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ARTICLE

Austrian Observations of Luzon in the 1878 Book *Fragments Concerning a Geology of the Island of Luzon* by Richard Freiherr von Drasche-Wartinberg, Translation of Chapter 6: Benguet

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ABSTRACT

Since the 1860s, German-speaking scholars have visited the Philippines. Philippine historians now recognize their contributions to the study of the Spanish colony, its islands, and inhabitants. These scholars included Austrian nationals, among them the relatively unknown Richard Freiherr von Drasche-Wartinberg. Von Drasche visited the Philippines in 1878 and published his geological findings in his book *Fragmente zu einer Geologie der Insel Luzon (Philippinen). Mit einem Anh. über die Foraminiferen der tertiäeren Thone von Luzon von Felix Karrer* (*Fragments concerning a Geology of the Island of Luzon (Philippines). With an Appendix Concerning the Foraminifers of the Tertiary Clays of Luzon by Felix Karrer*). While it contributes to studies of the Philippines, research has so far uncovered only snippets of English translations of the original.

This research note introduces and contextualizes the book, particularly the sixth chapter concerning Benguet, which it translates for scholars who require an English language copy of the text. To facilitate comparison with the original and convey its particular character, the translation aims to remain true to the content, writing style, and formatting of the original text.

KEYWORDS

von Drasche, Austrian scientist, geological survey, Luzon, foraminifera

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Introduction

This research note introduces and contextualizes the book *Fragmente zu einer Geologie der Insel Luzon (Philippinen). Mit einem Anh. über die Foraminiferen der tertiäeren Thone von Luzon von Felix Karrer*[1] (*Fragments concerning a Geology of the Island of Luzon (Philippines). With an app. of the foraminifera of the tertiary clays of Luzon by Felix Karrer*). The monograph was published in 1878 by Richard Freiherr von Drasche-Wartinberg (referred to hereafter as "Von Drasche," following his designation at the time of his book) and describes his travels and his geological findings on the island of Luzon in the Philippines of that same year. The sixth chapter of the book is particularly interesting and was chosen for translation.

While the *Fragmente* may hitherto be relatively unknown in the Philippines, enduring interest in his book is indicated by recent editions of it, for example by Pranava in 2020 (Booklooker 2023) and Forgotten Books in 2022 (Akademika 2023). The contribution of von Drasche to early collections of items from the Philippines has been acknowledged in fairly recent scientific publications (Marschall 2010; Jimi, Salazar-Vallejo, Kajihara 2017). The book is fairly easily available in the German language of the original, but a full translation into English is not. There exists a translation into the Spanish language, *Datos para un estudio geológico de la Isla de Luzón (Filipinas)*, retrieved from the *Boletín de la Comisión del Mapa geológico de España* of 1881, albeit with the description of being "in part very untrustworthy" (Becker 1901, 113; United States War Department 1909, 516). Research has so far uncovered only snippets of English translations of von Drasche's *Fragmente*, found in George Ferdinand Becker's book *Report on the Geology of the Philippine Islands* (Becker 1901, 33–34, 41, 92). As German is not a popularly spoken language in the Philippines, a translation into a more commonly read language could benefit students of Philippine History and the Earth Sciences and may generate interest in and facilitate use of von Drasche's contribution to these disciplines.

The book covers the strike directions of the Philippine islands, the general oro- and hydrography of the island of Luzon, the Bahia of Manila and its environs, the plain of Pampanga, Mount Arayat, the Sierra of Zambales, the Cordillera Central and the Caraballo Sur region, the Military District of Benguet, the Military Districts of Lepanto and Bontoc, the Laguna de Bay and its banks, the mountain range of Balete and San Mateo, the Provinces of Tayabas and Camarines Norte, and the Provinces of Camarines Sur and Albay.

Designated as a piecemeal geological study of the Island of Luzon, the text aims to be scientific, in spite of many complex sentences. While it follows von Drasche's travels around Luzon, it reads less like a typical travel journal than a brief and selective (hence the term "fragments" in the title) geological guide to the Island. The author himself refers to it as "a silent call for future travelers to conduct research and to collect" in the Philippines (von Drasche 1878, vii). Von Drasche does not include dates of his visits to individual sites while he reports his geological

findings. These, and the landscape, are the main concerns of his sightseeing and cultural experiences, which he describes in detail. He includes very few personal reflections and memorable moments, such as being surprised by a storm in Benguet in chapter 6, which serves more as an example of the difficulties that geologists face in the tropics, which include "dense vegetation and the deeply interfering decomposition of the ground" (von Drasche 1874, vii). His further personal experiences concern the "lack of all artificial development through quarries, road- and railroad constructions;" good maps, which "the only useful one is that of F. Coello;[2]" "the wild tribes in the mountains, which mainly in the north of Luzon, make most of the passages impossible" (von Drasche 1878, vii); difficulties finding a guide among the Negritos due to feuds between their tribes (von Drasche 1878, 13).

The book does, however, have a rich cultural background and offers a historical perspective of an early intellectual and technical approach to geological exploration of the Philippines by an Austrian researcher. It opens up the six following interesting and interwoven avenues of research, especially about Austro-Philippine relations: politics, religion, society, scientific research (in the context of the *Fragmente*, particularly geology), economics, and, finally, colonialism. The sixth chapter, which discusses Benguet, was chosen for translation for this research note, as the province has a long mining history and is a site affected by interesting recent developments in the mining industry of the Philippines. In combination with von Drasche's economic and social background as the son of an industrialist with an interest in coal, the matter of mining in the Philippines also raises the question of whether von Drasche's motivation for his exploration of Luzon was purely of an academic nature or influenced by economic interests.

Materials and Methods

To make von Drasche's work more accessible to scholars who require an English version of the text, a translation of a portion of the original text, namely the sixth chapter, is being undertaken, which is offered in this article. Several dictionaries were used to address the specific vocabulary used in the text, primarily:

Geological terminology:	*Wörterbuch der Geologie/Dictionary of Geology*
German terms:	*Duden - Deutsches Universalwörterbuch/Duden – German Universal Dictionary*

This translation aims to remain true to the content and style of writing—including punctuation, formulation, sentence, and paragraph structure—as well as the overall formatting of the original text. While the original style may be more demanding to peruse, the pursued adherence to it is hoped to facilitate comparison with the original and better convey its particular character, peculiar to the author, his culture, and his time.

Discussion

In the nineteenth century, scientifically oriented travel was greatly facilitated, according to Christa Riedl-Dorn, leading to a large number of Austrian individuals and increasingly Austrian scientific associations becoming involved in studying and collecting research material (Riedl-Dorn 1998–1999, 156–57). There were, according to Hermann Mückler, several Austrians who traveled the Indo-Pacific for a variety of reasons (Mückler 2012, 9). The nineteenth century saw several circumnavigations, and specifically scientific expeditions of the Austrian and later Austro-Hungarian navy, which undertook nautical and scientific tasks within the training program of naval cadets, and rendered the Austrian science and court museums an invaluable service by enriching their collections (Ibid., 13). Other Austrian individuals traveled to the region on various non-Austrian ships (Ibid., 14). Austrian contributions to the study of the Philippines may, to this day, provide stimulating material for studies in areas such as anthropology, colonialism, diaspora, ethnography, geology, history, and migration.

In the nineteenth century, German and Austrian scientists writing about the Philippines enjoyed the trust and respect of Filipinos, such as Jose Rizal, whose good friend Ferdinand Blumentritt was an Austrian national. In *Spectres of Germany: Colonial Rivalry & Scholarship in the Philippine Reform Movement & Revolution*, Nathaniel Parker Weston draws close attention to a gracious letter written by Felipe Agoncillo, minister plenipotentiary of the First Philippine Republic. The letter is dated 3 March 1900, addressed to Rudolf Virchow, German scientist and president and co-founder of the German Society for Anthropology, Ethnology, and Prehistory (Deutsche Gesellschaft für Anthropologie, Ethnologie, und Urgeschichte, DGAEU)—and is flatteringly expressive of Agoncillo's gratitude to German scientists for their contribution to knowledge of the Philippines. Agoncillo makes the effort to thank a number of them individually by surname: [Fedor] Jagor, [Carl] Semper, [Alexander] Schadenberg, [Wilhelm] Joest, [Adolf] Bastian, [Bernhard] Meyer, [Hans] Meyer, and [Ferdinand] Blumentritt (Weston 2021, 3). By the time of the said letter, this contribution already covered around four decades, as "[b]eginning in the 1860s, the German-speaking scholars named by Agoncillo began producing new knowledge about the Philippines and its inhabitants that soon established them across Europe and the world as the foremost experts on the Spanish colony" (Ibid., 225).

The use of scientific texts produced by these scientists transgressed the academic world to that of colonial politics in the Philippines, where Spanish colonials employed them as a means of exerting power over the country: "In hopes of retaining the colony, several Spanish authors adopted portions of the translated German-language texts in their writings about the commercial potential in the islands" (Ibid., 5). The Filipino residents deftly turned the tables using the same third-party findings, and "repudiated arguments about their lack of civilization in part through recourse to non-Spanish authorities on the Philippines, such as

Jagor and other German-speaking scholars" (Ibid., 5). It comes as no surprise that, as Weston notes, Philippine historians, including Benedict Anderson (Anderson 2005) and Resil Mojares (Mojares 2006), have grasped the importance of this German scholarship (Weston 2021, xiv).

Among the many scientists mentioned in Agoncillo's letter, Blumentritt is the sole Austrian, and, while his fellow scientist, von Drasche, is not mentioned, his contribution to the knowledge of the Philippines is significant. In his *Bibliotheca Philippina*, Blumentritt thanks von Drasche for his extraordinary courtesy (Blumentritt 1885, Foreword). Von Drasche, an industrialist who had studied geology, had visited the Philippines from 1875 to 1876 and had apparently provided helpful material with the subsequent publication in 1878 of his geological findings in his *Fragmente*. Von Drasche was subsequently awarded membership of the Leopoldina, an academy of medicine and the natural sciences, which in 2008 was declared the German National Academy of Sciences (Leopoldina 2023).

