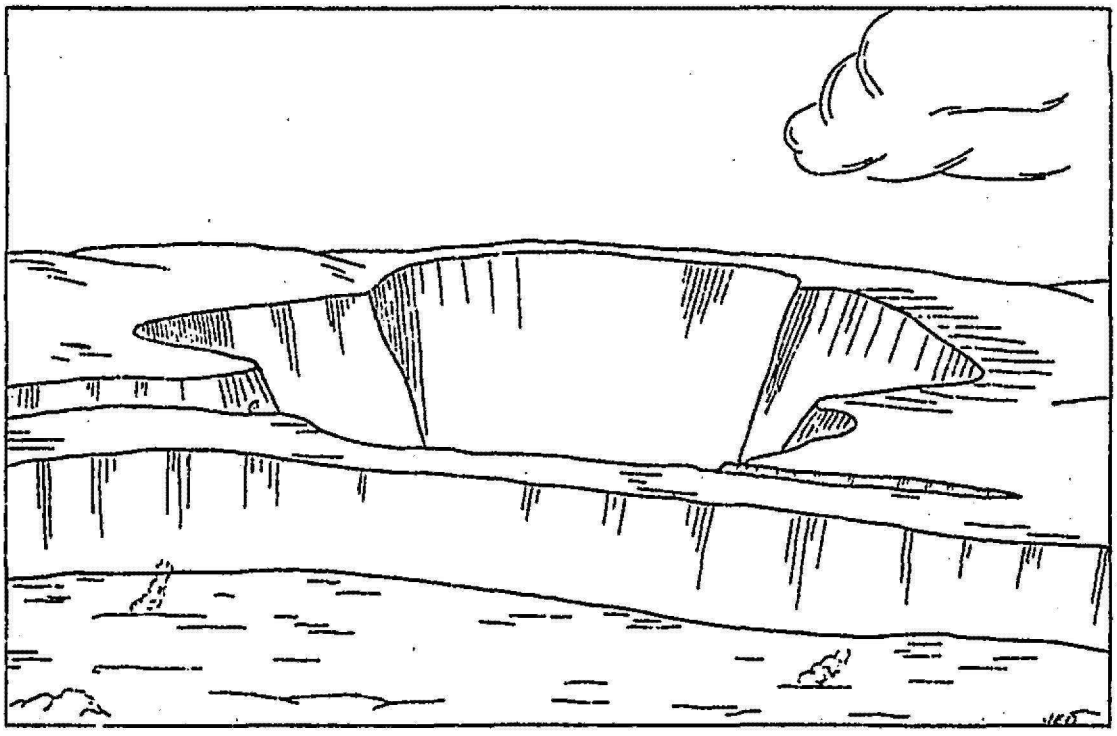
NATURE NOTES



KILAUEA IKI CRATER FROM UWEKAHUNA

Hawaii National Park
VOL III 1933 NO III

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HAWAII NATIONAL PARK
NATURE NOTES

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E. P. Leavitt, Superintendent John E. Doerr, Jr. Park Naturalist

