain 238 biographies of researchers who made significant new contributions to the knowledge of the geology of Indonesia's vast and stunning region. Most of them were geologists or mining engineers, but the collection also includes 'naturalists', palaeontologists, volcanologists, oceanographers, geophysicists, petroleum geologists, petrographers, geochemists, agro-geologists, archeologists, geomorphologists, entrepreneurs in petroleum, coal, and economic minerals, academic teachers, as well as several key administrators and influencers. Each biography delves into their perspectives on the land, their journeys, and their work, with a particular focus on their contributions to Indonesian geology. Given the adventurous nature of their lives and experiences, the title "The Adventure in Paradise" is apt. The majority of these researchers described were active during the Dutch colonial era from the early to mid-19th century. As the Netherlands had a limited geological knowledge base at that time, focused primarily on small-scale mining, and lacking significant outcrops, many of the earliest pioneers in Indonesian geology hailed from Germany and Switzerland (Figure 2).

The author defines geoscience pioneers as individuals who made groundbreaking, globally recognised contributions to the various disciplines of geoscience. He posits that such pioneers are inherently adventurous, ambitious, and resolute, qualities essential for enduring the demanding and protracted fieldwork often required in Indonesia. Conducting research in remote and challenging environments is a hallmark of these scientific pioneers (volume 1, p.7). Notably, the vast majority of these figures were European-born (mainly Dutch, German, and Swiss), white, and male, with only a limited number of female palaeontologists represented.

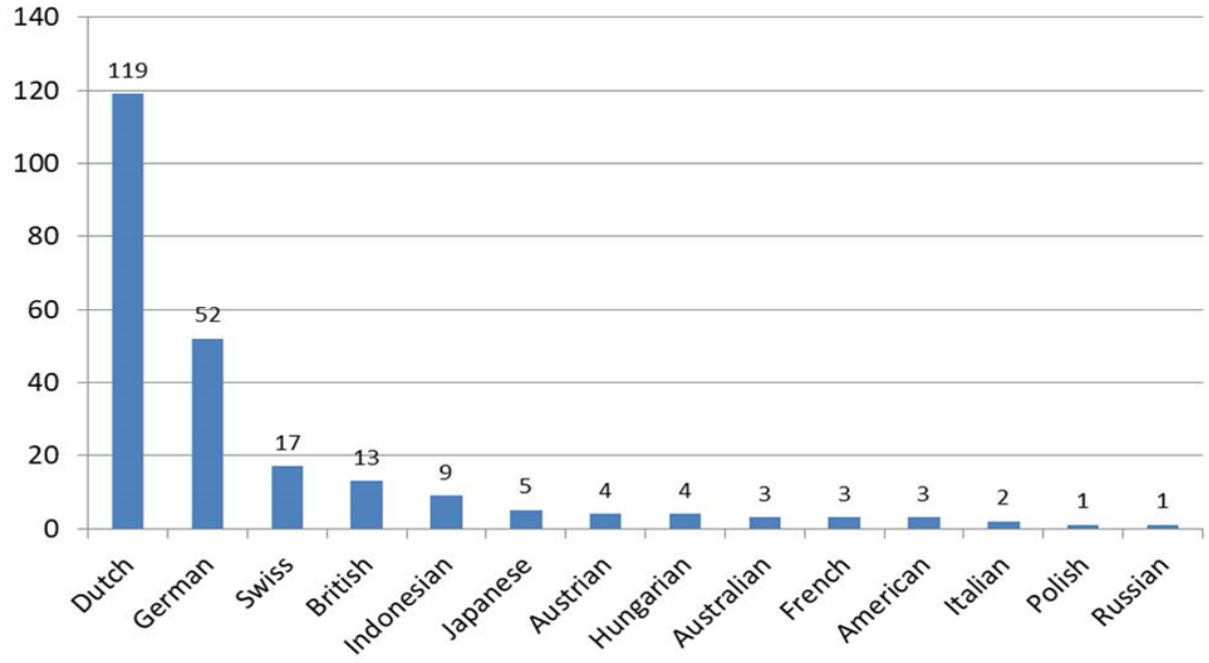


Figure 2: *The 238 geoscientists discussed in the Pioneers books, by nationality. About half are Dutch, followed by German, Swiss, British, and ten other nationalities.*

Many of these scientists who came to the Indonesian Archipelago benefited from 'state-of-the-art' geological training in their native countries. Some attended world-renowned institutions, while others came from diverse backgrounds, including civil engineering, medicine, and even the clergy. Many of the latter pursued geology as a passion rather than a profession. Van Gorsel's work incorporates a rich array of materials to showcase their contributions, such as book covers, maps, paintings, photographs, and geological thin sections. Additionally, the book features various documents from the petroleum and mining industries. To provide a comprehensive portrait of these individuals, Van Gorsel also delves into their personal lives, including family, political affiliations, and ultimate fates.

The author undertook extensive research of historic literature, traveling internationally to gather materials from libraries, museums, archives, organisations, and even cemeteries in Asia and Europe. His dedication offers readers a unique perspective on the value of exploring the world. While the decision to visit the gravesites of strangers may seem unusual, his efforts to connect with surviving relatives and associates of these figures resulted in invaluable information and photographs. The culmination of this exhaustive research has produced a groundbreaking body of work.