The *Fragmente* came into being in an interesting context. Politically, the author's country has been linked—if not particularly obtrusively—through the Austrian House of Habsburg, also known as the House of Austria, which brought forth the Habsburg Spanish monarchs. The Austrian Holy Roman Emperor Maximilian I (1459–1519) fathered Philip I, King of Spain (1478–1506), the first Spanish Habsburg monarch. Philip I's grandson, Philip II, King of Spain (1527–1598) [Wheatcroft 103, 105], under whose rule the Philippines was conquered, became the archipelago's eponymous ruler. Both dynastic monarchies were still respectively ruling the Austro-Hungarian Empire and the Spanish Empire at the time that von Drasche left his homeland of Austria in the former to visit the Philippines in the latter.

Moving swiftly to the avenue of religion, the Spanish conquest of the Philippines and its conversion of much of the Philippine population to the Catholic faith are well known. Austria joined in this endeavor, and as noted by Maria Zenaida Collinson, "[b]etween 1673 and 1729 Jesuits from territories of the Austrian empire began arriving in the Philippines" (Collinson 2017, 29). The Philippines remains predominantly Catholic to this day, and, according to the Philippine Statistics Authority, "[o]f the 108,667,043-household population in 2020, nearly four-fifths or 85,645,362 persons (78.8%) reported Roman Catholic as their religious affiliation" (Mapa n.p.). The *Fragmente* contains very few references to religion and Catholicism, other than the mention of a Cura in Pampanga, who helped von Drasche find a Negrito guide (von Drasche 1878, 13), and the description of Angaqui as a Christian village (Ibid., 38). It focuses on geological findings, keeping a fairly neutral tone about manifestations of religion in the Philippines, and avoiding a possible involvement in local concerns of a religious, political, or social nature.

Regarding the social aspects of the background of von Drasche's book, the areas of migration and diaspora at the time it was written are particularly interesting.

They embrace a variety of visitors from Austria as well as other parts of the world, and have remained relevant and at times problematic topics to this day, for example, with respect to human trafficking. By 2021, 5,874 Philippine nationals were living in Austria (Statistik Austria, n.p.). Austrians continue to be interested in residing in the Philippines, and as of July 1, 2022, 1,400 Austrian nationals were living in the Philippines (Ibid., n.p.)—arguably, a sizeable number out of a total of 9,104,772 Austrian citizens in their homeland.

Tying up with Austrian migrants and visitors to the Philippines, we find along the academic avenue of interest visiting scientists from Austria. Of these, Austrian Ambassador Wilhelm M. Donko points out the "Austrian Jesuit missionary, botanist and pharmacist Georg Joseph Kamel (1661–1706) who lived, worked and died in Intramuros, Manila. The 'camellia' is named in his honor" (Donko 2017, 52). Warwick Anderson adds to this: "Fr. J.G. Kamel, S.J., for whom Linnaeus named the camellia, undertook the most extensive analysis of Philippine material to date" (Anderson 2007, 292). Fr. Kamel's academic attainments stand in contrast to the criticism leveled at Spaniards in the Philippines under Spanish rule, with the claim that "[m]ost visitors [in the early nineteenth century] found the Spanish residents 'exceedingly indolent,' and deplored the lack of books in the archipelago (MacMicking 1969, 47)" (Anderson 2007, 292).

Education in the Philippines under Spanish rule was a contentious matter, which affected interactions with visitors from abroad. For the Filipino nationalist Jose Rizal, for example, "a commitment to science and reason informed patriotism, and patriotism implied a scientific orientation to the world" (Ibid., 298)—before he was executed on the grounds of rebellion against the Spanish colonial government. A protection of the innocence of the residents could, for example, serve to keep criticism of the Spanish rule at bay. It might explain the cause of the reported complaint of an English visitor to Manila early in the nineteenth century that, "with 'jealousy of foreigners exceeding even the bounds of credibility, she [the Philippines] invariably refused them admittance, whether for scientific or commercial purposes (Piddington 1828, 68–69)" (Anderson 2007, 292). This is somewhat corroborated by the finding of Rudolf Angstner, that the local government in the Philippines did indeed follow a maxim in 1820, barring all foreigners from permanent residency (Angstner 2017, 61). It was only by 1845 that a Spanish decree was circulated, "allowing foreign consuls to take up their duties in the capitals of Spanish colonies" (Ibid., 65)—paving the way for scientists like von Drasche.

An Austrian diplomatic representation in the Philippines was then and remains until today desirable for Austria, especially for economic reasons. Regarding the historical economic context of von Drasche's book, the commercial promise of the Philippines looms large. Back in the nineteenth century, this led to the first Austrian consulate in Manila once possible. In 1871, the Austrian Imperial Chancellor Count Friedrich Ferdinand von Beust had appealed to his Emperor

Franz Josef "[s]eeing that as the port city of Manila has gained in commercial and maritime importance since the opening of the Suez Canal, and that the appointment of an Imperial and Royal Honorary Consul has been favored not just by the consular inquiry committee, but also by the Hungarian as well as the [Austrian] Imperial-Royal Ministry of Trade" (Ibid., 68). Emperor Franz Josef gave his approval on 16 September 1871, about four years before von Drasche's visit, "and the Austro-Hungarian Empire established its 'official' presence in Manila" (Ibid., 68). The bilateral relations between Austria and the Philippines are now sufficiently friendly, and economic interests enticing enough, for Austria to now have an Embassy in Manila, as well as Honorary Consulates in Cebu and Davao. The Austrian Embassy in Manila reports that "Austrian exports to the Philippines reached the second highest value of the new millennium in the past year 2021 with EUR 164.02 million", while imports from the Philippines to Austria reached EUR 205.68 million that year (Austrian Embassy Manila 2022, n.p.).

As regards the geological exploration of the Philippines, it may be interesting to note Helmut W. Flügel's reference to the development around 1750 of the question, rooted in national economic mercantilism, of the practical use of the exploration of the ore bearing mountains for the good of the state and its population (Flügel 2003, 29). This may have been a motivating reason for von Drasche's geological exploration of the island of Luzon. While immigration to Austria in more recent history appears to be focused more on workers, with Gisela M. Reiterer pointing to the migration to Austria as starting in the 1960s, when the country faced a shortage of labor (Reiterer 2008, 37), in the Philippines, the economically alluring field of mining still commands great attention. The *2017 Annual Survey of Philippine Business and Industry (ASPBI) - Mining and Quarrying Sector with Total Employment of 20 and Over: Preliminary Results*, indicates that there were 130 mining establishments in the Philippines that year, employing 31,522 people with a total value of output amounting to an impressive 139,324,480,000 Philippine Pesos (Bautista 2019, n.p.).

This economic avenue of thought, particularly in view of the profound importance of mining to his life and family, gives Richard von Drasche's geological exploration of the Philippines credible context and adds depth to his undertaking. Gustav Otruba tells of how, in 1870, von Drasche's father had stated his ownership of 15 coal mines with about 800 million hundred weights of coal and an annually effective production of over 6 million hundredweights of coal, employing more than 4,000 workers. He claimed to mine a further 4 million hundred weights of coal in the coal seams he had opened up (Otruba 1962, 23). Von Drasche's geological studies look like a good investment in the family business of coal mining, which produced the raw material required for their profitable brick factories. Indeed, von Drasche reports in Chapter 6 on his unsuccessful search for the hard coal deposit in the area of Aringay, Benguet, and considers it "possible that the massive volcanic tuffs occurring here contain lignite deposits" (von Drasche 1874, 30).

He later visits a goldmine in Capunga, northeast of Trinidad (von Drasche 1874, 32). Near the end of his travels, he surmises that there are two types of gold deposits in the Philippines (Ibid., 63).

This apparent marriage of economic and academic interests in von Drasche's geological survey bears on greater, international concerns, when the effects of the economic crisis on Austria-Hungary after the crash of 1873 are taken into account. The resulting increase in interest in overseas activities is noted by Walter Sauer as follows: "In economic terms, securing raw material supplies for Austrian industry became an issue for the first time." (Sauer 2012, 16). Austrian interest in getting hold of geological resources is understandable, and mining in the Philippines continues to have great appeal to international companies. In 2023, the Australian Trade and Industry Commission announced on the Australian Government website that "Unlike previous administrations' resistance to mining, the Marcos Jr. Administration has prioritized the revitalization of the mining sector" (Australian Government 2023, n.p.). The Philippine administration believed that "mining holds the greatest potential to be a key driver in the Philippines' economic recovery following the pandemic" and "will also secure the country's long-term growth", while the Australian government saw "strong supply opportunities across the entire mining value chain" (Ibid., n.p.). This sounds plausible, given the Australian government's estimate that "The Philippines is one of the world's most richly endowed mineral resource countries. It is estimated to have about $1 trillion worth of untapped copper, gold, nickel, zinc, and silver reserves. Only 5 percent of these reserves have been explored, and 3 percent is covered by mining contracts" (Ibid., 2023, n.p.). This optimism was shared by the Canadian Government, which in 2024 advised that "The Philippines has rich deposits of copper, gold, nickel, and other minerals still waiting to be tapped, and 55 operating metallic mines and seven processing plants" (Government of Canada 2024, n.p.). Mining further creates employment in mineral processing, mine site construction, and material supply, which can be lucrative and enticing for international companies.