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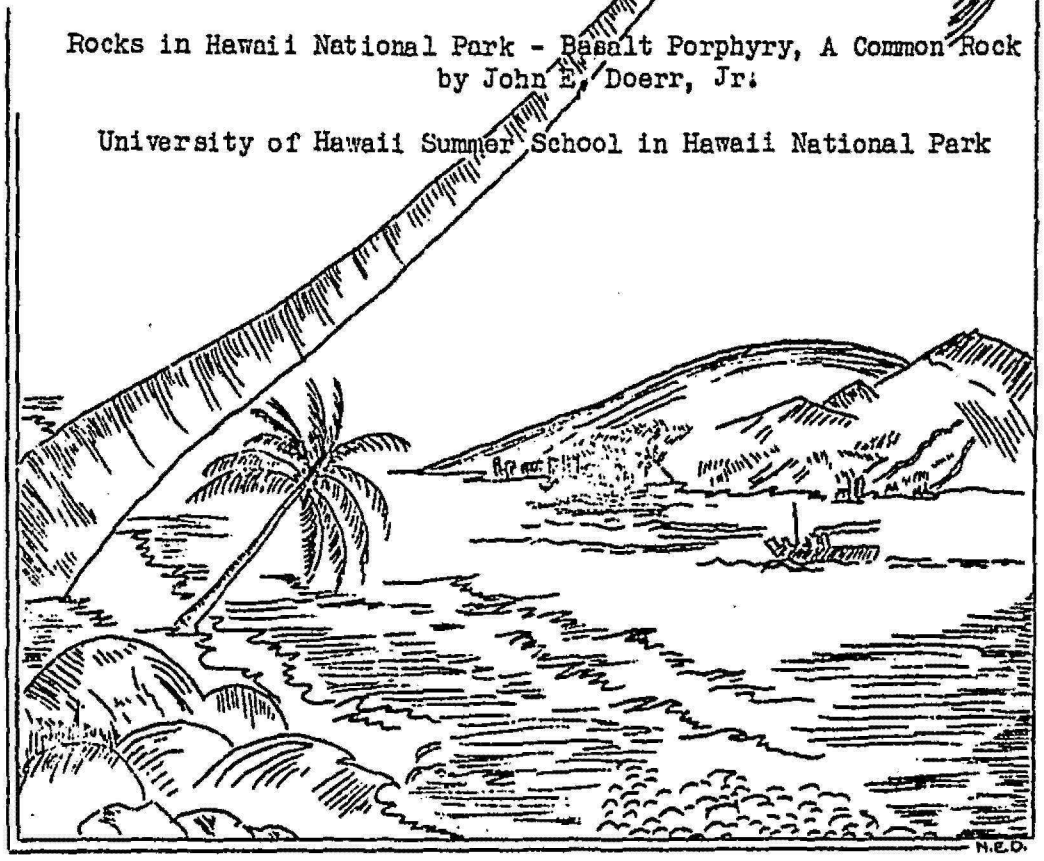

FOSSIL FERNS

A deep hole dug into the countless layers of lava that have issued from Kilauea might expose the remains of some of the first plants to inhabit the slopes of the Volcano. Those who have had some experience in fossil hunting and who realize that lava rocks have rarely produced a fossil, may be of the opinion that the introductory statement is the product of a very vivid and uncontrolled imagination.

Molten lava issuing from a volcano is much hotter than any temperatures ordinarily experienced by most people. The temperature of such lava may seem much higher than would actually be necessary to totally destroy all evidence of any vegetation in the pathway of a flow, particularly a growth of vegetation as fragile as ferns.

In 1832, molten lava broke out on Byron's Ledge, a wall-like isthmus which separates the craters of Kilauea and Kilauea Iki. The lava cascaded down the steep slopes of the isthmus into both craters. The shallow streams of lava running down the wooded slopes into Kilauea Iki destroyed all vegetation in their pathway.* The heavily wooded walls of the crater were scarred by tongues of black, shiny lava. Vegetation creeping back into the area covered by the 1832 flow has not completely hidden the evidence of that flow, even though 100 years has elapsed since the activity.

The new trail leading into Kilauea Iki Crater cuts through the 1832 flow in several places. Exposures along the trail indicate that the flow covered the slope with a pahoehoe lava veneer which varies in thickness from a few inches to a maximum of less than 10 feet. Where the lava is thinnest, blocks and slabs of the veneer can be easily pried up. The relatively smooth underneath surface of the blocks contain perfect impressions of segments of the pinnae of "amaumau" (Sadleria cyatheoides) ferns. In many specimens the mold of the midrib, and the revolute or curled margins of the segments are easily distinguishable. In a few specimens the impressions of the long narrow sori or spore cases of the fern can be identified. The charred remains of segments can be found in a few impressions. These small charred flakes have remained protected beneath the flow for over 100 years.

Having seen these fossil ferns, it requires no stretch of the imagination to visualize how the 1832 flow cascading into Kilauea Iki pushed over and buried the ferns which made their impressions in the hot, viscous underneath surface of the flow. Other flows could cover the lava of 1832 without altering its underneath surface and disturbing the fern impressions, thus the evidence of formerly existing plant life could be preserved for periods longer than 100 years.