Van Gorsel's four-volume work aims to introduce and preserve the legacy of pioneering naturalists and geoscientists who contributed to Indonesian geology. Most of this historic geoscience material of Indonesia is still relevant today, but is not readily accessible to current generations of Indonesian geologists, primarily as a result of language barriers (most texts are in Dutch or German), and limited library facilities in Indonesia. By highlighting the achievements of some of the best-trained scholars of their era, he seeks to inspire future generations and prevent the duplication of efforts. The generally reliable

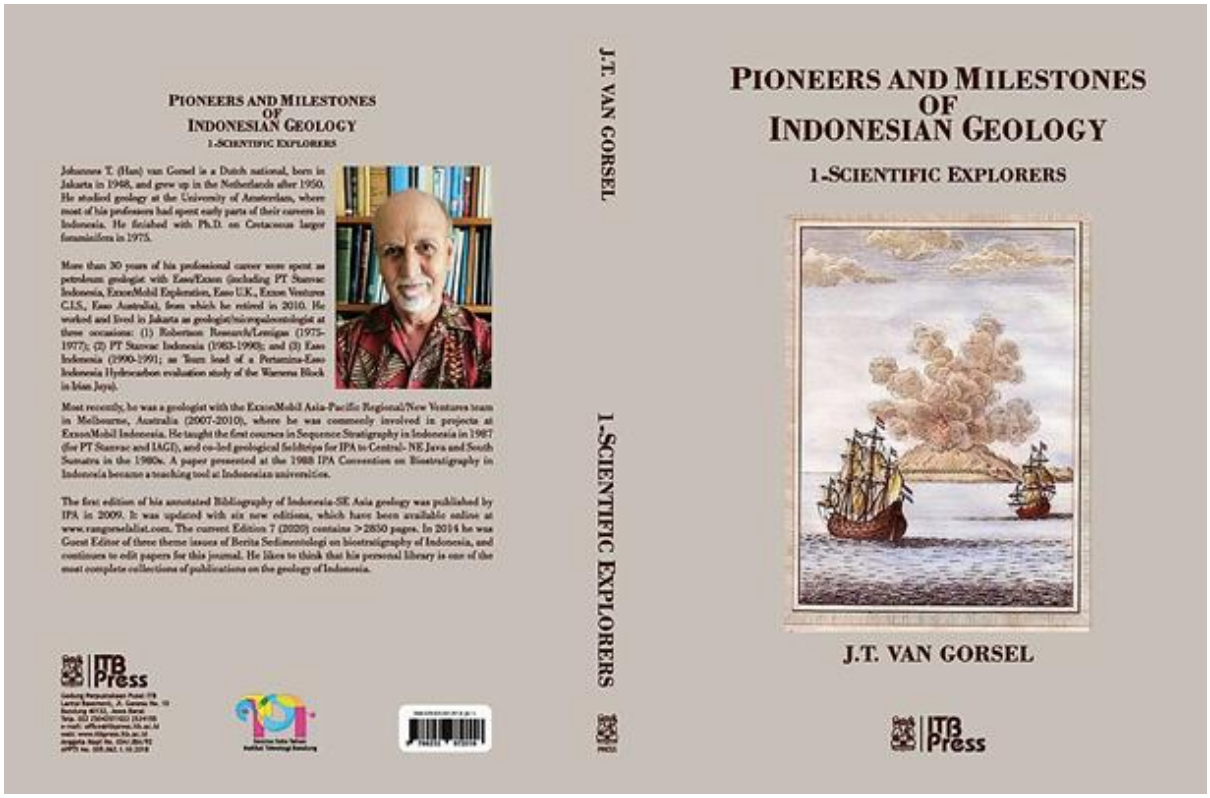


Figure 3: *Back and front covers of "Pioneers"-volume 1. The biography and picture of the author is on the left (back cover of the book).*

historical observations presented in this work are essential for a comprehensive understanding of the field and can help avoid past missteps.

REVIEW OF VOLUME 1 – SCIENTIFIC EXPLORERS

Volume 1 of the series starts with a general and historic framework, then it continues to the early 'naturalist' explorers of the 1600s-1800s. These were experts of natural sciences, including botany, zoology, geology, mineralogy and paleontology (specialist geologists did not exist yet before about 1850). The second half of the first volume describes the many international geologic-geographic and oceanographic expeditions conducted in the Indonesian region, starting in the late 1800s and ending in the 1940s, with the Japanese occupation and the ensuing Indonesian Independence.

In the early 1800s, following the demise of the VOC East Indies trading company, and after the end of the Netherlands' recovery of power from French occupation of the Netherlands and the British occupation of the Netherlands Indies (under Governor T.S. Raffles), King Willem I recognised the need for more scientific studies in the Netherlands Indies and appointed Caspar G.C. Reinwardt, professor of natural history in Amsterdam, as the first government botanist and naturalist in 1816. One tangible connection to this historic figure can be found today in the Bogor Botanical Gardens, which was founded by Reinwardt in 1817 (Figure 3), a short forty-five-minute drive from Jakarta.



Figure 4: *A monument of C. Reinwardt as the founder of the Bogor Botanical Garden (1817), with the reviewer in the center of the garden.*

