NOTES

FOSSIL TREE STUMPS FOUND IN SITU ON SUBMERGED RIDGE AT AMCHITKA ISLAND, ALASKA[1]

Two ancient tree stumps, in situ and partially embedded in bedrock, were found at a depth of 23 m off the Bering Sea coast of Amchitka Island in the western Aleutians. The stumps were found by the authors in October 1972 approximately 1.1 km north-northwest of Banjo Point (Figure 1) during underwater surveys of physical and biological damage associated with recent nuclear testing on Amchitka.

The two stumps were located at the base of a narrow ridge of bedrock which is over 100 m in length, rises abruptly from a generally level bedrock bottom at a depth of about 23 m, and is oriented approximately normal to the adjacent coastline. The height and thickness of the ridge range from about 4 to 8 m, and its clifflike faces are nearly vertical. This ridge is thought to be an abandoned erosional sea stack related to a brief stillstand of sea level during Pleistocene time at about 20 to 30 m below present sea level (L. M. Gard, U.S. Geological Survey, Denver, CO 80225, pers. comm.).

Each of the stumps is about 1 m high and seems to have a trunk diameter of about 30 to 40 cm. The one stump that was studied in detail is located in a slight recess at the base of the west face of the ridge (Figure 2). The base of the stump is at the level of the generally horizontal bedrock sea floor which extends westward from the ridge; at this place the ridge face is 8 m high. The stump itself is mostly surrounded by undisturbed bedrock (Figures 3, 4). With the exception of lower root extremities which extend outward several centimeters from the base of the cliff and disappear into the adjacent horizontal substrate, the stump is flush with or slightly recessed into the cliff face.

Directly above the stump in the roof of the rock recess is a vertical cylindrical hole about 20 cm in diameter and depth. The existence of a small diameter opening extending upward through the rock was indicated by a stream of fine air bubbles escaping from the cliff face about 4 m above the stump. The air was from the divers' exhalations that had become trapped in the hole above the stump. It appears that the stump had originally been totally encased in bedrock but was then partly exposed as the cliff face eroded away. The hole above the stump may once have contained a higher portion of the tree trunk, but the wood within the hole disintegrated, leaving the cavity in the rock.

Additional wood material was found in the immediate vicinity of the stump. On the horizontal bedrock sea floor within 2 to 5 m from the

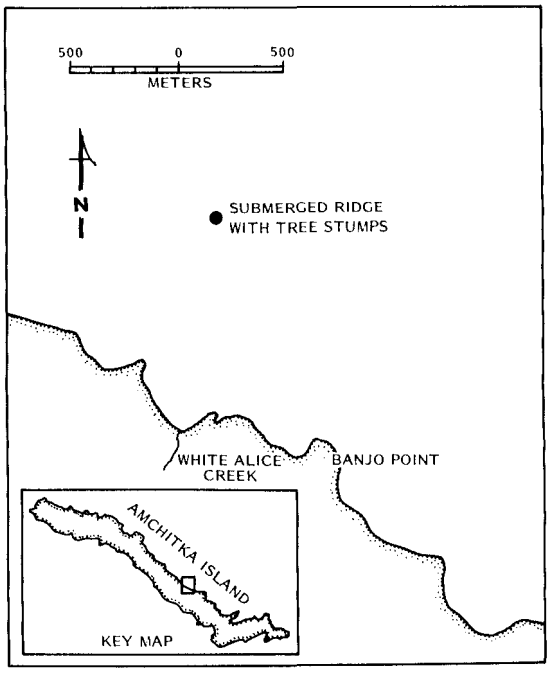

FIGURE 1.—Location of submerged ridge with in situ tree stumps in relation to the adjacent shoreline of Amchitka Island, Alaska.

[1] This work was supported by the U.S. Atomic Energy Commission as a part of its Amchitka Bioenvironmental Program.