Fossil fern impressions are found not only in the 1832 flow but also in the 1923 flow which is on the east slope of Kilauea near the pit-crater of Makaopuhi, and in the 1868 flow from Mauna Loa. William Hillebrand has described almost perfect leaf scars of fern-trees in

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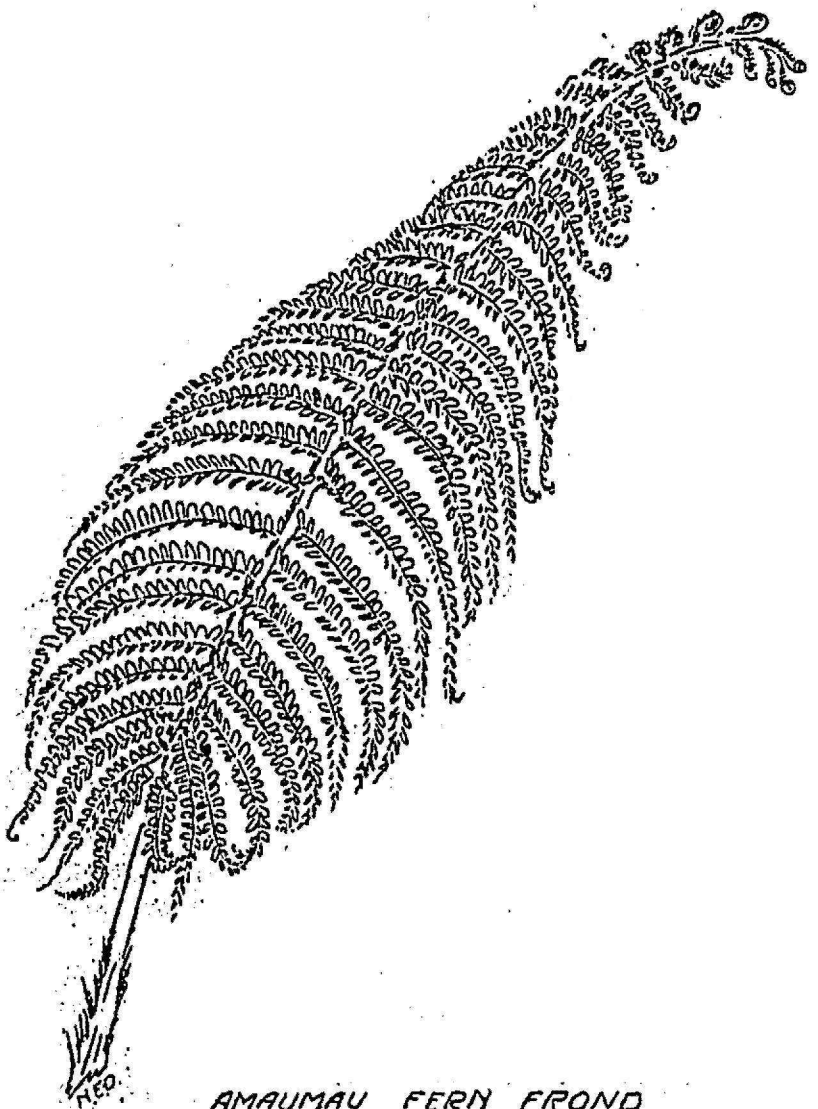
* "Before this time (1832) Kilauea iki had long been free from lava visitations, and its sides were wooded to the bottom." Wm. T. Brigham, Memmoirs of the B.P.Bishop Museum, Vol. II, No.4, p.46, Honolulu, 1909.

the 1868 flow in Kahuku on the south slope of Mauna Loa.*.

Some day a deep hole may reveal between the layers of lava the impressions of much older fossil ferns - the impressions of vegetation which grew on a surface now buried beneath many ancient flows.

by John E. Doerr, Jr.
Park Naturalist



AMAUMAU FERN FROND
SADLERIA CYATHEOIDES - 1/5

*Brigham, Wm. T., Memoirs of the B. P. Bishop Museum, Vol. II, No. 4, p. 111, Honolulu, 1909.

FOREST NOTES

(Editor - These "Forest Notes" were contributed to this pamphlet by C. S. Judd, Territorial Forester of the Territory of Hawaii.)

There are now 1,027,299 acres in the 64 Territorial forest reserves on the five main islands of the Hawaiian Group, 65% of which is owned by the Territory of Hawaii.* Thus, almost one-quarter of the 4,118,400 acres on all of the islands is devoted to forest protection for the main purpose of water conservation.