Mining in the Philippines remains, however, a fraught subject with a long history. Benguet, for example, which von Drasche describes in the sixth chapter of his *Fragmente*, has a history of mining going back to before the Spanish colonial era in the Philippines. Today, "Itogon, one of Benguet's mining towns, is host to three large-scale mining operations: Benguet Corporation, Inc., established in 1903, ISRI started in 1930, and Philex Mining Corporation (Rappler 2024, n.p.). The Rappler reported that "ISRI is applying for a mineral processing and sharing agreement (MPSA) covering 581 hectares. Dalicno, a sitio with around 2400 registered voters, and its water source are inside the applied area." The local residents were now concerned about the serious impact these activities would have on their "watershed, water source, residential areas, and livelihood" (Ibid., n.p.). Throughout the Spanish period, toward the end of which von Drasche visited Benguet, the "mining and trade of gold were among the most vital economic

activities of the Ibaloy and Kankanay Igorots of Benguet province" (Habana 2000, 455), and many attempts were made "to locate and exploit the Igorot gold mines" (Ibid., 455).

The exploitation of countries like the Philippines and their resources was, of course, not limited to the activities of Spanish colonialists. Although an empire, Austria does not necessarily come to mind in discussions about colonialism. But according to Alison Frank, "The insistence that Austria's maritime trade was benevolent did not, however, prevent Austria from encountering the same moral, legal, and commercial paradoxes that affected any Europeans to bring civilization, in the form of commerce" (Frank 2012, 411). Indeed, it has been found that "at no point in time did the Habsburg Empire regard European imperial policies as illegitimate" (Sauer 2012, 17). Colonialist involvement was not well evaded by Austrians abroad, as "most, if not all individuals who traveled across Africa, the Americas or Asia for the purposes of 'exploration' or 'research,' did so in a political, colonial context. Some even enjoyed the covert backing of state institutions" (Sauer 2012, 22). The interests of these individuals were "political, economic, scientific, and cultural, religious, etc., and they could arise from civil society or government or both" (Sauer 2012, 22). This idea is corroborated elsewhere: "Although Austria-Hungary never owned overseas colonies, the monarchy played an important role in seconding colonial politics of the German Empire. […] In addition to such direct involvement with European colonialism, Austrian institutions initiated many 'semi-colonialist' activities, such as missionary work or scientific expeditions" (Loidl 2012, 161). Furthermore, the Modern Humanities Research Association has asserted that "Austrians participated in all aspects of the prolonged and dynamic process of European penetration and appropriation of the overseas short of acquiring territorial possessions" (Modern Humanities Research Association 2012, 1), and that "even travelers who claimed detachment from mainstream discourses were indebted, and in turn contributed, to the Europeans' project of defining the world beyond Europe in their terms" (Modern Humanities Research Association 2012, 2).

In this discomforting light, the Austrian engagement with the world at that time gains a darker image. The frigate *Novara*, which circumnavigated the world from 1857 to 1859, may have been on a scientific mission, but, according to Donko, it "became the first Austrian warship to make a port call in the Philippines" (Donko 2017, 43–44). Indeed, his mention that "there was usually at least one Austian warship permanently stationed in East Asia, one from the 1870s to the outbreak of World War I in 1914" (Donko 2017, 52), could have appeared like a silent threat for those countries in whose waters the respective warship was located. Sauer has furthermore found that "it was a conscious policy among navy commanders to use travelers as camouflage for colonial conquest" (Sauer 2012, 8). Matters get worse considering Sauer's comment on violence being used frequently by travelers against the local population "to extort from them food, porters or guides, to enforce passage or simply as deterrent or punishment. This had become a matter

of course, and the Austria-Hungarian travelers made no exception" (Sauer 2012, 9–10). He also refers to reports of "killings by [Graf Sámuel] Teleki [von Szék] / [Ludwig Ritter von] Höhnel 1888 in Kenya and by [Oscar] Baumann (heading a German expedition) in 1892 in Rwanda and Burundi" (Sauer 2012, 10). These actions appear even more heinous, also in spirit, as Sauer notes that almost "all 'explorers' had colonial interests in mind anyway, and in many cases criticized their own (Austro-Hungarian) government for not being pro-active in overseas policies" (Sauer 2012, 10).

So, on the one hand, Austria "was able to use the construct of a 'clean colonial past' to establish good relations with […] the newly independent countries in Africa and Asia in particular" (Sauer 2012, 6). It does, however, come as no surprise to encounter the assertion that "the repercussions of Austria's colonial past are still tangible well into the twenty-first century, and connections between overseas science and racial though [sic] are visible in Austria as much as elsewhere. […] Austria is not free from postcolonial demands for retribution, here claims for the return of human remains or artefacts "(Modern Humanities Research Association 2012, 3). These skeletons in Austria's closet reinforce the following of Sauer's questions, that is particularly relevant to von Drasche's book: "Has Austrian academic research […] always been unselfish and unconnected to any political or economic interests?" (Sauer 2012, 7). Dr. Phil. Richard von Drasche was reported to have used the great wealth of his father for considerable humanitarian charity, suggesting a benevolent nature of the man, which could have extended to his research in other countries and the peoples there. He did, however, receive a baronetcy for this generosity (Otruba 1962, 31). But even if von Drasche's incentive in exploring the Philippines was, at least in part, of an economic nature, and he served the Austrian colonialist interests in the Philippines by producing valuable knowledge of the Philippine landscape and geological resources of space, energy, and minerals, the question remains how much he knew and approved of this. The detrimental effect on the local Philippine population is also debatable, as Austria did not rule the Philippines and thus had little power over its people. The Philippine readers had furthermore shown themselves quite capable of making use of such academic material for their agenda against their perceived detractors, redirecting German and Austrian fire at Spanish fire.

Translation

SIXTH CHAPTER
The military district of Benguet.

In the west of the Cordillera Central are the so-called districtos militares. The same lie in the upper run of the Rio Agno, as well as in the entire river basin of the Rio de Abra up to a few miles before it flows into the China Sea. The southernmost of

these districts is Benguet, farther north follow Lepanto, then Bontoc, and finally Abra. Toward the east, the Cordillera forms the border between these provinces and Nueva Vizcaya.

In these extraordinarily mountainous areas, Coello's map at the scale of 1: 1,000.000 is absolutely insufficient. Of the provinces Abra, Bontoc, and Lepanto, there is, as already mentioned in the foreword, a printed sketch: Croquis de la provincia Abra. Levantado en los 1868 al 1870 por el Comandante grado de Infa y Gobernador de la misma Dn. Esteban Peñarubia. Comprende parte de la provincia de Ilocos Sur y de los districtos de Lepanto y Bontoc. Escala de 1/200000 [Sketch of the province of Abra. Drawn up in 1868 to 1870 by the Commander, Infantry rank and Governor of the same Dn. Esteban Peñarubia. It includes part of the province of Ilocos Sur and the districts of Lepanto and Bontoc. Scale of 1/200000]. The eastern part of this map is unfortunately also incorrect and was probably drawn only according to collected information and not according to own observations; a large number of place names do not exist in reality, likewise, the directions of the rivers are often quite incorrectly drawn.

The districts of Benguet, Lepanto, and Bontoc that were drawn anew by me on plate I should depict the area, if nowhere near completely perfectly, then nevertheless, more correctly.

To get to Benguet from the plain, I turned from S. Jacinto northwards to Aringay, from where the path leads to the military district. From S. Jacinto, the same leads via S. Faban consistently along the flat seacoast. San Fabian lies a few minutes from the sea. Here, the chain of hills appears again, which had receded at Sto. Niño, from the east up to the road. As far as Aringay and probably even further north runs a 200 to 300-foot-high range of hills along the narrow alluvial area, that plunges quite steeply toward the plain. Numerous streams have broken through it vertically on their course, and let the higher mountains of the eastern mountain range be seen through their valleys (s. Fig. 8). This exceptionally regular decline

of the range of hills toward the sea corresponds to an old shoreline. The acclivity from the foot of the hills to the sea is so gentle that a lowering of several meters would be sufficient for the sea to lap against the hills again.

To the east of Sto. Tomas lies the high Mte. de Sto. Tomas or Mte. Tonglon. It is connected in the south with the low Mte. S. Fabian. Both are exceptionally densely forested mountains.

The Monte S. Tomas has, according to A. Montero's[3] map, a height of 8120 sp. feet, (Semper [Zeitschr. F. Allg. Erdkunde 1862, p. 8] cites the height of this mountain according to measurements by CI. Montero at 6948 feet), should also be one of the highest mountains of Luzon. It is usually thought to be an extinct volcano, as a passage in a report about a contemporaneous eruption of three volcanoes in

January 1641 is seen to point to it. Jagor (op. cit. p 323) provides a literal translation of this document, in which, however, 1. this eruption can point to all kinds of mountains of northwest Luzon, and 2. nothing whatsoever is said about an actual eruption. The passage in question reads: Near the Igolots,[4] who in relation to the Ilocos[5] live five days' journey away further east inland, the earth suffered so terrible and frightening an earthquake on the 4th of January as the preceding raging storm had announced. The earth swallowed three mountains, of which one, on the slopes of which lay three villages, was inaccessible. This whole mass, torn from its foundations, flew into the air at the same time as much water, so that the gap formed a wide lake, without leaving any sign, neither of the villages, nor the high mountains, that had stood there. Wind and water blew up the guts of the earth with such an extraordinary rage, that trees and mountains were slung in pieces 12 pikes[6] high and made such a terrible sound upon ramming into each other in the air and in falling, that it could be heard many hours away." In this confusing narration, nothing of "fire," a word that historians old and new like to throw about so much when describing eruptions, is mentioned; it seems that the phenomenon described can be traced back to a strong earthquake with massive landslides and damming of the waters caused by it. Semper narrates meanwhile (op. cit., 83) that in the work by P. Buseta, an eruption of 1635 is mentioned, and he also reports "the eruption of hot gases at the foot of the mountain of sedimentary conglomerate, without the slightest trace of igneous rocks or lavas."

Of the coal deposit in the area of Aringay, I was unable to find out anything; it may be possible that the massive volcanic tuffs occurring here contain lignite deposits.

