

the several species. Taking *Apatosaurus* as an illustration, Mr. Mook points out the necessity of making allowance for differences of age in the various individuals compared; which differences can generally be recognised by studying the degree of fusion of certain bones and the development of crests and rugosities on them.

As an aid to the study of Prof. Osborn's numerous papers on the fossil vertebrate animals, we welcome the handsome second edition of the Bibliography of his published writings which we have just received. It includes a classified index as well as the usual chronological list, and forms a most useful compendium for the student. It shows not merely where Prof. Osborn has described the various fossils, but also where he has discussed the points of philosophical interest which arise from these descriptions.

A. S. W.

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EXPLORATIONS IN THE HAWAIIAN ISLANDS.

PROF. A. S. HITCHCOCK, of the U.S. National Museum, and his son, travelled recently in the Hawaiian Islands, studying the flora, especially with reference to the grasses, making what might be termed a forage survey.

The islands visited were Kauai, Oahu, Lanai, Molokai, Maui, and Hawaii. They are all of volcanic origin and composed of lava, except a very small part, which is of coral formation. Kauai, geologically the oldest island, shows the greatest effect of erosion, its deep canyons rivalling the beauty of the Grand Canyon of Colorado. The rainfall on the mountains of the windward side is excessive, that of Waialeale, the highest peak of Kauai, being as much as 600 in. per annum. But the lee side of the islands is arid, the rainfall being often reduced to fewer than 15 in. per annum.

To the south the islands are successively younger, Hawaii, the largest, being even now in a state of volcanic activity. On this island are situated the two highest peaks of the group, Mauna Kea, 13,825 ft., and Mauna Loa, 13,675 ft. in height. There is scarcely any vegetation upon these peaks, above 10,000 ft., especially upon Mauna Loa, which is made up of comparatively recent lava. Much snow covers the peaks in winter, extensive banks persisting throughout the year. The magnitude of the mountain mass is greater than at first appears, because the cones arise from the very floor of the ocean, 18,000 ft. below the surface, thus making the total height more than 30,000 ft. So gradual is the slope from the sea to the summit that the eye is deceived and the great height is not at first fully appreciated. The active volcano, Kilauea (4000 ft.), with its pit of boiling lava, is on Hawaii, while Haleakala, said to be the largest crater in the world, is on Maui, the second largest island of the group.

Important agricultural industries of the island include sugar, live stock, and pineapples. The native Hawaiian population is decreasing, and it is only in the less accessible parts of the islands that the primitive customs still prevail. Here may be found the native grass huts made of a wooden framework filled in with a thatch of grass. The grass used for this purpose is usually pili (*Heteropogon contortus*), an indigenous grass, abundant upon the rocky soil of the lowlands.

The introduced flora is very noticeable near towns, ranches, and plantations, and one must go several miles from Honolulu to find indigenous or native plants. Of sixty species of grasses found on Oahu, about fifty were introduced from foreign countries. One of the introduced trees of great economic importance is the algaroba tree (*Prosopis juliflora*) or kiawe, as the Hawaiians call it. It is found in a belt on the lowlands along the shores of all the islands, and occupies the soil almost to the exclusion of other plants. The pods are very nutritious, and are eagerly eaten by all kinds of stock. Its flowers furnish an excellent quality of honey. The Molokai ranch alone produces 150 to 200 tons of strained honey per year. The prickly pear cactus (*Opuntia tuna*) has become extensively naturalised in the drier portions of all the islands. Two introduced shrubs, Guava and Lantana, now occupy extensive areas, and have become great pests. In the moister portions of the islands large areas have been occupied by Hilo grass, which has little value as a forage plant. The kukui, or candlenut, tree (*Alcurites moluccana*), with its light, almost silvery, green foliage is now a common and rather striking element in the valleys and gorges.

The indigenous flora is highly interesting, though not abundant in species. Two of the commonest trees are the ohia (*Metrosideros polymorpha*) and the koa (*Acacia koa*). The former, also called ohia lehua and lehua, resembles, in the appearance of the trunk, our white oak, but bears beautiful clusters of scarlet flowers with long, protruding stamens. The koa produces a valuable wood much used in cabinet-making. Characteristic of the upper forest belt on the high mountains of Hawaii is the mamani (*Sophora chrysophylla*), a leguminous tree with long, drooping clusters of yellow flowers and long, four-winged pods constricted between the seeds. In the arid regions is found the wiliwili (*Erythrina monosperma*), a deciduous tree with gnarly growth. Its bare branches are conspicuous, as deciduous trees are unusual in the tropics. It has very soft light wood, and bright scarlet seeds. Among the peculiar plants of the islands is the silversword (*Argyroxiphium sandwicense*), a strikingly beautiful composite with glistening silvery leaves, which grows only on the slopes of cinder cones in the crater of Haleakala, and in a few very limited localities on Hawaii. The family Lobeliaceæ is represented by about 100 species belonging to six genera. The numerous arborescent or tree-like species are very peculiar and characteristic. Many of them form slender trunks like small palms, crowned with a large cluster of long narrow leaves, the trunks of some species being as much as 30 or 40 ft. high.

The indigenous grasses of the Hawaiian Islands are not numerous. A tall species of *Eragrostis* is the dominant grass upon the plain between Mauna Loa and Mauna Kea. Upon many of the summits of the high mountain ridges in the regions of heavy rainfall are found open bogs which support a peculiar and interesting flora. Many species form more or less hemispherical tussocks which rise above the general level of the bog. A showy lobelia with numerous large cream-coloured flowers as much as 3½ in. long, peculiar violets, and a sundew are found there. These boggy areas are devoid of trees, and sometimes occupy