Ketaun, in Lebong, flowing to the west coast, and of the upper Musi, flowing to the east coast ; the valleys of Makakau and Selabung or the upper Komering, an affluent of the Musi, between Sebelat and Kaba. The Makakau and Selabung drain into Lake Ranau, which on the south side is dammed by the volcano Seminung. Thc southernmost longitudinal valley of Sumatra is that of the Semangka, which flows into the bay of the same name. Generally the lower valleys of the rivers lie at elevations of 600 to 1000 ft.; higher up they rise to 2500 or 3000 ft.; the mountain chains rise to 5500 ft.; the volcanoes tower up from 6500 to nearly 10,000 ft. (7) The section of south Sumatra between the eastern chain of old rocks and the east coast with its numerous river mouths is formed of the alluvium of sea and rivers. In the river-beds, however, and at some distance from the sea, older strata and eruptive rocks underlie the alluvium. The strata near the mountain chains and volcanoes consist of diluvial tuffs.

*Geology.*—The oldest rocks are gneiss, schist and quartzite, the schist often containing gold. They probably belong to several geological periods, but all were folded and denuded before the Carboniferous beds were deposited. They form the backbone of the island, and crop out on the surface at intervals along the mountain chain which runs parallel to the west coast. Here and there they arc penetrated by granitic intrusions which are also Pre-Carboniferous. The next series of rocks consists of slates below and lime­stones above. It lies unconformably upon the older rocks; and the limestone contains *Fusulina, Phillipsia* and *Productus,* indicating that it belongs to the Upper Carboniferous. These beds are found only in northern Sumatra. They are accompanied by intrusions of diabase and gabbro, and they are sometimes folded, sometimes but little disturbed. No Permian beds are known, and for many years Mesozoic deposits were supposed to be entirely absent, but Triassic clays and sandstones with Daonella have been found in the upper part of the basin of the Kwalu (East Sumatra). They rest unconformably upon the Carboniferous beds, and have them­selves been tilted to a steep angle. Cretaceous beds also have been recorded by Bücking. Tertiary deposits are very widely spread over the plains and low-lying country. They consist of breccias, conglomerates, sandstones, marls, and limestones, with seams of coal and lignite. The most valuable coal occurs in the Eocene beds. At the close of the Eocene period great eruptions of augite-andesite took place from two fissures which ran along the west coast. The Miocene consists chiefly of marls, with occasional beds of lignite and limestone. On the east coast it sometimes yields petroleum. The Pliocene occurs chiefly in the low-lying land and is generally covered by drift and alluvium. Sometimes it contains thick seams of lignite or brown coal.

The present volcanoes lie along a line (with offshoots) which runs parallel to the west coast, but some distance to the east of the fissures from which the early Tertiary lavas were poured. Lava streams are seldom emitted from these volcanoes, the material erupted consisting chiefly of ash and scoriae, which are spread over a very wide extent of country. Augite-andesite predominates, but basalt and rhyolite also occur.

*Climate.—*As throughout the whole of the Malayan Archipelago, so in Sumatra, which lies about equally balanced on both sides of the equator, the temperature stands at a high level subject to but slight variations. The monthly temperature mounts only from 77° F.. in February to 80∙6° in May, August and November. In the distribution of the rainfall, as dependent on the direction of the winds, the following parts of Sumatra must be distinguished:

(1) south-east Sumatra, on which, as on Banka and Billiton, the heaviest rainfall occurs during the north-west monsoon, the annual volume of rainfall increasing from 98∙4 in. in the east to 139 in. in the west. Of the 139 in. of yearly rainfall, 91·7 in. are brought by the north-west and 47·3 in. by the south-east monsoon.

(2) The west coast. Here the rainfall for the year increases from the southern and northern extremities towards the middle. Ben­kulen, *e.g.* gets 126 in.; Singkel (2° 15' N.),. 172 in. and Padang 184 in. in the year. Here, too, the prevailing rainfall is brought by the north-west monsoon, but in this belt its prevalence is not so pronounced, Padang getting 94 in. of rain during the north-west monsoon, against 90 in. during the south-east. The mountain chain immediately overhanging it, the high temperature of the sea wash­ing it, the frequent thunderstorms to which it is subject, the moist atmosphere of its equatorial situation, and the shorter régime of the dry south-east wind are the principal causes of the heavier rainfall on the west coast. The higher stations of middle Sumatra, on the lee side of the western mountain chain, have a yearly rainfall of only 78∙7 in. (3) The northern and north-eastern parts of Sumatra are swept by a variety of winds. The south-east wind, however,

predpminates. Blowing over land and in the direction of the longitudinal valleys, the south-east wind is comparatively dry, and thus favours the formation of steppes in the north such as the Toba plains. The north-east and south-west winds, on the other hand, being laden with the moisture of the sea, bring rain if they blow for any length of time.