Unfortunately, I could not find a guide who would lead me to the top of the mountain. Recently spotted gangs of Malay robbers (Tulisanes), who penetrated even to the plain, plundered the villages and were said to have their hideouts around the Aringay, frightened the fearful population to such an extent that no one wanted to accompany me; thus, the ascent had to be abandoned.

At the village of Aringay, the Rio de Aringay breaks through the parallel chain of hills and pours into the sea a quarter of an hour from the village. The Quebrada created by the river is used to get to the capital of Benguet, lying in the east. The range of hills near Aringay consists of a pale yellow, earthy tuff, which is a composite of disintegrated feldspar particles, in which numerous small hornblende crystals are scattered.

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One crosses the river several times and climbs up an extraordinarily steep path on its right bank over a mountain consisting of tuff, and finally arrives at the river again at the hamlet of Galiano.

Galiano lies on the right bank of the Rio de Aringay in a small, charming valley surrounded by mountains. On the banks of the clear and rapid river, beautiful tuffs

appear with a NE-SW strike and easterly dip below 10°. These tuffs are no longer earthy here, but rather hard, crystalline, sandstone-like; under the microscope, however, the tuff structure soon becomes clear. In a powdery, brown ground paste lie numerous flakes of green, dichroic hornblende and rounded off feldspar grains. Meanwhile, both components of the mixture are still quite fresh. The feldspars seem to be twofold, both orthoclastic and plagioclastic. The banks alternate with marl strata, which contain the remains of dicotyledonous plants. Prof. Semper mentions (*Ztschr. F. wissensch. Zoologie* 22; Bd. 235 „*Ueber Generationswechsel bei Steinkorallen* etc.") a coral found in the hills of Aringay, like the Heteropsammia rotundata Semp. found in the Philippine seas. Should this coral be found in the tuffs? Without a doubt, all these owe their origin to the trachyte-hornblende rocks.

From Galiano, one arrives after five hours of a very arduous journey at Benguet. Three times one crosses the river and always finds splendid tuff banks outcropping, the direction of which is incidentally very irregular. So, I found about one hour above Galiano: Str. h 2, Fall. h 8 45°.

One finally leaves the river and climbs up an extremely steep mountain. The road leads invariably through the white, crumbly tuff. One finally reaches the highest point, covered in spruce forests, and finds oneself on one of the mountain faces that encircle the valley of Benguet. Within half an hour, one has reached La Trinidad or Benguet, the main municipality of the eponymous district. The locality, which consists almost entirely of government buildings, stands at the edge of a circular valley, which lies about 4000 feet above sea level. The surrounding steep mountains should lie about 500–600 feet above the valley plain.

C. Semper has reported to us in detail (see Zeitschrift für allgem. Erdkunde 1862, p. 84–86, and „Die Philippinen und ihre Bewohner." Würzburg 1869) on this highly interesting valley. With an accurate look, he recognized in the coral biolithit sides girding the same remains of a former atoll. The Valley is almost circular, half a geographic mile in diameter, and is invaded on two opposite sides by a west-east flowing stream in two narrow gorges. To the west lies a small lagoon, which however, is said to take on large dimensions in the rainy season. This stream currently runs dry in the middle of the atoll, to appear again soon.

The village of Benguet lies on the western side of the valley. Further southwest, the mountain range breaks up into several round hills, over which the path from Galiano leads. The mountains surrounding the circular valley are of a fairly uniform height.

If one climbs them, one becomes aware with amazement that most of them consist of fossils, mainly coral-bearing limestone. This limestone is partly highly crystalline, but always tremendously craggy, isolated into sharp needles with dolines and rills. Viewed from the valley, one notices that those

mountains consisting of coral biolithit it show a clear stratification in thick banks, which is less conspicuous from up close. The dip is a weak one toward the west. Fig. 9 renders a part of these mountains, in the background is the Casa Real of Benguet at the foot of the tuff hills. The surface of the coral mountains is mostly covered by a fine red earth, which fills out the spaces of the sharp cliffs. Earth is often several feet thick and extremely thinly layered. At the southwesterly hillside of the valley, I found the same stone kernels of indeterminable gastropods, reminiscent of cerithium. The exceptionally delicate layering and the extremely fine material definitely point to the piedmont scarp from a calm sea basin, closed off from the waves. Nothing appears more suited to forming such piedmont scarps than the closed-off lagoon of an atoll. The low walls of the basin-shaped valley are, however, not composed of coral biolithit, but of nicely stratified hornblende-andesite tuffs, which appear particularly nicely behind the Casa Real. In the rich groundmass, one clearly recognizes numerous black hornblende needles, and much kaolinized feldspar; there are small hollow cavities in places, filled with a chip green delessite-like soil.

In these mostly horizontally layered tuffs, I found fist-sized glacial detritus of a greenish, very weathered volcanic rock. There, where the rampart is significantly lowered, that is in the southwest, one finds both tuffs and thick masses of the red earth, from which individual coral biolithit needles look out here and there. Here, I also found hornblende-andesite, a nicely crystalline rock, outcropping. The red earth sadly prevents the closer study of its relationship with the coral biolithit. Semper thinks that this place was once a canal, through which the lagoon was linked with the sea; the debris would then be interpreted as beach pebbles.

I will reserve for the end of the following chapter the examination of the peculiar appearance of the atoll, as during these lines we will yet report several times on similar appearances, and I indicate only in Fig. 10 the distribution of the tuff- and limestone masses as I was able to establish upon an on-site inspection of the hillside.

From Benguet, I undertook an excursion to one of the gold mines that were exploited by the Igorots near Capunga, which lie in the north-east of Trinidad on a mountain range that, striking to the northeast, joins the Cordillera Central only at the springs of the Agno. On its ridge are to be found numerous rancherias, according to Commandant Scheidnagel. Up to the Rancheria Taquilin, one finds almost exclusively only coral biolithit and red clays outcropping. The precipitous rampart of Benguet falls outwards with a lesser acclivity.

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The coral biolithit suddenly disappears and makes way for the augite-andesites, which come to light in large blocks that mostly show a plate-shaped differentiation. Under the microscope, one distinguishes slightly decomposed

plagioclase, augite in twins (the twins are here not, as usual, narrow, intercalated lamella, but both halves of the crystal are against each other in a twinning position) porphyritically intermingled hornblende and a light brown, lobed, strongly dichroic decomposition product, and some magnetite.

West of that andesite ridge lies the Rancheria Capunga in the valley. If one continues on the mountain ridge, one finally finds nice, coarse-grained diorites outcropping. The hornblende appears in little green pillars, the calciclase is white, with a bit of a greasy sheen—here and there, one notices a quartz grain. In the microscopic section, the hornblende appears quite changed and no longer shows a dichroism.

Where the water has torn out a deep gorge in this rock, that is connected with a small inflowing stream of the Rio Agno, the Igorots wash gold out of the tremendous debris talus in the rainy season. In the diorite, one recognizes fissures that are filled with a white, argillaceous, disintegrated rock, which is impregnated with pyrite through and through. This disintegrated mass is mainly screened for gold. To this end, the Igorots have sunk low tunnels and small shafts, and extract from there the argillaceous mud. The washing of the gold takes place only in the rainy season when sufficient water is available. When I visited the site in the month of February, it was abandoned.

From Benguet, I continued my trek to the Rio Agno and followed the same almost to its source.

As far as Tabio, one walks steadily on the ridge of the northern mountain range previously mentioned. There, one reaches the highest point of the passage and turns to the east, down the valley. Even from the Monte Tabio, one has a superb view toward the east of the deep valley of the Rio Agno, with its protruding escarpment coast like a stage set.

From Capungan toward the Agno, the mountains consist, as far as I could observe, of diorite, which is, however, flake-wise overlaid by tuffs, similar to those of Benguet. (At the height of the mountain range, we were surprised by a heavy thunderstorm in the middle of the spruce forests; the way to the Rio Agno, that was calculated as only eight hours, respective Camarin de Bagnao, turned out to be a twelve-hour walk, and we were forced to march for more than three hours with improvised torches in the darkness, there was, of course, no mention of geological observations on the last half of the way.)

At the Camarin of Bagnao, one reaches the Agno on the right bank. The rancheria of the same name is to be found a little further below on the left Bank. The Banks of the

River, that is lined with Casuarinas, consist of massive, multiply indented rocks. They are similar on the outside to those at the origin of the Rio Bucao in the Sierra Zambales, and consist of decomposed calciclase, a green mineral in lobes, and with a clearly recognizable bifold cleavage, along with some magnetite. This diorite-like rock now forms the main mass of the mountain surrounding

Rio Agno. I refer to this stone only provisionally here as diorite, although it could also be possible that a corroded augite-calciclase-rock is present.

Between Mayangan and Asnal on the left bank of the river, fairly high above its channel, one notices a nice hornblende-glassy feldspar-trachyte-cone. Not far from Asnal, numerous hot springs come to light in the bed of a small stream in the trachyte. Through the churned-up mud and small mud pools, vapors hiss, richly laden with hydrogen sulfide, and encrust the ground with beautiful sulfur crystals. The trachytes in the wide perimeter are disintegrated to white earth, so that this small solfatara is already noticeable from a distance by its color.

The apparent boiling of the mud puddles is caused only by the gas bubbles streaming through; the individual springs have different temperatures, probably depending on how much they are mixed with normal spring water; I observed the highest temperature to be 37° R.