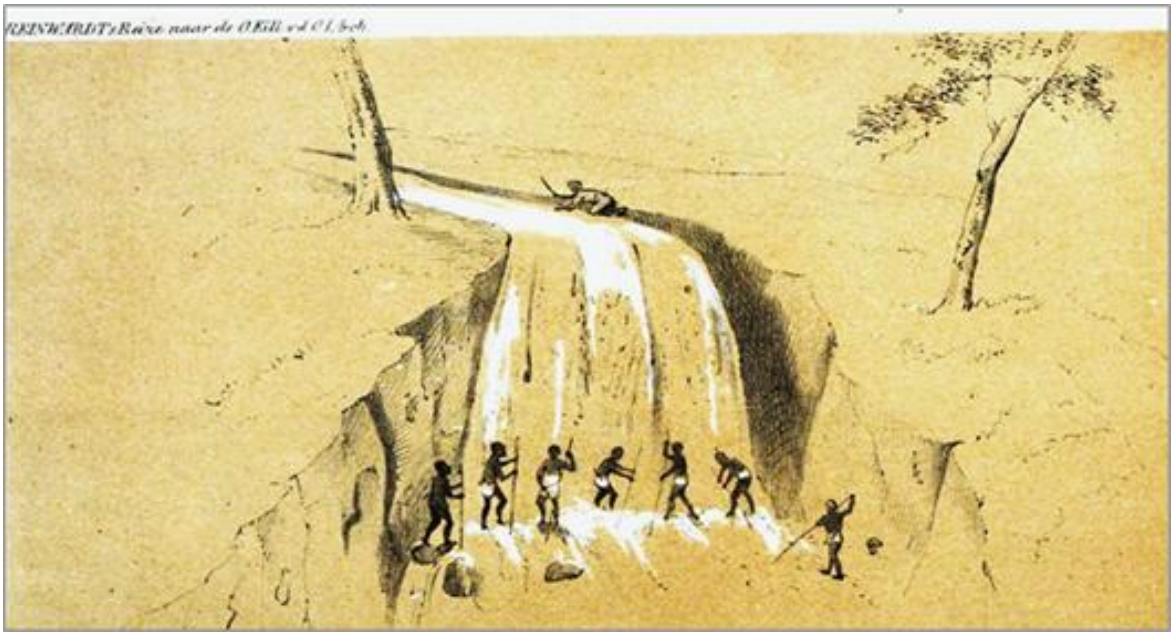


Figure 5: *A native gold mine in Gorontalo, North Sulawesi, in 1821 (Reinwardt, 1858, Reis naar de Oostelijke eilanden van de Oost-Indische Archipel).*

With scientific interests not limited to botany, the 'naturalist' Reinwardt also undertook a 15-month expedition to the eastern parts of the Indies Archipelago in 1821-1822, which delivered pioneering descriptions of native gold mines in North Sulawesi (Figure 5). During this trip, he also developed a then new theory for the formation of limestones: created from the fossilisation of corals and mollusks' shells.

Soon after the arrival of Reinwardt, the *Commission of Natural Sciences in the East Indies* (Indonesia) was organised in 1820, mainly at the initiative of C. J. Temminck, Director of the National Museum of Natural History in Leiden. This involved the organisation of a team of about 18 natural scientists and or 'naturalists', recruited primarily from Germany and the Netherlands. Their mission was to collect and study as many interesting plant, animal, and rock specimens as possible in the Netherlands Indies for the collections of the National Leiden Museum of Natural History in the Netherlands. The team did not travel altogether at the same time; the first two members arrived in Jakarta (then known as Batavia) in 1820, with the remaining members joining them over the following years. The commission operated until 1850 when it was disbanded after generally disappointing results, primarily because twelve of its eighteen scientists died during their initial 5-7 year missions, from diseases, accidents, etc., and many of their collections were lost in transit from the field to the Netherlands.

One of the members who did survive their years of fieldwork was Franz W. Junghuhn. Renowned for his dedication, Junghuhn produced a significant body of work, the most notable example being his famous book on the natural history of Java, with emphasis on its volcanoes and plants (multiple Dutch and German editions in 1850-1857; Figure 53).

Preserved at the Geological Museum in Bandung, West Java, Indonesia, this invaluable resource is housed in a specially constructed glass case to protect it for public viewing. According to museum staff, the book is undergoing digitisation to prevent its deterioration. To date, 200 of the total 900 pages have been completed. The accompanying Java album features beautiful lithograph prints of volcanoes, based on Junghuhn's sketches, enhancing the textual content. This information significantly aids in clarifying the staff's earlier explanation.

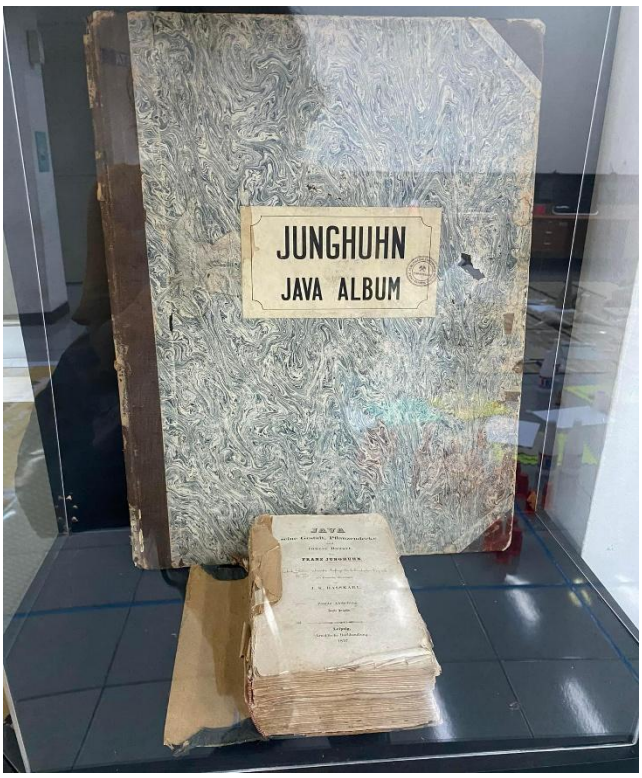


Figure 6: *This large, standing book, measuring approximately 60 by 40 centimeters, is a copy of the Java Album of F. Junghuhn (1854), on display in the library of the Indonesian Geological Survey Department. It features lithograph prints of volcanoes and scenery, based on Junghuhn's sketches. These visuals complement the descriptive content of the smaller-size accompanying textbook.*

