PHILOSOPHICAL TRANSACTIONS OF THE ROYAL SOCIETY A MATHEMATICAL, PHYSICAL & ENGINEERING SCIENCES

# Introductory Remarks

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# Introductory remarks

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It was at the beginning of the century that A. A. Michelson first used interferometric methods to measure the tilting of the ground due to tidal forces but for many years few more observations were made, and those few added little to Michelson's results. Subsequently new instruments were devised to measure tilting of the ground, the variation of gravity due to tides and horizontal components of strain, but until some twelve years ago attention was concentrated on the effects of tides and few observations were made. It is indeed now clear that observations of the response of the Earth to the tide-raising potential are unlikely to tell us anything significant about the bulk elastic properties of the Earth, although at one time it seemed that they could contribute to that end. The change in emphasis may be traced to the first observations of the free oscillations of the Earth excited by the shocks of large earthquakes and detected by tilt meters, gravity meters and strain guages. The periods of the free oscillations are much higher than the tidal periods; a large number can be estimated and they now provide rather precise information about the density and elastic moduli within the Earth. The first instruments were not sensitive enough to detect oscillations excited by any but the quite rare very large earthquakes, but recently more sensitive horizontal and vertical accelerometers have been constructed and observations have been obtained of oscillations excited by smaller and more numerous shocks, so that a broad flow of data may be expected in future.

Meanwhile, interest in continental drift was growing and with the discovery of magnetic lineations on the ocean floor and the idea of sea-floor spreading, the concept of plate tectonics, involving motions of a few centimetres a year between plates, was defined. Evidently it is of great interest to measure such movements directly, especially since plate tectonics might lead to a better understanding of the causes of earthquakes in seismic zones and hence possibly to the prediction of earthquakes. The study of movements close to faults does not require the most sensitive instruments and in some areas networks of tilt meters and strain meters have been established for the investigation of the development of particular earthquakes. At the same time it is becoming clear that the study of the free oscillations of the Earth may lead to a knowledge of the character of the shock that excited them.

These few remarks will indicate the great interest for geophysics in the study of changes of strain at the surface of the Earth. The means of satisfying that interest are being rapidly provided in the form of such advanced instruments as delicate accelerometers or strain gauges based on the laser interferometer, and it therefore seemed that the time was appropriate to look at the instruments that had been developed, to describe some of the problems to which they had been applied and to interest an extended group of geologists, geophysicists and engineers in the possibilities of measurements of strain.

Such were the aims of the discussion meeting, the contributions to which are published here. The topics include descriptions of instruments, discussion of how they may be used and the meaning of the observations, reports of measurements in particular regions, theoretical

considerations, and finally, some implications for geology and engineering. The organizers hope that the record of the discussion will prove to be not just a record of the state of the subject at the present time, but that because people are actively developing the subject, some of the papers will prove to be important contributions of lasting value.

The organizers wish to express their thanks to all those who accepted invitations to present papers, especially those who came from overseas to do so, and to the staff of the Royal Society for their invaluable advice and assistance in organization and publication.



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