From the Rancheria Aknal to the Camarin built by the government, it is another one and a half hours' walk. Immediately on the right bank of the little stream, diorite rocks outcrop again. From Aknal to Adavay, one crosses, directly behind the Camarin, a weathered hornblende-ice-spar-trachyte-cone. As soon as one has passed this, one encounters coral biolithit that is of the same consistency as that of Benguet. It contains numerous, if badly preserved, petrifactions, but it seems to be of limited extent, because one soon again finds the dioritic rocks, which, however, make way for a specific complex of strata. This is differentiated in colossal, multiply dislocated banks. The lowest layers form rough breccias and conglomerates of the dioritic rock. Higher up, the grain gets smaller, almost sandstone-like, finally followed by banks of green, violet, completely disintegrated rock, which is filled through and through with calcite veins.

These rocks are completely identical to those that I found along the upper course of the Pinquiang, although here the lower layers were missing, but the debris of breccias that I found in the river let me conclude that this supergroup was also present. One will remember that, also at the Pinquiang, this complex of strata was in proximate contact with the dense rocks of the Monte Dalemdem, so an overlying ground of the same on the massive, green calciclase rocks everywhere is probable. The way from Adavay to Lutab, which lies high on the left bank of the Agno, leads invariably through these rocks. They are also found constantly on the right bank of the river. As we will encounter this complex of strata more often, we want to refer to it as Agno-strata for the sake of brevity.

At Cabayan, a small quartz-trachyte-cone outcrops. In the white, argillaceous groundmass, one finds numerous parallelopipedic cavities, which are filled with iron ochre, and originating from decomposed feldspars; also, quartz in clear dihexahedra. After a narrow strip of Agno-layers, one crosses again a larger quartz-trachyte mass. At a tributary of the Agno, one finds nice hornblende-andesite outcropping with gray groundmass and numerous large hornblende crystals, aside from a lot of milk-white, indistinctly outlined feldspar. One finds embedded fragments of a rock consisting exclusively of small hornblende crystals.

From here, the path now leads with incredible steepness up to the small Rancheria Amlimay that lies about 1500 feet above the channel of the Agno. The Agno-slate passes here into banks of splintered, polychromatic chert.

From Amlimay, the path leads again precipitously downhill to Buguias. Not far from this location, the river splits into two parts. We turned to the left bank of the western river head, which, according to Peñarubia's map, originates at the southern foot of the Monte Dattá. C. Semper writes about the course of the eastern arm (Zeitschr. f. allg. Erdk., 1862 p. 96): " The easterly branching off arm of the Aguo (in the treatise cited here, Aguo is written at all times, while Coello's as well as C. Montero's map writes Agno; the residents of the river say "Agno") later heads north again, runs past the eastern side of the Dattá and sends a small arm west to the northeast side of the Mte. Dattá, whose eastern half thus sends the Aguo its streams. The actual springs of the Aguo must, however, still find themselves farther northwards, on the western part of the southern toe of the bank, the Abra originates with a pretty waterfall, first runs half an hour almost to the south, and then abruptly bends to the north." Accordingly, the course of the river was indicated in plate I.

Before Bugias, the hornblende-glassy feldspar-trachyte appears again, on which the Rancheria Lubay is built.

The valley of the western Agno becomes very wide here, the mountains recede in the east, and one soon is in Loo, the last Rancheria of Benguet. The surrounding area of the Camarins of Loo is composed of an argillaceous quartz trachyte, similar to that of Cabayan; here and there, nice dihexahedron can be released.

Original document

SECHSTES CAPITEL.
Der Militärdistrict Benguet.

Im Westen der Cordillera central befinden sich die sogenannten districtos militares. Dieselben liegen im oberen Lauf des Rio Agno, sowie im ganzen Flussgebiete des Rio de Abra bis wenige Meilen vor seiner Mündung in die Chinesische See. Der südlichste dieser Districte ist Benguet, weiter nördlich folgen Lepanto, dann Bontoc und schliesslich Abra. Gegen Osten macht die Cordillera die Grenze dieser Provinzen gegen Nueva-Vizcaya .

In jenen ausserordentlich gebirgigen Gegenden ist nun Coello's Karte im Massstabe von 1: 1,000.000 absolut ungenügend. Von den Provinzen Abra, Bontoc und Lepanto existirt, wie schon in der Vorrede erwähnt, eine gedruckte Skizze: Croquis de la provincia Abra. Levantado en los 1868 al 1870 por el Comandante grad^{o} de Inf^{a} y Gobernador de la misma Dn. Esteban Peñarubia. Comprende parte de la provincia de Ilocos Sur y de los districtos de Lepanto y Bontoc. Escala de 1/200000. Der östliche Theil dieser Karte ist leider ebenfalls unrichtig

und wurde wohl nur nach eingesammelten Informationen und nicht nach eigenen Beobachtungen gezeichnet; eine grosse Anzahl Ortsnamen existirt gar nicht in der Wirklichkeit, ebenso sind die Richtungen der Flüsse oft ganz irrig gezogen.

Die von mir auf Tafel I. neu eingezeichneten Districte Benguet, Lepanto und Bontoc dürften die Gegend, wenn auch noch lange nicht vollkommen richtig, so doch verbessert darstellen.

Um von der Ebene aus nach Benguet zu gelangen, wandte ich mich von S. Jacinto aus nordwärts nach Aringay, von wo der Weg zum Militärdistrict führt. Von S. Jacinto aus geht derselbe über S. Fabian stets längs der flachen Meeresküste. San Fabian liegt wenige Minuten vom Meere. Hier treten wieder die Hügelreihen, die bei Sto. Nino zurückgetreten sind, von Osten her an die Strasse. Bis Aringay und wohl noch weiter nördlich läuft längs der schmalen Alluvialfläche eine 200 bis 300 Fuss hohe Hügelkette, die ziemlich steil gegen die Ebene fällt. Zahlreiche Wasserläufe haben sie senkrecht auf ihr Streichen durchbrochen und lassen durch ihre Thäler die höheren Berge des östlichen Gebirges durchblicken (siehe Fig. 8). Dieser ungemein regelmässige Abfall

des Hügelzuges gegen das Meer zu, entspricht einer alten Uferlinie. Die Neigung vom Fusse der Hügel bis zum Meere ist so schwach, dass eine Senkung von wenigen Metern genügen würde, dass das Meer wieder die Hügel bespült.

Oestlich von Sto. Tomas liegt der hohe Mte. de Sto. Tomas oder Mte. Tonglon. Er steht im Süden mit dem niedrigeren Mte. S. Fabian in Verbindung. Beides sind ungemein dicht bewaldete Berge.

Der Monte S. Tomas hat nach A. Montero's Karte eine Höhe von 8120 sp. Fuss, (Semper [Zeitschr. f. Allg. Erdkunde 1862 p. 8] citirt die Höhe dieses Berges nach Messungen von CI. Montero mit 6948 Fuss), dürfte also einer der höchsten Berge von Luzon sein. Er wird meist für einen erloschenen Vulkan gehalten, da man eine Stelle eines Berichtes über den gleichzeitigen Ausbruch dreier Vulkane im Jänner 1641 auf ihn deutet. Jagor (a. a. O. p. 323) gibt eine wortgetreue Uebersetzung dieses Documentes an, aus welchem jedoch 1. dieser Ausbruch auf alle möglichen Berge von Nordwest-Luzon gedeutet werden kann und 2. von einer wirklichen Eruption gar nichts gesagt ist. Die betreffende Stelle lautet: „Bei den Igoloten, die in Bezug auf die Ilocos fünf Tagereisen weiter östlich landeinwärts wohnen, erlitt die Erde am 4. Januar ein so furchtbares und erschreckliches Erdbeben wie der vorausgegangene wüthende Orkan es angekündigt. Die Erde verschlang drei Berge, von denen einer, an dessen Abhang drei Ortschaften lagen, unzugänglich war. Diese ganze aus ihren Grundfesten gerissene Masse flog in die Luft zugleich mit vielem Wasser, so dass die Lücke einen weiten See bildete, ohne irgend ein Zeichen zurückzulassen, weder der Ortschaften, noch der hohen Berge, die dort gestanden hatten. Wind und Wasser zersprengten die Eingeweide der Erde mit so ausserordentlicher Wuth, dass Bäume und Berge in Bruchstücken 12 Piken

hoch geschleudert wurden und bei dem Aneinanderstossen in der Luft und im Herabfallen ein so furchtbares Geräusch machten, dass es viele Stunden weit gehört wurde." In dieser confusen Erzählung wird von „Feuer", mit welchem Worte die alten und neuen Historiker so gern bei der Beschreibung von Eruptionen herumwerfen, nichts erwähnt; es scheint, dass die beschriebene Erscheinung sich auf ein starkes Erdbeben mit dadurch hervorgerufenen mächtigen Bergstürzen und Aufstauungen der Gewässer zurückführen lasse. – Semper erzählt indess (a. a. O. p. 83), dass in dem Werke von P. Buseta ein Ausbruch von 1635 erwähnt ist, auch berichtet er „das Ausbrechen heisser Gase am Fusse des Berges aus sedimentärem Conglomerat, ohne die mindeste Spur eruptiver Gesteine oder Laven".

Von dem Steinkohlelager in der Gegend von Aringay konnte ich nichts erfahren, es wäre möglich, dass die hier auftretenden mächtigen vulkanischen Tuffe Braunkohlenlager enthalten.

Leider konnte ich keinen Führer finden, der mich auf die Spitze des Berges führte. Neuerdings gesehene Banden von malayischen Räubern (Tulisanes), die selbst bis in die Ebene drangen, die Dörfer plünderten und am Aringay ihre Schlupfwinkel haben sollten, erschreckten die furchtsame Bevölkerung dermassen, dass Niemand mich begleiten wollte; es musste somit die Besteigung aufgegeben werden.

Beim Dorfe Aringay durchbricht der Rio de Aringay die parallele Hügelkette und ergiesst sich eine Viertelstunde vom Dorfe ins Meer. Die durch den Fluss erzeugte Quebrada benützt man, um zur Hauptstadt des östlich gelegenen Benguet zu gelangen. Der Hügelzug besteht bei Aringay aus einem lichtgelben, erdigen Tuff, der aus zersetzten Feldspaththeilchen zusammengesetzt ist, in welchem zahlreiche Hornblendekryställchen eingestreut sind.