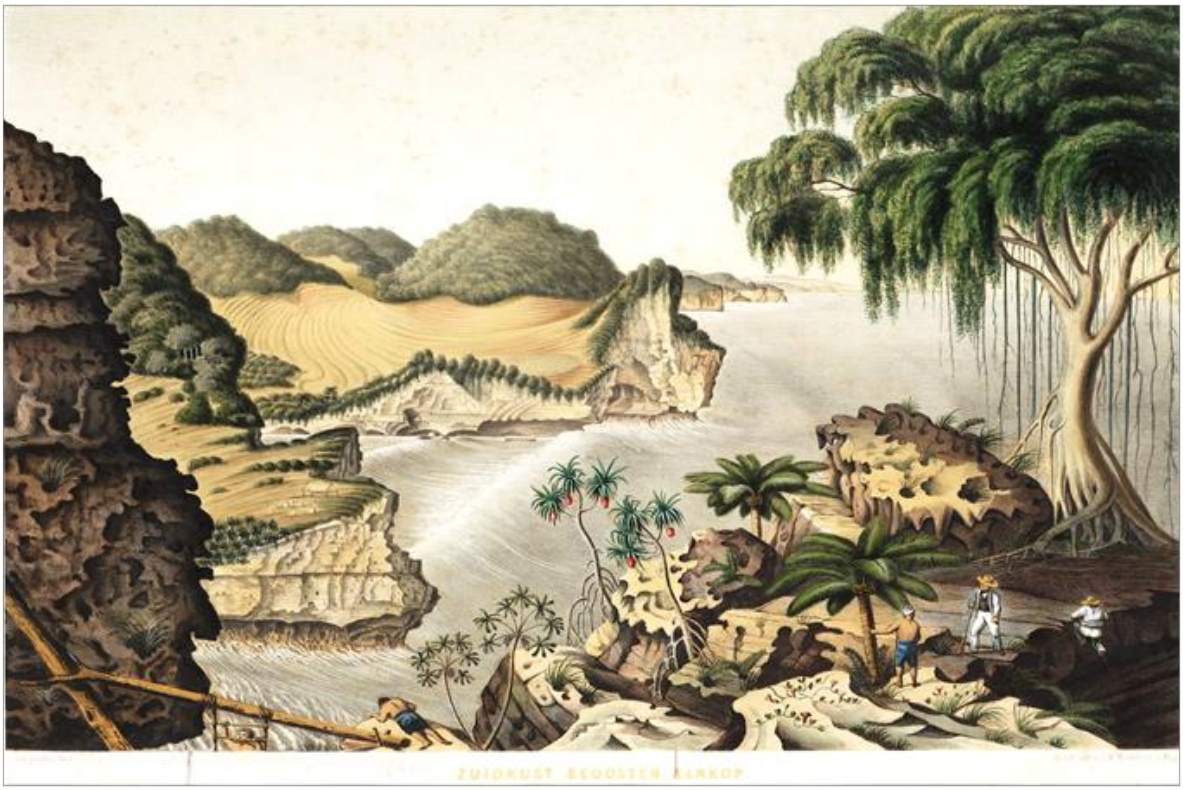


Figure 7: *A typical example of Junghuhn's 'romanticized' depictions of Java scenery, showing karst morphology of Miocene limestones along the Southern Mountains coast, East of Rankop (Junghuhn, 1854).*

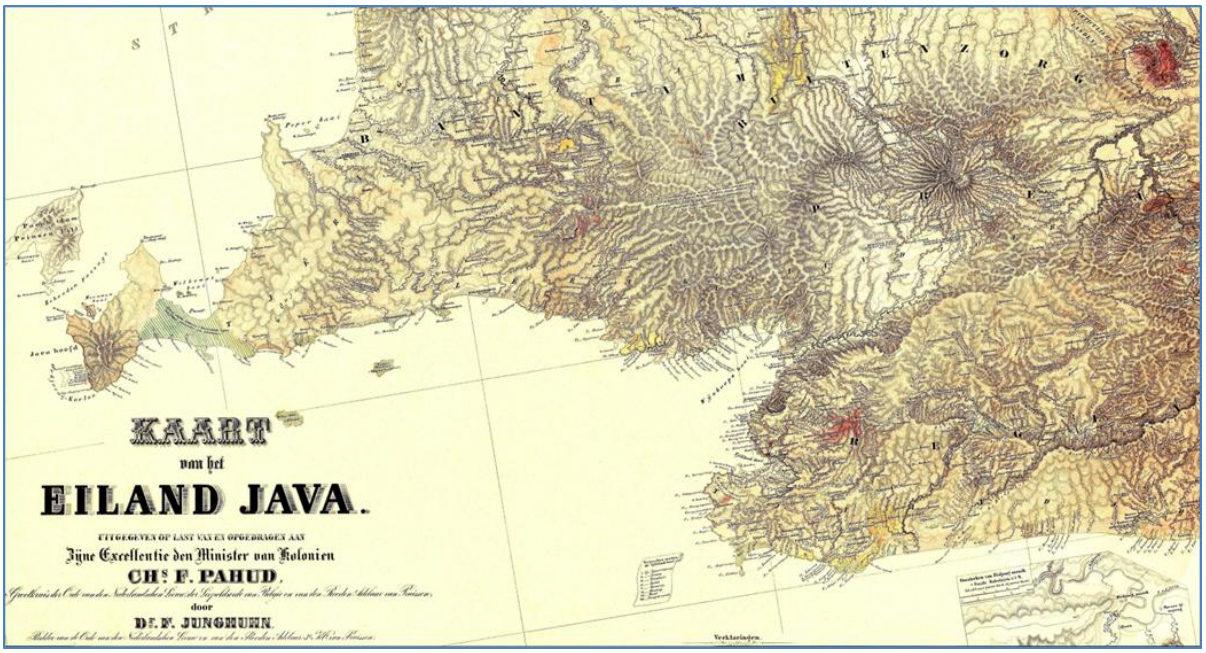


Figure 8: *A detail of Junghuhn's "Topographic map of the island Java" (Sheet 1; 1855).*