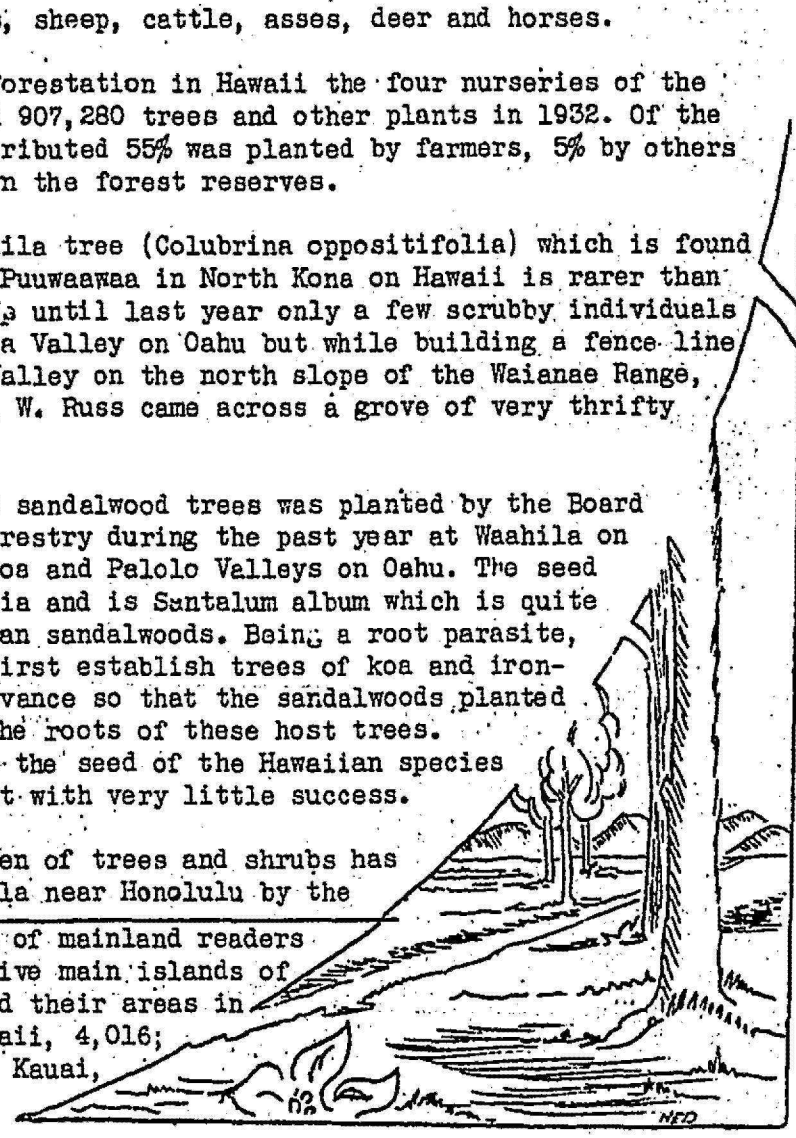
During 1932, the campaign of the Board of Agriculture and Forestry for ridding the native forests of destructive wild animals, in which the National Park Service and ranches assisted, resulted in the elimination of 17,637 goats, pigs, sheep, cattle, asses, deer and horses.

To encourage reforestation in Hawaii the four nurseries of the Territory distributed 907,280 trees and other plants in 1932. Of the 748,163 trees so distributed 55% was planted by farmers, 5% by others and 40% was planted in the forest reserves.

The Hawaiian kauila tree (Colubrina oppositifolia) which is found rather abundantly at Puuwaawaa in North Kona on Hawaii is rarer than sandalwood on Oahu. Up until last year only a few scrubby individuals had been seen in Makua Valley on Oahu but while building a fence line in 1932 in Makaleha Valley on the north slope of the Waianae Range, Assistant Forester G. W. Russ came across a grove of very thrifty kauila trees.

A grove of 1,716 sandalwood trees was planted by the Board of Agriculture and Forestry during the past year at Waahila on the ridge between Manoa and Palolo Valleys on Oahu. The seed came from Mysore, India and is Santalum album which is quite similar to the Hawaiian sandalwoods. Being a root parasite, it was necessary to first establish trees of koa and ironwood six months in advance so that the sandalwoods planted later could feed on the roots of these host trees. Attempts to germinate the seed of the Hawaiian species of sandalwood have met with very little success.

An Hawaiian garden of trees and shrubs has been started at Waahila near Honolulu by the



*For the information of mainland readers of Nature Notes the five main islands of the Hawaiian group and their areas in square miles are: Hawaii, 4,016; Maui, 728; Oahu, 598; Kauai, 547; Molokai, 261.