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Man überschreitet mehrere Male den Fluss und erklimmt auf ungemein steilem Pfad an seinem rechten Ufer einen aus dem Tuff bestehenden Berg und erreicht endlich wieder den Fluss beim Weiler Galiano.

Galiano liegt am rechten Ufer des Rio de Aringay in einem kleinen, reizenden, rings von Bergen umgebenen Thal. An den Ufern des klaren und reissenden Flusses treten schöne Tuffe mit NO-SW Streichen und östlichem Fallen unter 10° auf. Diese Tuffe sind hier nicht mehr erdig, sondern recht hart, krystallinisch, sandsteinartig; im Mikroskop wird indess bald die Tuffstructur klar. In einem pulverigen, braunen Grundteig liegen zahlreiche Fetzen von grüner, dichroitischer Hornblende und abgerundeten Feldspathkörnern. Beide Gemengtheile sind indess noch ziemlich frisch. Die Feldspathe scheinen zweierlei zu sein, sowohl orthoklastisch als plagioklastisch. Die Bänke wechseln ab mit Mergelschichten, die Reste von dicotytledonen Pflanzen enthalten. Prof. Semper erwähnt (Ztschr. f. wissensch. Zoologie, 22. Bd. p. 235, „Ueber Generationswechsel bei Steinkorallen

etc.“) einer in den Hügeln von Aringay gefundenen Koralle, ähnlich der in den philippinischen Meeren vorkommenden Heteropsammia rotundata Semp. Sollte diese Koralle in den Tuffen gefunden sein? Ohne Zweifel verdanken alle diese ihre Entstehung Trachyt-Hornblendegesteinen.

Von Galiano gelangt man in fünf Stunden sehr beschwerlichen Weges nach Benguet. Dreimal überschreitet man noch den Fluss und findet stets prächtige Tuffbänke anstehend, deren Streichen übrigens sehr unregelmässig ist. So fand ich etwa eine Stunde oberhalb Galiano: Str. h 2, Fall. h 8 45°.

Man verlässt endlich den Fluss und steigt einen äusserst steilen Berg hinan. Die Strasse führt stets in dem weissen, mürben Tuff. Endlich erreicht man den höchsten, mit Fichtenwäldern bewachsenen Punkt und befindet sich nun auf einer der das Thal von Benguet umkreisenden Bergwände. In einer halben Stunde hat man bergabwärts La Trinidad oder Benguet, den Hauptort des gleichnamigen Districtes, erreicht. Der fast nur aus den Regierungsgebäuden bestehende Ort steht am Rande eines kreisförmigen Thales, das circa 4000 Fuss über dem Meere liegt. Die umgebenden, steilen Berge dürften etwa 500–600 Fuss über dem Thalboden liegen.

C. Semper hat uns in ausführlicher Weise (siehe Zeitschrift für allgem. Erdkunde 1862, p. 84–86 und „Die Philippinen und ihre Bewohner.“ Würzburg 1869) über dieses hochinteressante Thal berichtet. Mit richtigem Blicke erkannte er in den dasselbe umgürtenden Korallenkalkwänden die Reste eines ehemaligen Atolls. Das Thal ist fast kreisrund, eine halbe geografische Meile im Durchmesser und wird an zwei entgegensetzten Seiten von einem west-östlich strömenden Bache in zwei engen Schluchten durchbrochen. Im Westen liegt eine kleine Lagune, die indess zur Regenzeit grosse Dimensionen annehmen soll. Dieser Bach versiegt momentan in der Mitte des Atolls, um bald wieder zum Vorschein zu kommen.

Der Ort Benguet liegt an der westlichen Seite des Thales. Mehr gegen Südwest löst sich das Gebirge in eine Anzahl runder Hügel auf, über welche der Weg von Galiano aus führt. Die das kreisförmige Thal umgebenden Berge sind von ziemlich gleichbleibender Höhe.

Besteigt man sie, so gewahrt man mit Erstaunen, dass der grösste Theil derselben aus Petrefacten, hauptsächlich korallenführenden Kalken besteht. Zum Theil sind diese Kalke hochkrystallinisch, aber stets ungemein schroff, in spitze Nadeln abgesondert mit Dollinen und Runsen versehen. Vom Thale aus betrachtet, bemerkt man, dass jene aus

Korallenkalk bestehenden Berge eine deutliche Schichtung in dicken Bänken zeigen, welche in der Nähe weniger auffallend ist. Das Fallen ist ein schwaches nach Westen. Fig. 9 gibt einen Theil dieser Berge wieder, im Hintergrunde ist das Casa real von Benguet am Fusse der Tuffhügel. Die Oberfläche der Korallenberge

ist meist mit einer feinen rothen Erde bedeckt, die die Zwischenräume der spitzen Klippen ausfüllt. Diese Erde ist oft mehrere Fuss mächtig und ungemein fein geschichtet. Am südwestlichen Gehänge des Thales fand ich in derselben Steinkerne von unbestimmbarer an Cerithium erinnernden Gasteropoden. Die ungemein zarte Schichtung sowie das äusserst feine Material weisen unbedingt auf den Absatz aus einem ruhigen, vom Wellenschlage abgeschlossenen Meeresbecken hin. Nichts scheint geeigneter solche Absätze zu bilden, als die abgeschlossene Lagune eines Atolls. Die niedrigen Wände des Kesselthales werden jedoch nicht von Korallenkalk, sondern von schön geschichteten Hornblende-Andesit-Tuffen zusammengesetzt, die besonders hinter der Casa real schön auftreten. In der reichen Grundmasse erkennt man deutlich zahlreiche, schwarze Hornblendenadeln und viel kaolinisirten Feldspath; stellenweise sind kleine Hohlräume mit einer spangrünen delessitartigen Erde ausgefüllt.

In diesen meist horizontal gelagerten Tuffen fand ich faustgrosse Geschiebe eines grünlichen sehr verwitterten Eruptivgesteins. Dort, wo sich der Ringwall bedeutend erniedrigt, also im Südwesten, findet man sowohl die Tuffe, als auch mächtige Massen der rothen Erde, aus welcher hie und da einzelne Korallenkalknadeln sehen, hier fand ich auch Hornblende-Andesit, ein schön krystallinisches Gestein, anstehend. Die rothe Erde verhindert leider, sein Verhältniss zu dem Korallenkalk näher zu studieren. Semper meint, dass diese Stelle einst ein Kanal war, durch welchen die Lagune mit dem Meere in Verbindung stand; die Gerölle wären dann als Strandgerölle zu deuten.

Ich behalte mir bis zum Schlusse des folgenden Capitels die Betrachtung über das Merkwürdige Auftreten des Atolls vor, da wir im Laufe dieser Zeilen noch mehrmals von ähnlichen Erscheinungen berichten werden und gebe nur in Fig. 10 die Vertheilung der Tuff- und Kalkmassen an, wie ich sie bei einer Begehung der Gehänge constatiren konnte.

Von Benguet aus unternahm ich einen Ausflug zu den von den Igorrotes ausgebeuteten Goldwäschereien bei Capunga, welche im Nordosten von Trinidad auf einem Gebirgszug liegen, der in nordöstlicher Richtung streichend, erst bei den Quellen des Agno sich mit der Cordillera central vereinigt. Auf seinem Kamm befinden sich nach den Angaben des Commandanten Scheidnagel eine grosse Anzahl Rancherias. Bis zur Rancheria Taquilin findet man fast ausschliesslich noch Korallenkalk und rothe Thone anstehend. Der steile Ringwall von Benguet fällt nach aussen mit geringerer Neigung.

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Der Korallenkalk verschwindet plötzlich und macht hornblendeführenden Augit-Andesiten Platz, die in grossen Blöcken, die meist plattenförmige Absonderung zeigen, zu Tage anstehen. Unter dem Mikroskope unterscheidet man leicht zersetzten Plagioklas, Augit in Zwillingen (die Zwillinge sind hier

nicht wie gewöhnlich schmale, eingeschaltete Lamellen, sondern beide Hälften des Krystalls befinden sich gegeneinander in Zwillingsstellung) porphyrisch eingesprengte Hornblende und ein lichtbraunes, lappiges, stark dichroitisches Zersetzungsproduct und etwas Magneteisen.

Westlich von jenem Andesit-Rücken liegt im Thale die Rancheria Capunga. Schreitet man auf dem Gebirgsrücken weiter, so trifft man endlich schöne grobkörnige Diorite anstehend. Die Hornblende tritt in grünen Säulchen auf, der Plagioklas ist weiss, etwas fettglänzend—hie und da bemerkt man ein Quarzkorn. Im Dünnschliffe erscheint die Hornblende recht umgewandelt und zeigt keinen Dichroismus mehr.

Dort, wo das Wasser in diesem Gesteine eine tiefe Schlucht ausgerissen hat, die unten mit einem kleinen Zufluss des Rio Agno in Verbindung steht, waschen die Igorrotes aus den ungeheuren Schutthalden in der Regenzeit Gold. In dem Diorite erkennt man Klüfte, die mit einem weissen, thonigen, zersetzten Gesteine erfüllt sind, das durch und durch mit Schwefelkies imprägniert ist. Diese zersetzte Masse wird hauptsächlich auf Gold geschlämmt. Zu diesem Zweck haben die Igorrotes niedrige Stollen und kleine Schächte abgeteuft und fördern daraus den thonigen Schlamm. Das Waschen des Goldes geschieht nur in der Regenzeit, wo genügend Wasser vorhanden ist; als ich den Platz im Monate Februar besuchte, war er verlassen.

Von Benguet aus setzte ich meine Wanderung zum Rio Agno fort und verfolgte denselben fast bis zu seinem Ursprung.