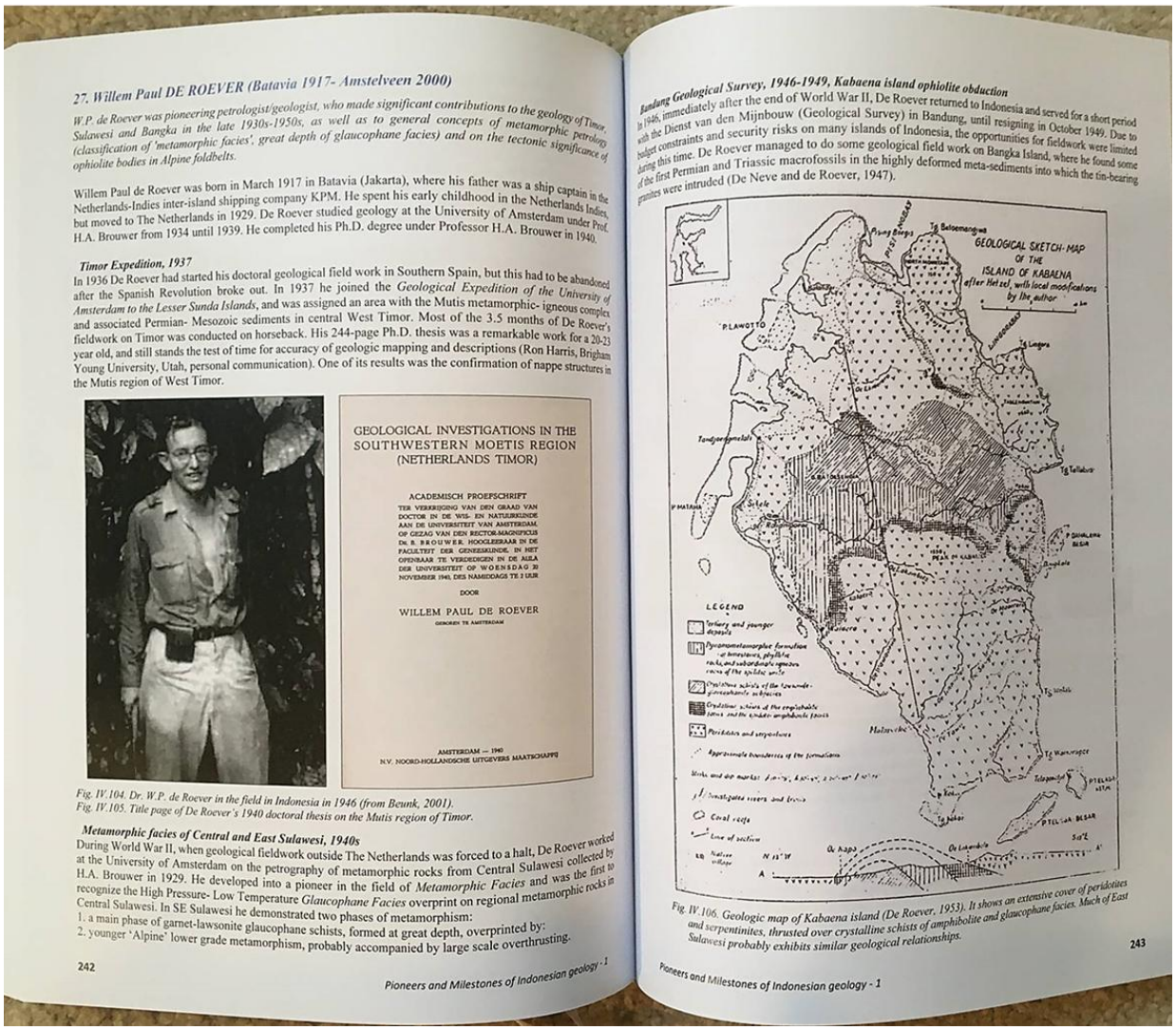
Junghuhn, the German-Dutch medical doctor and naturalist (1809-1864), is a familiar figure in Indonesia and was studied by generations of middle school biology students. Despite harsh fieldwork conditions, he made significant contributions, including the first topographic map of the Batak Lands of Sumatra, the renowned map of Java (Figure 8), and several geological works. His legacy is honored with memorials on the slopes of Tangkuban Perahu, in his hometown of Mansfeld, and at his birthplace in Germany. Van Gorsel contends that Junghuhn primarily dedicated his career to the Dutch East Indies during the mid-19th century."

Another Commission member highlighted in the book is Salomon Muller, a German naturalist, who extensively explored and documented remote Indonesian regions from 1826 to 1837 (e.g. Figure 9). Muller's significant contributions include the discovery of coal deposits in Southeast Kalimantan and the identification of the distinct faunal boundary between western (Asian) and eastern (Australian) faunas in Indonesia. This discovery is generally credited to British naturalist Alfred Russel Wallace ('Wallace Line'), but Wallace was merely the first to describe this faunal boundary in the English language. Despite this oversight, Van Gorsel posits Muller as the true founder of zoological geography (Glaubrecht, 2002). Enduring arduous conditions, Muller amassed a vast collection of birds, plants, and minerals during his expeditions. Upon returning to Europe in 1837, he dedicated himself to their scientific study. His many publications are cataloged in the 'Pioneers' book. Muller retired in Germany in 1850 and passed away in 1864.

