K-Ar dates for sills from the Neahkahnie Mountain and Tillamook Head areas of the northwestern Oregon coas

Alan R. Niem and Frank B. Cressy

Isochron/West, Bulletin of Isotopic Geochronology, v. 7, pp. 13-16

This page is intentionally left blank to maintain order of facing pages.

K-AR DATES FOR SILLS FROM THE NEAHKAHNIE MOUNTAIN AND TILLAMOOK HEAD AREAS OF THE NORTHWESTERN OREGON COAST

Alan R. Niem and Frank B. Cressy, Jr.
Department of Geology
Oregon State University
Corvallis, OR 97331

We report K-Ar dates for two sills in the northern Coast Range of Oregon. The dated samples were collected in March, 1972, from the coarse-grained basaltic portion of the sill that forms Neahkahnie Mountain and from a fine-grained basalt of an apophysis near the top of the Tillamook Head sill at Ecola State Park (fig. 1).

The K-Ar age determinations were performed by Donald J. Parker of Oregon State University at the Kline Geological Laboratory of Yale University under the direction of R. L. Armstrong. Argon was determined by isotope dilution, potassium by atomic absorption spectrophotometry (Armstrong, 1970). Constants used in the reduction and analytical data were $K^{40} = 0.0119$ atom percent; $K_{\beta} = 4.72 \times 10^{-10} yr^{-1}$, $K_{\epsilon} = 0.584 \times 10^{-10} yr^{-1}$. Analyses of standards indicate that calibrations are accurate within 2 percent. Uncertainties reported are for analytical error only and represent one standard deviation or the standard error for averaged dates. The geochronometry laboratory of Yale University is supported by NSF Grant GA-26025.

GEOLOGIC DISCUSSION

Several thick basaltic sills form headlands along the northwest coast of Oregon, marginal to the Coast Range. The sills and associated dikes intrude Tertiary marine sedimentary rocks and are hypabyssal equivalents of extrusive submarine basaltic breccia and flows of the Depoe Bay Basalt (Snavely, MacLeod, and Wagner, 1973) of middle Miocene age. The sills of Tillamook Head and Neahkahnie Mountain are tholeiitic basalt and are chemically indistinguishable from the extrusive Depoe Bay Basalt. They are also compositionally similar to the Yakima-type basalts of the Columbia River Group.

The K-Ar age determination provided dates of 15.5±0.4 m.y. and 15.9±0.3 m.y. for the Neahkahnie Mountain sill and the Tillamook Head sill respectively. Turner (1970) obtained a similar age (14±2.7 m.y.) for basalt at Ecola State Park near Tillamook Head. He also obtained similar data (14.5±1.0 m.y.) for basalt from flows at Cape Meares, a short distance to the south, that correlate with the basalt at Ecola State Park and Tillamook Head. The spatial proximity of the sills (13 miles apart), their structural relationship, and similar petrography and radiometric ages suggest that they were intruded during the same volcanic episode and may even be exposed parts of the same sill.

The upper portion of the Tillamook Head sill at Indian Beach in Ecola State Park contains many irregular apophyses that are locally brecciated and altered along their margins. The apophyses are associated with penecontemporaneously folded deep marine turbidite sandstones and mudstones. In addition, blocks of these contorted sedimentary rocks are incorporated in the apophyses. The mudstones contain Foraminifera of the lower to middle part of the West Coast Miocene (late Saucesian and Relizian; Niem and others, 1973).

Field relationships suggest that the upper portion of the sill apparently intruded a thick water-saturated pile of semilithified sand and mud layers at very shallow depths beneath the sea floor, deforming the sedimentary sequence into a series of folds. Extensive steam blasting of the basalt resulted in local brecciation of the apophyses.

The time-span of the uppermost part of the Saucesian and Relizian Stages of Kleinpell (1938) according to Turner (1970) includes the time-interval of the radiometric ages of the Tillamook Head and Neahkahnie Mountain sills. Thus, the correspondence of the K-Ar age of the Tillamook Head sill and the foraminiferal age of the intruded strata also indicate that the intrusion occurred soon after deposition of the sedimentary sequence.

SAMPLE DESCRIPTIONS

I. YU-1N K-Ar (whole rock) 15.5±0.4 m.y.

Neahkahnie Mountain sill. Coarse-grained equigranular basalt (SE¼ Sec. 18, T3N, R10W; 45°45′N, 123° 58′W; Nehalem 15′ quadrangle; 200 ft S of second view point on U. S. Highway 101, approx. 11 mi S of

