

effect, the on-going process of monitoring is important as insurance that management objectives are being accomplished. The study can be used as a comparison to data gathered during a 1975 study and also to establish a baseline for comparing patrol trip data gathered in the future.

Telephotometer readings from The Watchman (which overlooks Crater Lake and offers a 180-degree view of the surrounding countryside) have been collected this year for four "targets" to serve as baseline visibility data for future years. Beginning July 1 and continuing through September, eight readings were taken daily (each of the four targets was "read" at 9 a.m. and 3 p.m.) through powerful lenses with a built-on computer that measures the intensity of light. The computer automatically figures the ratio of difference between the light from the sky and the light reflected from the target. The wider the ratio (the sharper the contrast between sky and target), the clearer the air. The project is a joint effort between Crater Lake NP and the Oregon Department of Environmental Quality. Evaluation of the raw data is being done by EPA's Environmental Monitoring Systems Lab in Las Vegas. *Park Science* will report the lab's findings in a later issue.

Managers in need of information about the Mountain Pine Beetle (MPB), *Dendroctonus ponderosae*, will find useful a recent publication, *Management of Mountain Pine Beetle Infestations at Coulée Dam NRA*, by R. Gerald Wright of the University of Idaho CPSU and graduate student Richard Nathanson. The publication is CPSU/UI B 81-5. The information includes life history of the beetle and its use of host species, plus an examination of different commonly used control measures and their environmental implications.

Crater Lake Explosion

Greenland Ice Yields Data

Two different approaches to geologic dating are offering Crater Lake interpreters and visitors a panoramic view of ancient earth history and a choice of dates for the eruption that blew the top off Mount Mazama and created the incredible blue jewel of the National Park System.

The date used by park interpreters is 6840 B.P. — where B.P. stands for years "before present" and the years are "radiocarbon years." (Radiocarbon years are figured by the carbon 14 dating method — the difference between radiocarbon years and calendar years being a function of the strength of earth's magnetic field and the consequent amount of cosmic ray bombardment occurring at the time the subject material was being formed.) The data on which this interpretation is based comes from research by Charles Bacon of the U.S. Geological Survey, Menlo Park, Calif. Bacon first suspected and then produced conclusive stratigraphic proof that there were two eruptions within the overall climactic action that produced the lake. His carbon-14 dating is based on four different charcoal samples taken from the ends of the original pyroclastic flows, tens of kilometers away from the blast site, and from one charcoal sample found underneath the original pumice fall (a scattering of extrusive material less dense than is found in pyroclastic flows). From these five carbon samples, Bacon deduced a mean age of 6840 radiocarbon years, plus or minus 50 years, before the present day as the time of the eruption.

The so-called "main event" — the unroofing of the mountain, its collapse and the formation of the lake — is now known, through Bacon's studies, to have been preceded by perhaps 175 years by an eruption that pro-

duced Liao Rock — the rhyodacite (thick lava) flow which is so prominent a feature of the lake's northwest rim.

Duane Champion, also of the USGS Menlo Park complex, was called in the past two years by Bacon to bring his "paleomagnetic secular variation" analysis to bear on Bacon's radiocarbon-based results. It was the way the magnetite in the instantly formed rocks of the two explosions lined up with the magnetic poles of the earth at the time of the two blasts that confirmed the time separation.

Champion's work is based on the fact that the earth's magnetic pole changes position gradually over time, both in inclination and in declination. *Declination* is the angle between "true north" and magnetic north (which is not always at the spin axis of earth.) *Inclination* of the magnetic field varies from generally horizontal near the equator to vertical at the magnetic pole. At the latitude of Crater Lake, the magnetic inclination down from the horizontal is typically about 60 degrees, varying from shallower to steeper than 60 degrees in the same way the declination angle changes. As Bacon had predicted, the two-eruption theory was corroborated by the different recordings of magnetization found by Champion.

Then, on August 9 of this year, the *New York Times* front-paged a story about an international team of scientists working on a platform in southern Greenland, from which they have drilled almost to the bottom of the Greenland ice sheet. In a chart accompanying this item, the Mount Mazama explosion is given as having occurred 6381 years B.P., a seeming discrepancy of nearly 500 years from the radiocarbon date. As of August 9, the team had penetrated 6,687 feet and expected shortly to reach bottom, "where the ice may date back 100,000 years to a warm period before the last Ice Age."

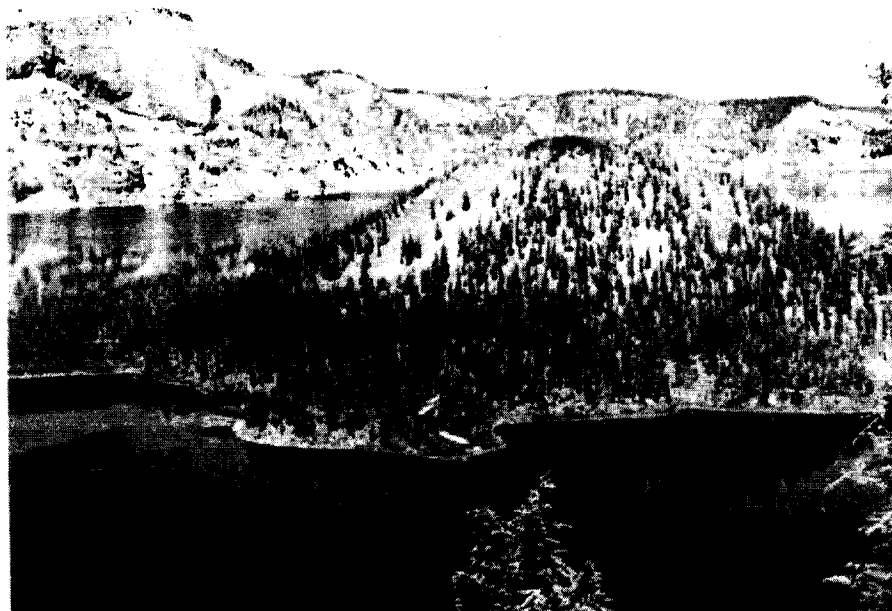
The drilling is a joint American-Danish-Swiss project and the dating method uses the relative abundances of two forms of oxygen for counting ice layers like annual growth rings. In colder weather, the heavier of the two oxygen isotopes — oxygen 18 — is less likely to precipitate. Therefore winter snow is made up predominately of oxygen 16, the lighter isotope. This summer-winter cycle of oxygen layers makes possible the pinpointing of volcanic eruptions for the past nine centuries with an error margin of only one year. The layers grow progressively harder to count, until at about 8000 B.C. "it becomes difficult . . . but ages can be roughly estimated."

Champion warns about the "fudge factor" that must be taken into radiocarbon dating considerations, but points out that this factor works to *increase* the radiocarbon age of Crater Lake — setting it back possibly as far as 7,650 to 7,770 absolute years before the present, and thus separating it even further from the time indicated by the Greenland drill team.

"I can't quarrel with their methodology," Champion said. "After all, they're counting real layers of absolute years. I can only surmise that the ash they found may have come from some other explosion — not Mount Mazama."

From WASO

The Natural Science Division, WASO, has a large supply of *Preserving Our Natural Heritage, Volume 1: Federal Activities*. Individuals wishing free copies should write to Gary Johnston, Natural Science Division (494), National Park Service, DI, Washington, D.C. 20240.



Liao rock looms over Wizard Island at Crater Lake.