Carl A.L.M. Schwaner, another German naturalist-geologist, was a prominent figure in Southeast Kalimantan during the mid-19th century. Van Gorsel asserts that Schwaner's most significant achievement was his arduous journey across Kalimantan/Borneo Island, traversing from Banjarmasin in the southeast to Pontianak in the west, and navigating the Kapuas Murung, Katingan, Melawi, and Kapuas rivers. Given the region's hostile inhabitants known for headhunting, his feat is commemorated in the naming of the Schwaner Mountain range, now renowned among Indonesian geologists. Schwaner's geological contributions include the discovery of additional Eocene coal deposits at Riam Kiwa in Southeast Kalimantan, which the government subsequently developed into the Netherlands Indies' first coal mines in 1848-1849. Tragically, Schwaner succumbed to fever in Batavia at the young



Figure 9: *One example of the value of historic texts: is one of Salomon Muller's sketches of the islands of Sunda Straits, showing the Krakatau volcano complex in 1836, before its destruction in 1883 (Muller, 1844).*



27. Willem Paul DE ROEVER (Batavia 1917- Amstelveen 2000)

W.P. de Roever was pioneering petrologist/geologist, who made significant contributions to the geology of Timor, Sulawesi and Bangka in the late 1930s-1950s, as well as to general concepts of metamorphic petrology (classification of 'metamorphic facies', great depth of glaucophane facies) and on the tectonic significance of ophiolite bodies in Alpine foldbelts.

Willem Paul de Roever was born in March 1917 in Batavia (Jakarta), where his father was a ship captain in the Netherlands-Indies inter-island shipping company KPM. He spent his early childhood in the Netherlands Indies, but moved to The Netherlands in 1929. De Roever studied geology at the University of Amsterdam under Prof. H.A. Brouwer from 1934 until 1939. He completed his Ph.D. degree under Professor H.A. Brouwer in 1940.

Timor Expedition, 1937

In 1936 De Roever had started his doctoral geological field work in Southern Spain, but this had to be abandoned after the Spanish Revolution broke out. In 1937 he joined the *Geological Expedition of the University of Amsterdam to the Lesser Sunda Islands*, and was assigned an area with the Mutis metamorphic- igneous complex and associated Permian- Mesozoic sediments in central West Timor. Most of the 3.5 months of De Roever's fieldwork on Timor was conducted on horseback. His 244-page Ph.D. thesis was a remarkable work for a 20-23 year old, and still stands the test of time for accuracy of geologic mapping and descriptions (Ron Harris, Brigham Young University, Utah, personal communication). One of its results was the confirmation of nappe structures in the Mutis region of West Timor.

GEOLOGICAL INVESTIGATIONS IN THE SOUTHWESTERN MOETIS REGION (NETHERLANDS TIMOR)

ACADEMISCH PROEFSCHRIFT
TER VERKRIJGING VAN DEN GRAAD VAN DOCTOR IN DE WIS- EN NATUURKUNDE AAN DE UNIVERSITEIT VAN AMSTERDAM, OP GEZAG VAN DEN RECTOR-MAGNIFICUS Dr. R. BROUWER, HOOGLEERAAR IN DE FACULTEIT DER GENEESKUNDE, IN HET OPENBAAR TE VERDEDIGEN IN DE AULA DER UNIVERSITEIT OP WOENSDAG 20 NOVEMBER 1940, DES NAMIDDAGS TE 1 UUR

DOOR

WILLEM PAUL DE ROEVER
GEBOREN TE AMSTERDAM

AMSTERDAM — 1940
N.V. NOORD-HOLLANDSCHE UITGEVERS MAATSCHAPPIJ

Fig. IV.104. Dr. W.P. de Roever in the field in Indonesia in 1946 (from Beunk, 2001).
Fig. IV.105. Title page of De Roever's 1940 doctoral thesis on the Mutis region of Timor.

Metamorphic facies of Central and East Sulawesi, 1940s

During World War II, when geological fieldwork outside The Netherlands was forced to a halt, De Roever worked at the University of Amsterdam on the petrography of metamorphic rocks from Central Sulawesi collected by H.A. Brouwer in 1929. He developed into a pioneer in the field of *Metamorphic Facies* and was the first to recognize the High Pressure- Low Temperature *Glaucophane Facies* overprint on regional metamorphic rocks in Central Sulawesi. In SE Sulawesi he demonstrated two phases of metamorphism:
1. a main phase of garnet-lawsonite glaucophane schists, formed at great depth, overprinted by:
2. younger 'Alpine' lower grade metamorphism, probably accompanied by large scale overthrusting.

242

Pioneers and Milestones of Indonesian geology - 1

Bandung Geological Survey, 1946-1949, Kabaena island ophiolite obduction

In 1946, immediately after the end of World War II, De Roever returned to Indonesia and served for a short period with the Dienst van den Mijnbouw (Geological Survey) in Bandung, until resigning in October 1949. Due to budget constraints and security risks on many islands of Indonesia, the opportunities for fieldwork were limited during this time. De Roever managed to do some geological field work on Bangka Island, where he found some of the first Permian and Triassic macrofossils in the highly deformed meta-sediments into which the tin-bearing granites were intruded (De Neve and de Roever, 1947).