Bis Tabio schreitet man stets auf dem Rücken jenes schon früher erwähnten nördlichen Gebirgszuges. Dort erreicht man den höchsten Punkt des Ueberganges und wendet sich östlich, thalabwärts. Schon vom Monte Tabio aus hat man gegen Osten eine herrliche Aussicht auf das tiefe Thal des Rio Agno mit seinen coulissenartig vorgeschobenen Uferwänden.

Von Capungan aus gegen den Agno besteht das Gebirge, so weit ich beobachten konnte, aus Diorit, der jedoch fetzenweise von Tuffen, ähnlich jenen von Benguet überlagert wird. (Auf der Höhe des Gebirges wurden wir von einem heftigen Gewitter inmitten der Fichtenwaldungen überrascht; der nur auf acht Stunden berechnete Weg zum Rio Agno, respective Camarin de Bagnao erwies sich als ein zwölftstündiger Marsch, und waren wir gezwungen, mehr als drei Stunden mit improvisirten Fackeln in der Dunkelheit zu marschiren, von geologischen Beobachtungen auf der letzten Hälfte des Weges war natürlich keine Rede.)

Beim Camarin von Bagnau erreicht man den Agno auf dem rechten Ufer. Die gleichnamige Rancheria findet sich etwas weiter unterhalb am linken Ufer. Die Ufer des

mit Casuarinen umsäumten Flusses bestehen aus massigen, vielfach zerklüfteten

Felsen. Sie sind im Aeusseren ähnlichen denen beim Ursprung des Rio Bucao in der Sierra Zambales und bestehen aus zersetztem Plagioklas, einem grünen Mineral in Lappen und mit deutlich erkennbarer zweifacher Spaltung nebst etwas Magneteisen. Dieses dioritähnliche Gestein bildet nun die Hauptmasse der den Rio Agno umgebenden Gebirge. Ich bezeichne dieses Gestein hier nur vorläufig als Diorit, obwohl es ebenfalls möglich wäre, dass ein angegriffenes Augit-Plagioklas-Gestein vorliegt.

Zwischen Mayangan und Asnal am linken Ufer des Flusses, ziemlich hoch über seinem Bette bemerkt man eine schöne Hornblende-Sanidin-Trachyt-Kuppe. Unweit Asnal treten im Bette eines kleinen Baches in dem Trachyte zahlreiche heisse Quellen zu Tage. Durch den aufgewühlten Schlamm und kleine Schlammbassins zischen reich mit Schwefelwasserstoff beladene Dämpfe und inkrustieren den Boden mit schönen Schwefelkrystallen. Die Trachyte sind im weiten Umkreise zu weisser Erde zersetzt, so dass diese kleine Solfatara schon von Weitem durch ihre Farbe auffällt.

Das scheinbare Kochen der Schlammpfützen wird nur von durchströmenden Gasblasen verursacht; die einzelnen Quellen haben verschiedene Temperaturen, wohl je nachdem sie mit gewöhnlichem Quellwasser mehr oder weniger vermischt sind; die höchste Temperatur beobachtete ich bei 37° R.

Von der Rancheria Aknal bis zu dem von der Regierung errichteten Camarin sind noch ein und eine halbe Wegstunde. Gleich am rechten Ufer des kleinen Baches stehen wieder die Dioritgesteine an. Von Aknal nach Adavay zu verquert man Gleich hinter dem Camarin eine verwitterte Hornblende-Sanidin-Trachyt-Kuppe. Sobald man diese passirt hat, trifft man auf Korallenkalk, der genau von derselben Beschaffenheit, wie jener von Benguet ist. Er enthält zahlreiche, wenn auch schlecht erhaltene Versteinerungen, scheint aber geringe Ausdehnung zu besitzen, denn bald findet man wider die dioritischen Gesteine, die aber hier einem eigenthümlichen Schichtencomplex Platz machen. Dieser ist in colossale, vielfach dislocirte Bänke abgesondert. Die untersten Lagen bilden grobe Breccien und Conglomerate des dioritischen Gesteines. Höher hinauf wird das Korn kleiner, ja fast sandsteinartig, endlich folgen Bänke von grünem, violettem, vollkommen zersetztem Gesteine, das durch und durch mit Kalkspathadern erfüllt ist.

Diese Gesteine sind vollkommen identisch mit jenen, die ich längs des Oberlaufes des Pinquiang fand, hier fehlten zwar die unteren Lagen, jedoch liessen mich Trümmer von Breccien, die ich im Flusse fand, schliessen, dass auch diese Abtheilung vorhanden sei. Man wird sich erinnern, das auch am Pinquiang dieser Schichtencomplex in nächster Berührung mit den dichten Gesteinen des Monte Dalemdem war, also eine Auflagerung desselben auf den massigen, grünen Plagioklasgesteinen allerorten wahrscheinlich ist. Der Weg von Adavay nach Lutab, das hoch am linken Ufer des Agno liegt, führt stets durch diese Gesteine. Auch am rechten Ufer des Flusses stehen sie fortwährend an.

Da wir diesem Schichtencomplex noch öfter begegnen werden, so wollen wir ihn der Kürze halber als Agno-Schichten bezeichnen.

Bei Cabayan tritt kleine Quarz-Trachyt-Kuppe zu Tage. In der weissen, thonigen Grundmasse findet man zahlreiche parallelopipedische Hohlräume, die mit Eisenocker ausgefüllt sind, und von zersetzten Feldspathen herrühren; ausserdem Quarz in deutlichen Dihexaedern. Nach einem schmalen Streifen Agnoschichten verquert man wieder eine grössere Quarz-Trachytmasse. Bei einem Nebenflusse des Agno findet man schönen Hornblende-

Andesit anstehend mit grauer Grundmasse und zahlreichen grossen Hornblendekrystallen, nebst viel milchweissem, undeutlich contourirtem Feldspath. Bruchstücke eines ausschliesslich aus kleinen Hornblendekrystallen bestehenden Gesteins findet man eingeschlossen.

Von hier aus führt nun der Weg mit unglaublicher Steilheit bis zur kleinen Rancheria Amlimay, die etwa 1500 Fuss über dem Bett des Agno liegt. Die Agno-Schiefer gehen hier in Bänke von splittrigem, vielfärbigem Kieselschiefer über.

Von Amlimay führt der Weg wieder steil herab nach Buguias. Unweit dieses Ortes spaltet sich der Fluss in zwei Theile. Wir wandten uns auf das linke Ufer des westlichen Quellflusses, der nach Peñarubia's Karte am Südfusse des Monte Dattá entspringt. Ueber den Lauf des östlichen Armes schreibt C. Semper (Zeitschr. f. allg. Erdk. 1862, 96): „ Der östlich sich abbiegende Arm des Aguo (in der hier citirten Abhandlung wird stets Aguo geschrieben, während sowohl Coello's als C. Montero's Karte Agno schreibt; auch die Anwohner des Flusses sprechen „Agno") zieht sich später wieder gegen Norden, läuft an der östlichen Seite des Dattá vorbei und sendet einen kleinen Arm westlich an die Nordostseite des Mte. Dattá, dessen östliche Hälfte somit dem Aguo seine Bäche zusendet. Die eigentlichen Quellen des Aguo müssen sich jedoch noch weiter nordwärts finden, am westlichen Theile des Südfusses entspringt der Abra mit einem hübschen Wasserfall, läuft erst eine halbe Stunde fast gegen Süden und biegt sich dann schroff um nach Norden." Dem entsprechend wurde auch der Verlauf des Flusses auf Tafel I angegeben.

Vor Bugias tritt wieder Hornblende-Sanidin-Trachyt auf, auf welchem die Rancheria Lubay erbaut ist.

Das Thal des westlichen Agno wird hier sehr breit, die Berge treten östlich zurück und bald befindet man sich in Loo, der letzten Rancheria von Benguet. Die Umgebung des Camarins von Loo wird von einem thonigen Quarztrachyt, jenem von Cabayan ähnlich, gebildet, stellenweise lassen sich schöne Dihexaeder auslösen.

Endnotes

1. Felix Karrer (1825–1903), Austrian geologist
2. Likely Francisco Coello (1822–1898), Spanish cartographer: Semper and Jagor used the map of the islands created by the Spanish cartographer Francisco Coello as a starting point for their own. His effort had been part of a project to create a comprehensive atlas of Spain's colonies, though it was never completed (Weston 2021, 23). Like von Drasche, Semper and Jagor, and later Jose Rizal, criticized the map (Weston 2021, 161).
3. Likely Claudio Montero, captain of the Spanish Navy, as noted in the Bibliography of the Philippines Islands: 223. Philippines, Luzon Island. Manila Bay. Surveyed by the Spanish Philip- pine hyd'e commission under the direction of Captain Claudio Montero, 1861. 23 ¼ x 32. London, 1866. [Great Britain. Admiralty. Hydrographic Office. Chart no. 976]. (Griffin 1903, 298)
4. Term for "Igorots" used during the Spanish era.
5. Term for "Ilocanos" used during the Spanish era.
6. From "pieke," a unit of length.

References

Akademika. 2017. *Fragmente zu einer Geologie der Insel Luzon (Philippinen) mit einem Anhange über die Foraminiferen der tertiären Thone von Luzon* (Classic Reprint). Forgotten Books. https://www.akademika.no/realfag/geologi-og-geovitenskap/fragmente-zu-einer-geologie-der-insel-luzon-philippinen-mit-einem-anhange-aber-die-foraminiferen-der-tertiaren-thone-von-luzon-classic-reprint/9780282624026.

Anderson, Benedict. 2005. *Under Three Flags: Anarchism and the Anti-Colonial Imagination*. New York: Verso.

Anderson, Warwick. 2007. "Science in the Philippines." *Philippine Studies* 55, no. 3: 287–318.