Board of Agriculture and Forestry in cooperation with the University of Hawaii. The area is just back of the subdivision known as St. Louis Heights at an elevation of 1000 feet and is accessible by automobile. In this garden so far have already been planted such native trees and shrubs as the wiliwili, naio, hala, aalii, koa, Molokai red cotton, ohai, nioi, aulu, kokio keke6 and anapanapa.

In December 1932, the committee advising the Governor on Territorial Monuments, passed upon and approved 76 objects of historic, scientific, scenic and botanic interest which will soon be recommended for designation by the Governor as Territorial Monuments under Act 56 of the session laws of 1931.

In building the last pig hunters' cabin on the summit of the Koolau Range on Oahu, the Board of Agriculture and Forestry was greatly assisted in November 1932 by the U. S. Army Air Corps which cooperated in this work delivering the material to the site at the head of Kaipapau Canyon by airplane bombers. The frame timbers of redwood, the flat tin wall material and the corrugated iron roofing were wrapped in three tight bundles of 400 pounds each and tightly roped. These were dropped all within 200 feet of the cloth panel, laid on the ground, by the planes from a height of 30 feet. The timbers in only one bundle, which struck a rock bank end on, were damaged. The cabin which is 10 by 10 feet in size was completed on December 23, 1932, and affords comfortable accommodations in this very wet, jungle region.

Soon after the two fatalities on Kauai last summer when two young men lost their lives by falling down the cliffs, The Board of Agriculture and Forestry put the two following rules into effect:

1. Each hunter is first to report to the local ranger so that the latter will know where the different parties are hunting.
2. No permits are issued to boys under 18 years of age unless an application is first made by parent or guardian and in that case the boys are to be accompanied by an experienced adult who is acceptable to the local forest officers.

by C. S. Judd
Territorial Forester
Territory of Hawaii

ROCKS IN HAWAII NATIONAL PARK

BASALT PORPHYRY - A COMMON ROCK

(Editor's Note - This is the second of a series of articles describing the common rocks in Hawaii National Park. The first article, "Basalt, A Common Rock", appeared in Vol. III, No. 1 of Nature Notes, Jan-Feb. 1933.)

Among the various rocks in the vicinity of Kilauea which attract attention, basalt porphyry or olivine basalt porphyry is one of the most outstanding. A sample of this type of rock seems to be almost as important to some rock collectors as the glassy threads of Pele's Hair. The basalt porphyry in this region is particularly interesting because it contains bottle-green grains of olivine, a mineral known locally as "Hawaiian Diamonds".*

People examining the rocks on the floor of Kilauea frequently ask the question: "Why are there more olivines in some rocks than others?" The abundance of olivine in some basaltic rock (dark colored, fine textured, chemically basic igneous rocks) is evidence that certain events or processes occurred while the rock was forming. The numerous grains of olivine tell the story of what happened during certain stages in the crystallization of the lava.

Deep within the earth, hot, liquid, basaltic magma is composed of a mixture of oxides known as silica, alumina, iron, magnesia, lime, soda, potash and a few other oxides in minor quantities. As such a magma rises toward the earth's surface during a volcanic eruption the pressure and temperature of the magma are lowered to the point where the process of uniting and separation of certain oxides takes place. Geologists refer to that process as "magmatic differentiation". Such a caption conveys the idea that as the union of certain oxides takes place the substances thus formed sink or are left behind while the remainder of the liquid magma continues to rise to the surface. Whether the substances remaining below and thus segregated and concentrated are in the form of solid crystals or heavy liquids is a debatable question. In either case, the rock resulting from the solidification of the material in the zone of differentiation is composed of considerable amounts of one mineral. The segregation process in Kilauea magma results in the formation of shot-like grains of olivine embedded in an aphanitic (fine texture) matrix of basalt. The word porphyry is used to describe a rock in which there is a distinct contrast of size between the easily recognizable grains (phenocrysts) and the matrix or groundmass in which the grains are embedded. The name "olivine basalt porphyry" indicates that the large grains are olivine in a basalt matrix.

The rocks which solidified in the deeper parts of the throat of Kilauea and were thrown out during the 1924 eruption contain an

*Refer to Nature Notes, Vol.I No.5, Hawaii Nat'l Park, Oct. 1931.

abundance of olivine embedded in a matrix of basalt. They indicate that the segregation of olivine took place at depths below the surface of former lava lakes in Kilauea's Crater. The fact that some lava flows which have formed on the lower slopes of volcanoes contain more olivine than the flows which form the rims of summit craters, suggests that some flows on the lower slopes have been fed with magma from the part of the volcanic conduits where magmatic differentiation has taken place.*

The numerous grains of olivine in some rocks tell a story not only of separation in the magma but also a story of slow crystallization which in turn suggests that a uniform temperature was maintained for a time in the zone of segregation. Experimental work has proved that olivine is one of the first minerals to form when a basaltic magma is cooled.** One might logically conclude that the olivine formed at uniformly high temperature.