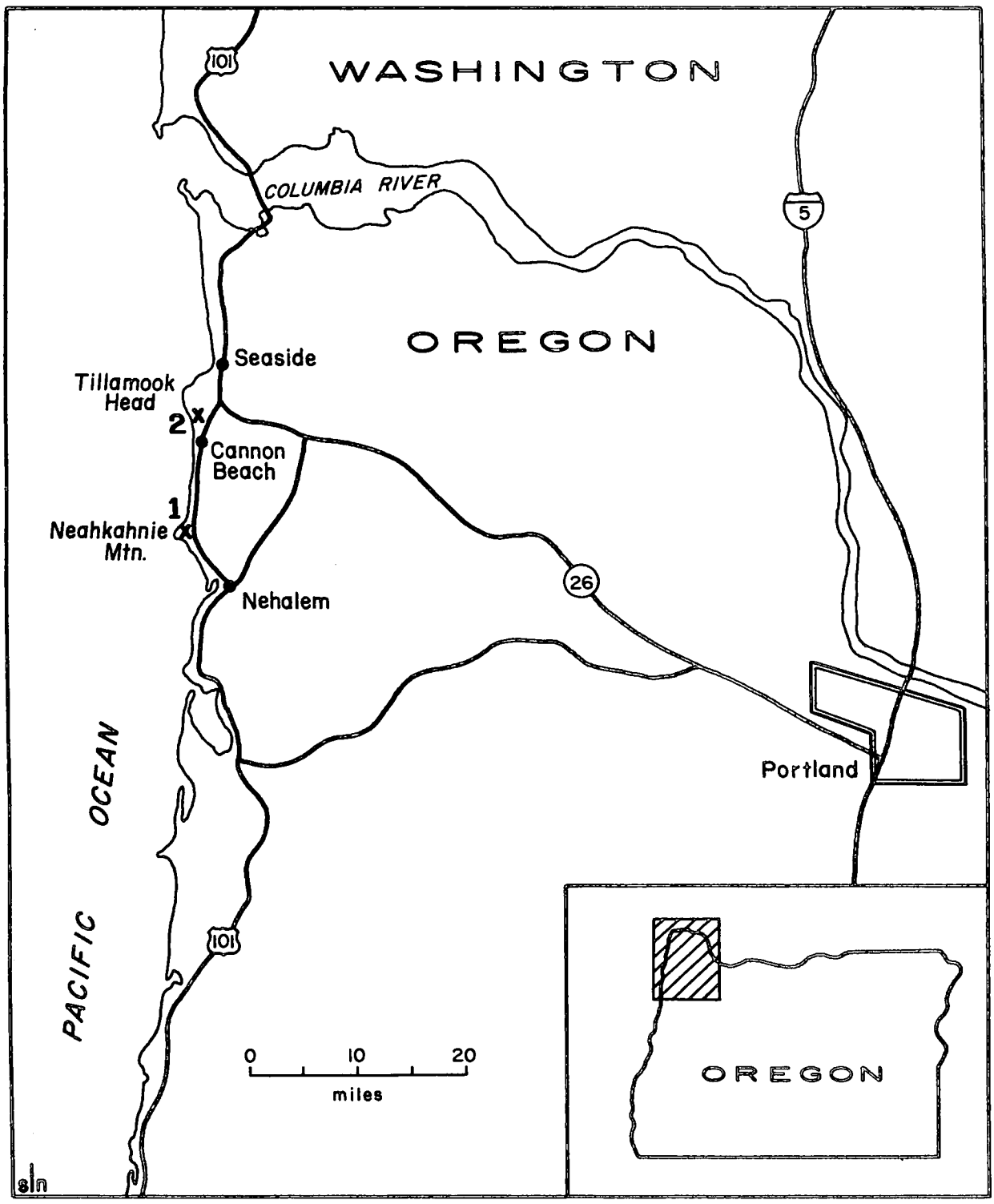

Figure 1. Map showing location of dated rock samples. The numbers are keyed to the sample descriptions.

Cannon Beach, Tillamook Co., OR) with an intersertal to intergranular texture. Randomly oriented phenocrysts of plagioclase (calcic andesine-sodic labradorite, $Ab_{47}An_{54}$) are 2-3 mm in length and consist of about 50-55% of the rock. The groundmass is composed of anhedral augite (35-40%) and magnetite (3-5%), minor chlorophaeite, olivine, and apatite (<1%) and a residual silicic glass. Analytical data: K = 1.53, 1.51%; $\overset{*}{A}r^{40}$ = 0.9363 x 10^{-6} cc/gm (56% ΣAr^{40}).

2. YU-E1 K-Ar (whole rock) 15.9±0.3 m.y.

Ecola State Park sill. Fine-grained equigranular basalt (SW¼NW¼SW¼ Sec. 7, T5N, R10W; 45°56'N, 123°59'W; Cannon Beach 15' quadrangle; 500 ft S of parking lot at Indian Beach, approx. 2 mi N of Cannon Beach, Clatsop Co., OR). Analytical data: K = 1.28, 1.28% $\overset{*}{A}r^{40}$ = 0.8144 x 10^{-6} cc/gm (25% ΣAr^{40}).

REFERENCES

Armstrong, R. L. (1970) Geochronology of Tertiary igneous rocks, eastern Basin and Range Province, western Utah, eastern Nevada, and vicinity, U. S. A.: Geochim. et Cosmochim. Acta, v. 34, p. 203-232.

Kleinpell, R. M. (1938) Miocene stratigraphy of California: Tulsa, Oklahoma, Am. Assoc. Petroleum Geologists.

Neim, A. R., Van Atta, R. O., Livingston, V., and Rau, W. W. (1973) Road log to Cenozoic geology of northwestern Oregon and southwestern Washington: Oregon Dept. Geol. and Min. Industries Bull. 77, p. 93-132.

Snavely, P. D., Jr., MacLeod, N. S., and Wagner, H. C. (1973) Miocene tholeiitic basalts of coastal Oregon and Washington and their relations to coeval basalts of the Columbia Plateau: Geol. Soc. America Bull., v. 84, no. 2, p. 387-424.

Turner, D. L. (1970) Potassium-argon dating of Pacific Coast Miocene foraminiferal stages: Geol. Soc. America Special Paper 124, p. 91-129.