GEOLOGICAL SKETCH-MAP OF THE ISLAND OF KABAENA
after Hetzel, with local modifications by the author

LEGEND

Fig. IV.106. Geologic map of Kabaena island (De Roever, 1953). It shows an extensive cover of peridotites and serpentinites, thrusted over crystalline schists of amphibolite and glaucophane facies. Much of East Sulawesi probably exhibits similar geological relationships.

243

Pioneers and Milestones of Indonesian geology - 1

Figure 10: *Two example pages from Pioneers volume 1, from the chapter on W.P. de Roever, a pioneer of geology of Timor and on metamorphic facies.*

age of 34 on March 30, 1851. The results of his works were published posthumously in 1853.

Van Gorsel's interest in the geology of Indonesia started in the late 1960s, when he was a student of- Willem Paul de Roever, professor of mineralogy and petrology at the University of Amsterdam. In biography chapter 27 he describes how, at the tender age of 23, De Roever participated in the 1937 Geological Expedition of the University of Amsterdam to the Lesser Sunda Islands, and earned his doctorate in 1940 with a groundbreaking thesis titled "Geological Investigations in the Southwestern Moetis Region (Timor)". The author emphasizes the extraordinary nature of de Roever's fieldwork, conducted primarily on horseback. The exceptional quality of his research garnered worldwide acclaim from experts.

De Roever became a pioneering figure in the classification of metamorphic facies, and in the 1950s was also the first to propose the revolutionary idea that the large ophiolite bodies outcropping across the Tethyan foldbelts and into Indonesia and New Guinea, were actually obducted

fragments of the Earth's mantle. His research was grounded in the petrography of metamorphic rocks from Central Sulawesi, based on samples collected by H. A. Brouwer in 1929. Undeterred by World War II, de Roever made a groundbreaking discovery: the overprinting of high-pressure, low-temperature glaucophane facies on regional metamorphic rocks in Central Sulawesi. Born in Jakarta in 1917, he passed away in Amstelveen in 2000.

Raden Saleh, a famous Indonesian artist, is unexpectedly revealed as an 'Accidental Naturalist' by the author. While celebrated as an accomplished Javanese painter, with masterpieces such as his portraits of mentor Antoine Payen (1847) and himself (1841), as well as the dramatic eruption of Mount Merapi (1865) (Figure 11), Saleh's talents and interests extended beyond the canvas. Van Gorsel highlights his contributions to natural history and paleontology, including the collection of Pleistocene *Stegodon trigonocephalus* skulls and molars in 1865-1866 (Figure 12). These specimens were subsequently analyzed by Professor K. Martin in Leiden. Unfortunately, Martin lamented the absence of Saleh's field notes detailing the excavation process.

There are many more pioneers listed in Volume 1. The earliest amongst them is G.E. Rumphius, who settled in Ambon as a merchant of the VOC from 1654, until his death in 1702, and, in his spare time, he described the flora of the Moluccas, as well as interesting rock types and the fossils from the Sula islands (now known as the first record of Jurassic ammonites and belemnites from Indonesia). Moreover, the Swiss cousins Paul and Fritz Sarasin have been the most referred to when scientists discuss the geology of Sulawesi. Petroleum geologist J.J. Dozy, who worked for BPM-Shell, was responsible for the accidental discovery of Ertsberg, the world's largest copper-gold deposit, in 1936 during a mountaineering expedition in West Papua.



Figure 11: *Javanese Raden Saleh's painting of the 1865 eruption of the Merapi volcano in Central Java (view during the day) (from Escher, 1983).*

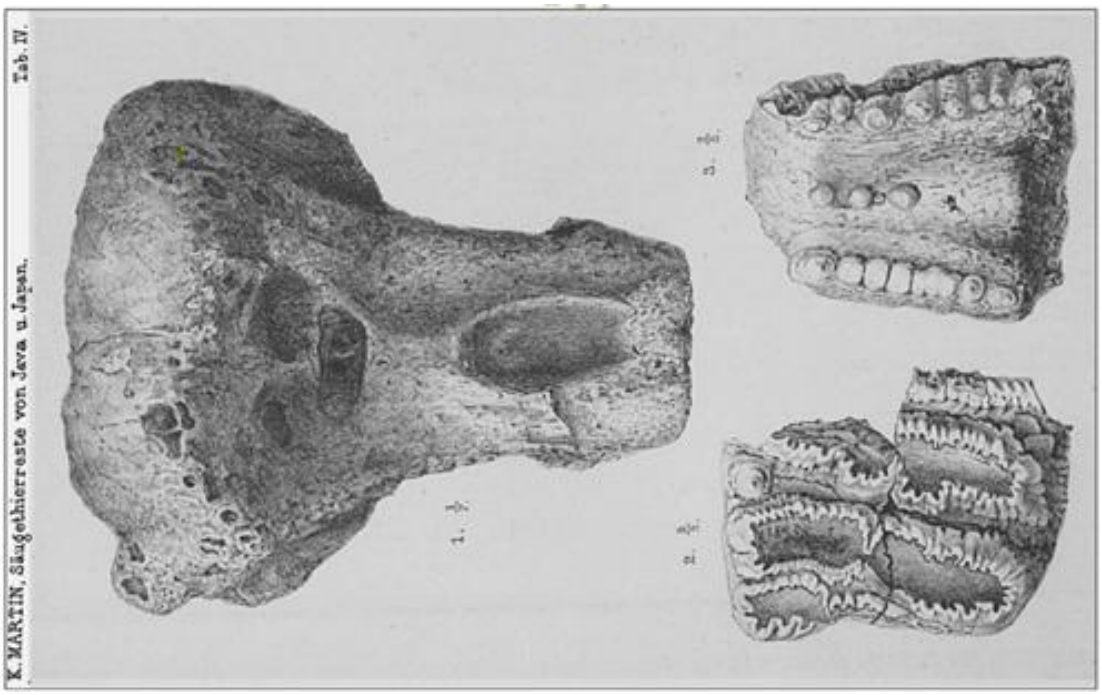


Figure 12: *Skull and molars of Stegodon trigonocephalus, found in Central Java by Raden Saleh in 1866.*

Apart from these names, there are still dozens more pioneers included in Volume 1.