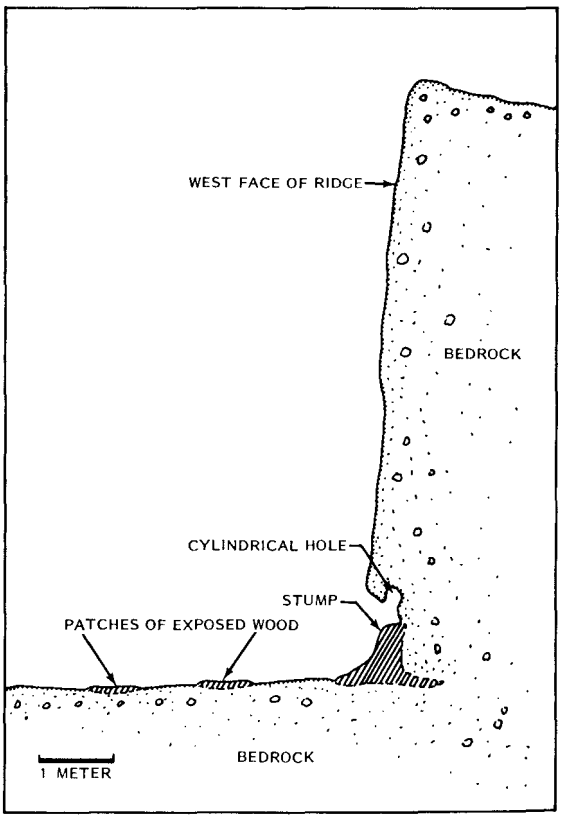

FIGURE 2.—Diagram showing approximate position of stump in relation to surrounding substrate features.

stump, several small areas of wood adhere tightly to or are partly encased in the bottom. The appearance and texture of this wood is similar to that of the stump, except that these small patches are worn down with upper surfaces flattened and generally conforming to the shape of the underlying bedrock. Although no direct connections were traced between these wood patches and the stump, their proximity and positions in relation to the stump suggest that they may be remnants of roots of the same tree. Probably buried in the substrate during the tree's life, the root remnants have now been exposed by the gradual eroding away of the rock in which they were encased.

Small samples of wood were collected from each stump. The wood is very dark brown in color and quite soft when wet but appears to be at least partially coalified. Pieces can easily be broken off or dug out with a knife. When dried, the wood becomes harder and more brittle and tends to distort and check. A sample of the wood was identified[2] as being from a coniferous tree, but further identification was not possible because the features necessary for generic identification had been removed by long-time hydrolysis.

A sample of the wood was submitted for radiocarbon dating. The indicated age of the wood exceeded 40,000 yr, the age limit of the C-14 technique of the laboratory[3] performing the analysis.

[2]Microscopic examination and identification was done by B. F. Kukachka, Center for Wood Anatomy Research, U. S. Department of Agriculture, Forest Service, Forest Products Laboratory, Madison, WI 53705.

[3]Radiocarbon dating was done by Teledyne Isotopes, Westwood, NJ 07675.

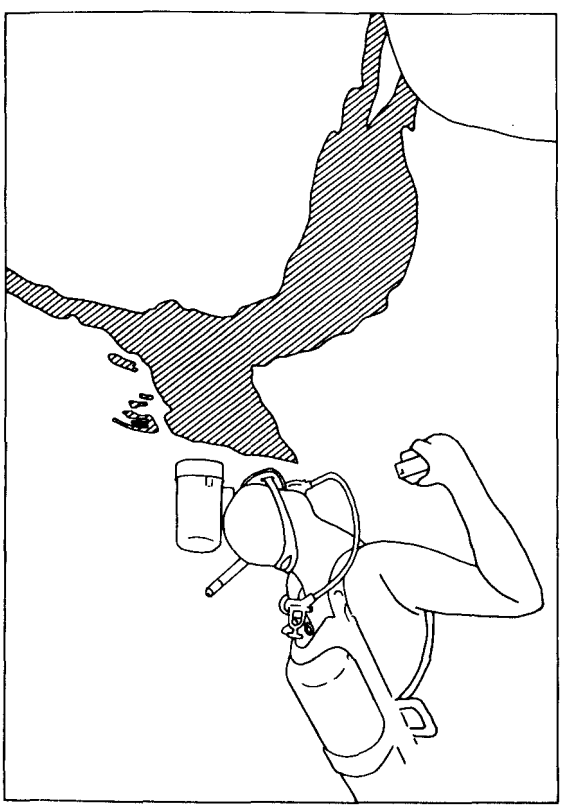

FIGURE 3.—Diagram indicating exposed wood (cross hatching) of the stump shown in the photograph of Figure 4.

