

- Geological Society of America Bulletin* 5:1049-86.
- Nichols, R.L. and Stearns, C.E. 1938. Fissure eruptions near Bend, Oregon (abs). *Geological Society of America Bulletin* 49(part 2):1894.
- Nieland, J.R. 1970. Spatter Cone pits, Sand Mountain Lava Field, Oregon Cascades. *Ore Bin* 32:231-36. Reprinted in *Underground Express* 1:77-80.
- Ollier, C.D. 1964. Caves and related features at Mount Eccles. *Victorian Naturalist*, 81:64-71.
- Ollier, C.D. and Brown, M.C. 1965. Lava caves of Victoria. *Bulletin Volcanologique* 28:215-30.
- Olson, D. 1975. Sand Mountain area caves. Unpublished notes and sketch map in Western Speleological Survey library.
- Peterson, N.V. and Groh, E.A. 1969. Ages of some Holocene eruptions in the Newberry Volcano area. *Ore Bin* 31:73-87.
- Peterson, N.V. and Groh, E.A. 1965. *Lunar geological field conference guide book*. Portland: Oregon State Dept. of Geology & Mineral Industries, 51 pp.
- Peterson, N.V. and Groh, E.A. 1965. *Lunar geological field conference guide book*. Portland: Oregon State Dept. of Geology & Mineral Industries, 51 pp.
- Pickering, W.H. 1908. The volcanoes of the Azores. *Appalachia* 11:344-50.
- Roach, A.W. 1952. Phytosociology of the Nash Crater lava flows, Linn County, Oregon. *Ecological Monographs* 22:170-93
- Russell, I.C. 1902. *Geology and water resources of the Snake River Plains of Idaho*. U. S. Geological Survey ———— 1903. *Notes on the geology of southwestern Idaho and southeastern Oregon*. U.S. Geological Survey Bulletin 217, 83 pp.
- Bulletin 199, 192 pp.
- Skinner, C.E. 1979. Kind of lost and found: The Little Belknap Crater System. *The Speleograph* 15:107-110.
- 1980. Oregon's deepest natural volcanic pits: Cheap thrills in big holes. *The Speleograph* 16:86-87.
- Stearns, H.T. 1928. Craters of the Moon National Monument, Idaho. *Idaho Bureau of Mines and Geology Bulletin* 13:18.
- Swanson, D.A., et al. 1979. *Chronological narrative of the 1969-1971 Mauna Ulu eruption of Kilauea volcano, Hawaii*. U. S. Geological Survey Professional Paper 1056.
- Taylor, E.M. 1965. Recent volcanism between Three-Fingered Jack and North Sister, Oregon Cascade Range. *Ore Bin* 27:121-47.
- 1967. Recent volcanism between Three-Fingered Jack and North Sister, Oregon Cascade Range. Ph.D. dissertation, Washington State University at Pullman.
- Warden, A.J. 1967. Eruption of Lopevi volcano (New Hebrides). *Bulletin Volcanologique* 30:277-318.
- Wentworth, C.K. and Macdonald, G.A. 1953. *Structures and forms of basaltic rocks in Hawaii*. U. S. Geological Survey Bulletin 994, 98 pp.
- Williams, H. 1944. *Volcanoes of the Three Sisters region, Oregon Cascades*. Bulletin of the Department of Geological Sciences, University of California.
- Williams, H. and McBirney, A.R. 1979. *Volcanology*. San Francisco: Freeman, Cooper & Co., 397 pp.
- Wood, C.E. 1976. Caves in rocks of volcanic origin. In *The Science of Speleology*, ed. T. D. Ford and C. H. D. Cullingford, pp 127-50. New York: Academic Press.
- 1976. Lava caves and a conference - Seminario Sulle Grotte Laviche, Catania, August 1975: A report. *Bulletin of the British Cave Research Association* 12:22-26.
- 1978. Lava tubes: Their morphogenesis and role in flow formation. Phd. thesis, University of Leicester. Extended abstract in *Cascade Caver* 18:15-17, 27-30.

SPELEOLIFEROUS LAVA FLOWS ASSOCIATED WITH THE BROTHERS AND SUBSIDIARY FAULT ZONES OF CENTRAL AND SOUTHEASTERN OREGON

Ellen M. Benedict, Pacific University

ABSTRACT

The Pacific Northwest at the western edge of the North American Plate is impacted by the interactions of three types of plate boundaries. As the Pacific Plate slips northward toward subduction in the Gulf of Alaska, it is dragging western Oregon northward. During the last 10 to 12 million years, the terrain south of the Brothers Fault Zone has been extended an estimated 50 miles over a distance of 200 miles. The Brothers Fault Zone, along which magma has upwelled repeatedly, is the "pivot" between the older highly folded rocks of the Blue Mountain Province and the younger highly faulted rocks of the Basin and Ranger Province. The basaltic lava fields along the Brothers and subsidiary parallel fault zones include: the Horse, Arnold, Potholes, Matz, Lava Pass, Devils Garden, Squaw Ridge, Green Mountain, Four Craters, Diamond Craters, Voltage, Saddle Butte, Jordan Craters and Cow Lakes. Caves have been discovered in most of these lava fields; their basalts vary in age. A second group of cave flows are associated with the stratovolcanoes which result from magma produced by the subduction of the Juan de Fuca Plate. The highly plastic, small and thin, warm and youthful Juan de Fuca Plate, originating from a spreading center located about 270 miles offshore from the Oregon-Washington line, is subducting at an oblique angle under the more buoyant North American Plate. Examples of the stratovolcanoes with speleoliferous basaltic flows are Mt. St. Helens and Mt. Adams in southern Washington, Newberry Volcano in central Oregon, and Medicine Lake Volcano in northern California.

(No paper received for publication)