Finally, one significant early milestone mentioned in the book was the compilation in 1915 of the first 'Geological Sketch Map of the Netherlands Indies' by Sulawesi pioneer E.C. (Edi') Abendanon. Obviously, there were still many 'white spots' (areas that had not yet been mapped or surveyed), but the main features of the geology of Java, Sumatra and West Kalimantan were already fairly well established at that time (Figure 13).

While minor typos may be present, this book effectively expands and deepens the understanding of geoscientists, particularly those based in Indonesia. The scope of the research is truly expansive. Countless lives and efforts have been dedicated to unraveling the geological secrets of the archipelago and advancing the field of geoscience.

Summarizing, in the first volume, Van Gorsel explained that from the 1400s through the late 1700s European traders came to the Indonesian region, at first from Portugal and later from the Netherlands, under the flag of the private enterprise United East Indies Company (VOC). They were well-armed entrepreneurs, who came for trading profits, and had no 'colonial' territorial ambitions, except for the establishment of strategically-located fortified trading posts. After the bankruptcy of the VOC in 1799, the state of the Netherlands assumed control of VOC assets and liabilities and started to expand territorial control over increasingly larger parts of what is now Indonesia, eventually resulting in the colony of the Netherlands East Indies. This transition also marked the beginning of more systematic scientific exploration of the natural world of the region, followed later by more systematic evaluations of its abundant natural resources.

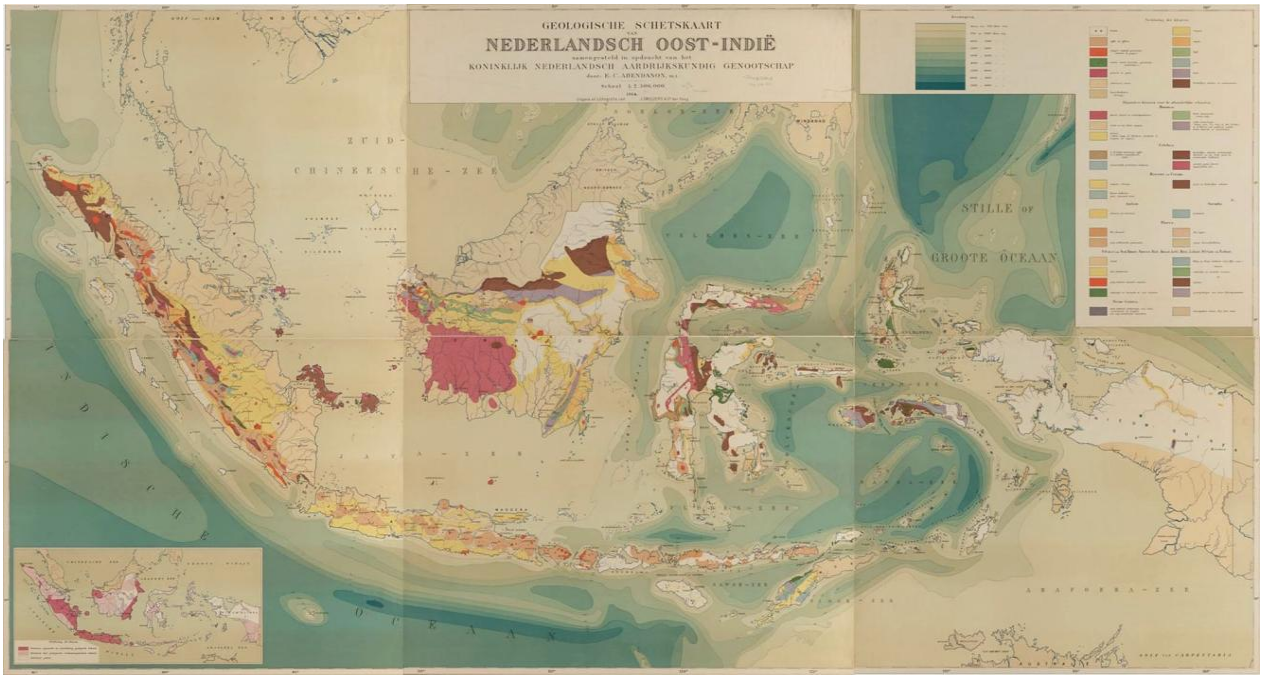


Figure 13: *The first nation-wide geological map of the Indonesian region (Abendanon, 1915).*

In volume two, the focus shifts to the work of the Bureau of Mines/ Geological Survey of the Netherlands Indies since 1850. In this year, an institution named the *Dienst van het Mijnwezen* (later renamed *Dienst van den Mijnbouw*) was established to more systematically explore and evaluate mining opportunities and provide as much cash as possible for the government. The review of Volume 2 will be published in the next edition of Berita Sedimentologi.

The Pioneers books are available for purchase from ITB Geology Department, Bandung, Indonesia. Some excerpts from the book volumes may also be viewed at https://www.vangorselslist.com/pioneers.html.