Angstner, Rudolf. 2017. "Austria's Consular and Diplomatic Presence in the Philippines – Searching for Historical Pieces: 1820–1937." In *Philippines-Austria Relations 500 Years*, edited by Maria Zenaida Collinson, et al., 60–82. Vienna: Embassy of the Republic of the Philippines in Austria.

Australian Trade and Industry Commission. 2023. "Mining in the Philippines: A New Chapter." https://www.austrade.gov.au/en/news-and-analysis/analysis/mining-in-the-philippines-a-new-chapter.

Austrian Embassy Manila. 2022. "Economy. Austria - Philippines Economic Relations." https://www.bmeia.gv.at/en/austrian-embassy-manila/bilateral-relations/economy.

Back, Otto, Erich Benedikt, Maria Hornung, and Ernst Pacolt. 1992. *Österreichisches Wörterbuch*. Vienna: ÖBV Pädagogischer Verlag.

Bautista, Rosalinda. 2019. "2017 Annual Survey of Philippine Business and Industry (ASPBI) - Mining and Quarrying Sector with Total Employment of 20 and Over: Preliminary Results." Report 2019–249. Quezon City: Philippine Statistics Authority. https://psa.gov.ph/content/2017-annual-survey-philippine-business-and-industry-aspbi-mining-and-quarrying-sector-total#:~:text=The%20preliminary%20results%20of%20the,formal%20sector%20of%20the%20economy.

Becker, George Ferdinand, and Johann Karl Ludwig Martin. 1901. *Report on the Geology of the Philippine Islands*. With a contribution by K. Martin, *Ueber Tertiäre Fossilien von den Philippinen* (1895). Extract from the Twenty-First Annual Report of the Survey, 1890–1900, Part II – General Geology, Ore and Phosphate Deposits, Philippines. Washington, DC: Government Printing Office.

Blumentritt, Ferdinand. 1882. *Vocabular einzelner Ausdrücke und Redensarten, welche dem Spanischen der Philippinischen Inseln eigenthümlich sind*: Mit einem Anhange, *Bibliotheca Philippina*, *Teil II*. Leitmeritz: Communal-Oberrealschule.

Booklooker. 2020. "Richard Drasche von Wartinberg: Fragmente zu einer Geologie der Insel Luzon (Philippinen)." https://www.booklooker.de/B%C3%BCcher/Richard-Drasche-von-Wartinberg+Fragmente-zu-einer-Geologie-der-Insel-Luzon-Philippinen-Von- Dr/id/A02Bp9FB01ZZG.

Coello, Francisco. *Atlas de España sus Posesiones de Ultramar (1847–1870)*. Madrid: Publisher Unknown.

De Vera, Sherwin. 2024. "Mining firm's Planned Expansion Threatens Benguet Village." *Rappler*, January 31. https://www.rappler.com/philippines/luzon/mining-firm-planned-expansion-threatens-benguet-village-january-29-2024/.

Donko, Wilhelm M. 2017. "The Austrian Navy and the Philippines: Early Contacts." In *Philippines-Austria Relations 500 Years*, edited by Maria Zenaida Collinson, et al., 41–54. Embassy of the Republic of the Philippines in Austria.

Drasche, Richard Freiherr von. 1878. *Fragmente zu einer Geologie der Insel Luzon* (*Philippinen*): *Mit einem Anhang über die Foraminiferen der tertiäeren Thone von Luzon von Felix Karrer*. Wien: Karl Gerold & Sohn.

_____. 1878. "Datos para un Estudio Geológico de la Isla de Luzón (Filipinas)." *Boletin de la Comisión del Mapa Geológico de España* 8:269–342.

Dudenredaktion. 2019. *Duden – Deutsches Universalwörterbuch: Das umfassende Bedeutungswörterbuch der deutschen Gegenwartssprache*. 9th ed. Berlin: Dudenverlag.

Flügel, Helmut W. 2003. "Österreich und die Entwicklung der Geohistorik zwischen 1670 und 1800." In *Geschichte der Erdwissenschaften in Österreich*: *4*. *Symposium* (*22–25 Oktober 2003*) *Klagenfurt*, edited by Christian Hauser, 29. Wien: Geologische Bundesanstalt.

Frank, Alison. 2012. "The Children of the Desert and the Laws of the Sea: Austria, Great Britain, the Ottoman Empire, and the Mediterranean Slave Trade in the Nineteenth Century." *The American Historical Review* 117, no. 2 (April): 410–44.

Government of Canada. n.d. "Mining in the Philippines." Trade Commissioner Service. Accessed July 11, 2025. https://www.tradecommissioner.gc.ca/philippines/market-reports-etudes-de-marches/0006603.aspx?lang=eng.

Habana, Olivia M. 2000. "Gold Mining in Benguet to 1898." *Philippine Studies* 48, no. 4: 455–487.

Harzhauser, Mathias, and Martin Krenn. 2022. "The Geological-Paleontological Collections of the Natural History Museum Vienna: An Exhaustive Evaluation of Provenance Context (1807 to 1918)." *Annalen des Naturhistorischen Museums in Wien. Serie A für Mineralogie und Petrographie, Geologie und Paläontologie, Anthropologie und Prähistorie* 124: 73–100.

Jimi, Naoto, Sergio I. Salazar-Vallejo, and Hiroshi Kajihara. 2017. "Designation of a Neotype and Redescription of Hesione reticulata von Marenzeller, 1879 from Japan (Annelida, Hesionidae)." *Zookeys* 657: 29–41.

Kalina, Melanie, and Stefan Lenes. 2022. "Der Außenhandel Österreichs im ersten Halbjahr 2022, Vorläufige Ergebnisse mit Spezialthema, 'Nationale und EU-weite Qualitätsbestrebungen für EBS.'" *Statistische Nachrichten*, October. https://www.statistik.at/fileadmin/pages/201/Aussenhandel_HJ2022_10_2022.pdf Leopoldina. "History of the Academy." https://www.leopoldina.org/en/about-us/about-the-leopoldina/history/the-history-of-the-leopoldina/.

Loidl, Simon. 2012. "Colonialism through Emigration: Publications and Activities of the Österreichisch-Ungarische Kolonialgesellschaft (1894–1918)." *Austrian Studies* 20: 161–75.

Mapa, Dennis S. 2023. "Religious Affiliation in the Philippines (2020 Census of Population and Housing)." *Philippine Statistics Authority*. https://psa.gov.ph/content/religious-affiliation-philippines-2020-census-population-and-housing/.

MacMicking, Robert. 1967. *Recollections of Manila and the Philippines*, edited by Morton J. Netzorg. Manila: Filipiniana Book Guild.

Marschall, Wolfgang. 2010. *Review of The Philippines: Early Collections*, by Barbara Bohle, et al. *Anthropos* 105: 266.

Modern Humanities Research Association. 2012. "Austrian Encounters in Colonial Space: Introduction." *Austrian Studies* 20: 1-4.

Mojares, Resil B. 2006. *Brains of the Nation: Pedro Paterno, T.H. Pardo de Tavera, Isabelo de los Reyes and the Production of Modern Knowledge*. Quezon City: Ateneo de Manila University Press.

Mückler, Hermann. 2012. "Vorwort." In *Österreicher in der Südsee: Forscher, Reisende, Auswanderer*, edited by Hermann Mückler, 9–10. Wien: LIT-Verlag.

_____. 2012. "Erstaunliche Berührungspunkte… Einführende Worte zu österreichischen Bezügen nach Ozeanien einst und jetzt." In *Österreicher in der Südsee: Forscher, Reisende, Auswanderer*, edited by Hermann Mückler, 11–20. Wien: LIT-Verlag.

Muret, Eduard, and Daniel Sanders. 1987. *Encyclopaedic Muret-Sanders German Dictionary*, *Volume 2*: *L–Z*. 4th ed. Berlin: Langenscheidt.

_____. 1987. *Encyclopaedic Muret-Sanders German Dictionary*, *Volume 1*: *A–K*. 4th ed. Berlin: Langenscheidt.

Otruba Gustav. 1962. Heinrich Drasche Von Wartinberg (1811–1880): Ein österreichischer Gewerke und Industrieller." *Tradition: Zeitschrift für Firmengeschichte und Unternehmerbiographie* 7, no. 1: 23–31.

Reiterer, Gisela M. 2008. "Filipino Austrians: Transforming Identities and Changing Selfhood Under Conditions of Migration." *Philippine Sociological Review* 56: 36–55.

Riedl-Dorn, Christa. 1999. „Österreichische naturforschende Reisende des 19. Jahrhunderts." *Philosophia Scientiæ*, no. S2: 155–80.

Sauer, Walter. 2012. "Habsburg Colonial: Austria-Hungary's Role in European Overseas Expansion Reconsidered." *Austrian Studies* 20: 5–23.

Schweitzer, Volker. 2012. *Wörterbuch der Geologie / Dictionary of Geology*. Berlin: Springer Spektrum.

Statistik Austria. 2023. "Bevölkerung nach Staatsangehörigkeit/Geburtsland." https://www.statistik.at/statistiken/bevoelkerung-undsoziales/bevoelkerung/bevoelkerungsstand/bevoelkerung-nach-staatsangehoerigkeit/-geburtsland.

Stockinger, Johann. 2012. "So umfährt man die ganze Welt." Manila, Drehscheibe zwischen Ost und West aus früher österreichischer Sicht." In *Österreicher in der Südsee: Forscher, Reisende, Auswanderer*, edited by Hermann Mückler, 149–80. Wien: LIT-Verlag.

United States War Department. 1908. *War Department Annual Reports, 1908. Volume VIII*: *Report of the Philippine Commission*, *Part II*, *Appendix*. Washington, DC: Government Printing Office.

Weston, Nathaniel Parker. 2021. *Specters of Germany*: *Colonial Rivalry and Scholarship in the Philippine Reform Movement and Revolution*. Quezon City: Ateneo De Manila.

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