FIGURE 4.—Outcrop of in situ stump at 23 m depth. Note texture of the volcanic mudflow deposit above the stump.

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The exposed parts of the stumps were partially encrusted with living organisms such as coralline algae, bryozoans, and sponges, but much of the exposed wood surface was barren of organisms. There was no visible evidence of any biological degradation of the wood, that is, no borer holes or indication of decay. The surfaces of the wood appeared to be shaped principally by mechanical weathering or erosion. Unlike new wood exposed in a marine environment, the wood of the stumps appears to have been immune to the usual attacks of wood-boring organisms. During the period of total encasement in the rock substrate, the wood probably underwent chemical changes that resulted in immunity to biodegradation.

As stated earlier and as shown in Figure 4, the substrate in direct contact with the stumps was undisturbed bedrock. Rock samples we obtained from fresh rockfalls along the cliff face containing the stumps were identified as coming from volcanic breccia of the Chitka Point Formation of the Miocene age (L. M. Gard, pers. comm.). The Chitka Point Formation is composed of subaerial lava flows, breccias, tuffs, and conglomerates derived from a volcano which must have been located on western Amchitka and eastern Rat Islands (Carr et al., 1971; L. M. Gard, pers. comm.). Potassium-argon dates obtained on lavas of the upper part of the Chitka Point Formation indicated an age of at least 12.4 ± 1.1 million yr (Carr et al., 1971).

Amchitka and all of the Aleutian Islands are now devoid of naturally occurring trees. Evidence that trees once grew on Amchitka does exist, however. During Miocene time, trees and other carbonaceous material were often incorporated into volcanic mudflows and debris flows of the Chitka Point Formation, as evident by the presence of this material in many of the outcrops of breccias, tuffs, and conglomerates along the Bering coast of Amchitka (Powers, Coats, and Nelson, 1960; L. M. Gard, pers. comm.).

The significance of the tree stumps reported in this paper derives from their in situ location 23 m below present sea level. Because of the offshore and submerged location of these stumps, they represent a time when the island was not only forested but larger and at least 23 m higher in relation to sea level.

Acknowledgments

L. M. Gard, Geologist, U.S. Geological Survey, assisted by supplying background information on the geologic history of Amchitka Island and by reviewing a draft of this manuscript for accuracy and aptness of interpretation. Theodore R. Merrell, Jr. assisted in the fieldwork and in the preparation of this report.

Literature Cited

Carr, W. J., L. M. Gard, G. D. Bath, and D. L. Healey.
1971. Earth-science studies of a nuclear test area in the western Aleutian Islands, Alaska: An interim summary of results. Geol. Soc. Am. Bull. 82:699-705.

Powers, H. A., R. R. Coats, and W. H. Nelson.
1960. Geology and submarine physiography of Amchitka Island, Alaska. U.S. Geol. Surv. Bull. 1028-P:521-554.

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ESTIMATION OF RATES OF TAG SHEDDING BY NORTHWEST ATLANTIC BLUEFIN TUNA[1]

A joint experiment was initiated by the Fisheries Research Board of Canada (FRBC), the National Marine Fisheries Service, and the Woods Hole Oceanographic Institution (WHOI) in 1971 under the leadership of F. Mather to estimate the rates of tag shedding by bluefin tuna. Five hundred and eighty bluefin tuna were double tagged with one of four types of dart tags off the east coast of the U.S. during the 1971 fishing season. Two types of darts, metal and plastic, were used and tags supplied by FRBC were slightly different from tags supplied by WHOI. Tags and tagging procedures

[1] Contribution No. 3010, Woods Hole Oceanographic Institution, Woods Hole, MA 02543.