*Fauna.*—Though Sumatra is separated from Java by so narrow a strait, both the zoologist and the botanist at once find that they have broken new ground on crossing to the northern island. The *Pachy­dermala* are strongly characteristic of the Sumatran fauna: not only are the rhinoceros *(Rh. sumatranus),* the *Sus vittatus,* and the tapir common, but the elephant, altogether absent from Java, is repre­sented in Sumatra by a species considered by some to be peculiar. The Sumatran rhinoceros differs from the Javanese in having two horns, like the African variety. It is commonest in the marshy lowlands, but extends to some 6500 ft. above sea-level. The range of the elephant does not extend, above 4900 ft. The wild *Bos sundaicus* does not. appear to exist in the island. An antelope *(kambing-utan)* occurs in the loneliest parts of the uplands. The common Malay deer is widely distributed, *Cervus munijac* less so. The orang-utang occurs, rarely, in the. north-east. Thesiamang *(Siamanga syndactyla)* is a great ape peculiar to the island. The ungko *(Hylobates agilis)* is not so common. A fairly familiar form is the simpei *(Semnopilhecus melalophus).* The chigah. *(Cercocebus cynomolgus)* is the only ape found in central Sumatra in a tame state. The pig­tail ape *(Macacus nemestrinus)—*as Raffles described it in his “ Descriptive Catalogue of a Zoological Collection made in Sumatra,” *Trans. Linn. Soc.* (1820), xiii. 243—is trained by the natives of Benkulen to ascend coco-nut trees to gather nuts. The *Galeo- pithecus volans (kubin,* flying cat or flying lemur) is fairly common. Bats of some twenty-five species have been, registered ; in central Sumatra they dwell in thousands, in the limestone caves. The *Pieropus edulis (kalong,* flying fox) is to be met with almost every­where, especially in the durian trees. The tiger frequently makes his presence felt, but is seldom seen; he prefers to prowl in what the Malays call tiger weather, that is, dark, starless, misty nights. The clouded tiger or *rimau bulu (Felis macroscelis)* is also known, as well as the Malay bear and wild dog. *Paradoxurus musanga* (“ coffee-rat ” of the Europeans) is only. too abundant. The Sumatran hare *(Lepus nelscheri),* discovered in 1880, adds a second species to the *Lepus nigricollis,* the only hare previously known in the Malay Archipelago. The *Manis javanicus* is the only repre­sentative of the Edentata. Some 350 species of birds are known, and the avifauna closely resembles that of the Malay Peninsula and Borneo, including few peculiar species.

*Flora.—*Rank grasses, *(lalang, glaga),* which cover great areas in Java, have an even wider range in Sumatra, descending to within 700 or 800 ft. of sea-level ; wherever a space in the forest is cleared these aggressive grasses begin to take possession of the soil, and if once they are fully rooted the woodland has great difficulty in re-establishing itself. Among the orders more strongly represented in Sumatra than in Java are the Dipterocarpaceae, Chrysobalanaceae, sclerocarp Myrtaceae, Melastomaceae, Begonias, Nepenthes, Oxali­daceae, Myristicaceae, Ternströmiaceae, Connaraceae, Amyridaceae, Cyrtandraceae, Epacridaceae and Eriocaulaceae. Many of the Sumatran forms which do not occur in Java are found in the Malay Peninsula. In the north the pine tree *(Pinus Merkusii)* has advanced almost to. the equator, and in the south are a variety of species characteristic of the Australian region. The distribution of species does not depend on elevation to the same extent as in Java, where the horizontal zones are clearly marked; and there appears to be a tendency of all forms to grow at lower altitudes than in that island. A remarkable feature of the Sumatran flora is the great variety of trees that vie with each other in stature and beauty, and as a timber-producing country the island ranks high even among the richly wooded lands of the archipelago. Forest products—gums and resins of various sorts, such as gutta-percha—are valuable articles of export.. The pro­cess of . reckless deforestation is perceptible in certain districts, the natives often destroying a whole tree for a plank or rafter. The principal cultivated plants, apart from sugar-cane and coffee, are rice (in great variety of kinds), the coco-nut palm, the areng palm, the areca and the sago palms, maize, yams, and sweet potatoes; and among the fruit trees are the Indian tamarind, pomegranate, guava, papaw, orange and lemon. Even before the arrival of Europeans Sumatra was known for its pepper plantations; and these still form the most conspicuous feature of the south of the island. For the foreign market coffee is the most important of all the crops, the Padang districts being the chief seat of its cultivation. Benzoin was formerly obtained almost exclusively from Sumatra from the *Styrax benzoin.*

*Population.—*The following table gives the area and estimated population of the several political divisions of Sumatra and of the island as a whole (excluding the small part belonging to the Riouw-Lingga residency):—

|  |  |  |
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| Division. | Area in sq. m. | Population. 1900. |
| Sumatra, West Coast .... | 31,649 | 1,527,297 |
| Sumatra, East Coast .... | 35,312 | 42 1,090 |
| Benkulen | 9,399 | 162,396 |
| Lampong Districts | 11,284 | 142,426 |
| Palembang | 53.497 | 804,299 |
| Achin (Atjeh) | 20,471 | 110,804 |
| Total | 161,612 | 3,168,312 |