AAAS–Newcomb Cleveland Prize

The AAAS–Newcomb Cleveland Prize for 1976–1977 has been awarded collectively to all the participants in the Viking mission. The first results from this project, describing the Viking mission and the environment of Mars, were published in 47 reports in *Science* on 27 August, 1 October, and 17 December 1976. According to Bentley Glass, chairman of the award committee, it was the committee's opinion "not only that the scientific reports collectively represent a unique achievement in the exploration of a neighbor planet, but also that the observations made and the scientific data reported so depend upon the technological development of the Viking Lander and its instrumentation that the prize should go to the entire group of persons who have made the Viking mission such an extraordinary achievement in the annals of modern science." At least 60 scientists and 10,000 supporting personnel were involved in the Viking mission.

The AAAS–Newcomb Cleveland Prize formerly was awarded to the best paper presented at the annual AAAS meeting. The format was changed last year because of the declining number of reports of original research presented at the meeting and the increasing emphasis of the meeting on public policy aspects of science. The prize is now awarded to the author of the outstanding paper published from September through August in the Reports section of *Science*. To be eligible, a paper must be the first publication of the author's own research. The award to the Viking mission is the first presentation made under the new format.

The award, which consists of $5000 and a bronze medal, will be accepted by Thomas Mutch of Brown University at the 1978 AAAS meeting in Washington. Mutch is leader of the Lander imaging team.—T.H.M.

reflective layer about 36 kilometers below the Socorro site is probably the Moho, although it is neither continuous nor located at a single depth. He suggests that, rather than being at a discrete depth, the Moho below the Rio Grande Rift is a series of laminations on a scale that is too small to be resolved by refraction.

The difficulty of relating the two approaches arises because signal travel times from source to reflector and back vary depending on the velocity of the signal in each different part of the crust through which the signal passes. If only nearly vertically reflected signals are used, it is very difficult to measure the transmission velocity of a particular part of the deep crust. Thus, the conversion from travel time to depth is necessarily an approximation based on estimated velocities.

Accurate velocities within deep crustal layers have most often been determined by seismic refraction studies. Unlike the vertically reflected signals used so far by COCORP, refracted signals travel considerable horizontal distances from their source before being recorded. The refracted signals first penetrate the crust at some angle from the vertical and are bent into a more or less horizontal path by the refractive effects of passing from one crustal layer to another. Eventually, the signal is bent back toward the surface where its arrival time, which is determined by its velocity through the crust, can be recorded.

Seismic refraction is not a true imaging method like reflection profiling, which produces an optical image directly. The end result of a refraction study is only the broad variation of velocity with depth. Because the varied effects of many kilometers of crust are averaged to give a single value at a particular depth, refraction studies cannot resolve small detail the way reflection profiling can.

Refraction studies are already supplementing COCORP data at several sites. Ronald Ward of the University of Texas at Dallas has conducted a series of limited "piggy-back" studies with COCORP signals refracted through the crust as well as those reflected at a wide angle. They are being used to determine shallow crustal velocities, to remove interfering signals from the COCORP data, and to map three-dimensional subsurface features, such as the roots of the Los Pinos Mountains near the Socorro site. Oliver is optimistic that future piggy-back studies will improve depth determinations by the use of wider angle reflections.

Independent refraction work by Dan McCullar and Scott Smithson of the University of Wyoming and by Kenneth Olsen and his colleagues at Los Alamos Scientific Laboratory tends to confirm the location of the Moho near Socorro at a depth of about 33 to 35 kilometers. This depth is slightly shallower than the depth outside the rift. Their work also suggests the presence of anomalous, and perhaps molten, rock beyond the limits set by the work of Sanford and COCORP.

Thinning of the crust and upwelling of magma are typical of areas such as the Great Rift Valley in East Africa which are generally regarded as geologically active zones of incipient ocean basin formation. COCORP researchers expect to return to the Rio Grande Rift to investigate further this conveniently located example of crustal alteration.

COCORP approached another basic geologic problem, the mechanism of mid-continent mountain formation, in its study of a deep fault near the Wind River Mountains of Wyoming. Reflection profiling is particularly well suited to tracing faults since they can be distinguished by the differences in the fine detail of the crustal blocks on either side of the fault, as well as by diffraction of the signal by features associated with the fault itself.

The fault straddled by the COCORP profile appears from surface indications to descend at a shallow angle, suggesting that one section of the crust slid over another as compression of the crust raised the mountains. But some geologists have raised the possibility that the angle of the fault might steepen with depth. If so, a block of crust might have been uplifted vertically instead of having slid horizontally to form the mountains.

Smithson, in a cooperative effort with COCORP, has done a preliminary analysis of the data from the Wyoming site. He believes that the fault can be traced to a depth of at least 30 kilometers. It appears to maintain its shallow angle throughout its descent, supporting the compressional theory.

COCORP seems well on its way to achieving its initial goal of demonstrating the utility of reflection profiling for studying the little known rocks of the deep crust. It is also making another point. Before COCORP, Phinney notes, solid earth research had not been included in "big science" as had such fields as oceanography and meteorology. He believes that the "old-fashioned, pickup truck" operation of the past had become a hindrance and that COCORP should serve as a model of cooperative, high quality data collection from the continental portion of the solid earth.

—RICHARD A. KERR