Practically every sample of basalt in the vicinity of Kilauea contains a few grains of olivine but not enough to distinguish the rock as a porphyry. The occassional grains may have been carried up from the zone of differentiation by the rising olivine-free magma.

The above explanation of the abundance of olivine in some rocks is based on changes in temperature and pressure in the magma as it rises toward the surface, and also on the effect of gravity which causes a concentration of heavier substances in the deeper parts of the magma. Those who are particularly interested in chemistry may desire to explain the concentration of olivine on the basis of certain chemical reactions. Cross states: "-there is some condition, commonly realized in Hawaii, which is particularly favorable to the formation of olivine from magmas whose silica is sufficient to have produced a much larger amount of a higher silicate than is found." Cross continues: "It appears to be a notable feature of the Hawaiian lavas that olivine occurs in greater abundance than it would if the available silica of the magma had been utilized to produce compounds of the highest possible silicity -."***

The occurrence of sufficient amounts of olivine in a basalt to distinguish it as an olivine basalt porphyry may be explained as due to segregation and slow crystallization at high temperature of certain fractional parts of the magma; or to some unknown condition within the magma which causes the silica to unite with the iron and magnesia to form olivine rather than other silicate minerals. No matter which explanation is given, it must account for the concentration of olivine in some rocks. Such rocks are classified as olivine basalt or olivine basalt porphyry.

by John E. Doerr, Jr.
Park Naturalist

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* Daly, R. A., Igneous Rocks and Their Origin, New York, 1914, p.228.
** Clarke, F. W., Data of Geochemistry, U.S.G.S. Bull. 770, 1924, p.393.
*** Cross, W., Lavas of Hawaii and Their Relations, U.S.G.S. Prof. Paper 88, 1915, p. 12 and 55.

UNIVERSITY OF HAWAII SUMMER SCHOOL IN HAWAII NATIONAL PARK

Through the cooperation of the National Park Service a branch of the regular summer session of the University of Hawaii will be held in Hawaii National Park, from June 19 to July 28. Six courses will be offered, each giving residence credit toward a degree on the same basis as courses given on the University campus in Honolulu. Dean B. O. Wist of the University of Hawaii will be in charge of the session.

Registration will take place in the National Park Administration Building, Monday, June 19. The time schedule of classes will be announced at that time.

Classroom space is available in the Park Administration Building, Uwekahuna Museum and Lecture Hall, as well as in the buildings at the Volcano House. The latter will serve as official headquarters during the session.

Summer school students may obtain board and room at the Volcano House at the special rate of $90.00 for the six-week period. Student rooms will be in the Volcano House cottages near the hotel.

In addition to the six University courses there will be a regular schedule of Park activities in which summer school students are invited to participate. The courses being offered by the University are as follows:

S190 BOTANY, Hawaiian Flora - An outdoor course intended to familiarize the student with the flora of the Kilauea region of Hawaii. Instructor, T. C. Zschokke, Extension Forester.

S279 EDUCATION, Problems of the Classroom Teacher - A course designed to meet the specific needs of classroom teachers in elementary schools. Instructor, Dean B. O. Wist.

S257 ENGLISH, Interpretation of the Short Story - A reading course concerned with the interpretation of various kinds of short stories. Instructor, Dr. W. B. Coale.

S262 GEOGRAPHY, Hawaiian Geography - This course is designed to help teachers in interpreting the present-day activities of the people of Hawaii. Instructor, Lorna H. Jarrett.

S262 GEOLOGY, Volcanology - A course in the science of volcano investigation, with special reference to the field and experimental aspects of the subject, and not requiring special attainments. Instructor, Dr. T. A. Jagger.

S291 NATURE STUDY, Nature Study in the Volcano Region - A course intended to develop acquaintance with and stimulate interest in the natural phenomena of Hawaii National Park.

For a more complete description of the courses refer to the University of Hawaii Quarterly Bulletin, Vol. XII, No. 1, Summer Session Announcement.

Editor