Continental evolution

The European Geotraverse

from Derek J. Blundell

THIS month sees the start of the European Geotraverse's first major experiment — a deep seismic survey of the lithosphere from northern Italy to Tunisia. Over the next seven years the European Geotraverse Project will study a swathe of ground some 100 km wide and 4,000 km long from the North Cape of Norway to Tunisia (see the map) and will provide a great increase in our knowledge of the tectonic evolution of continental regions of the Earth.

The European Geotraverse Project was initiated two years ago by Stephan Mueller, Professor of Geophysics at ETH, Zurich. Geologists and geophysicists from most of the European countries have been brought together to help formulate the project and support has been received from the European Science Foundation.

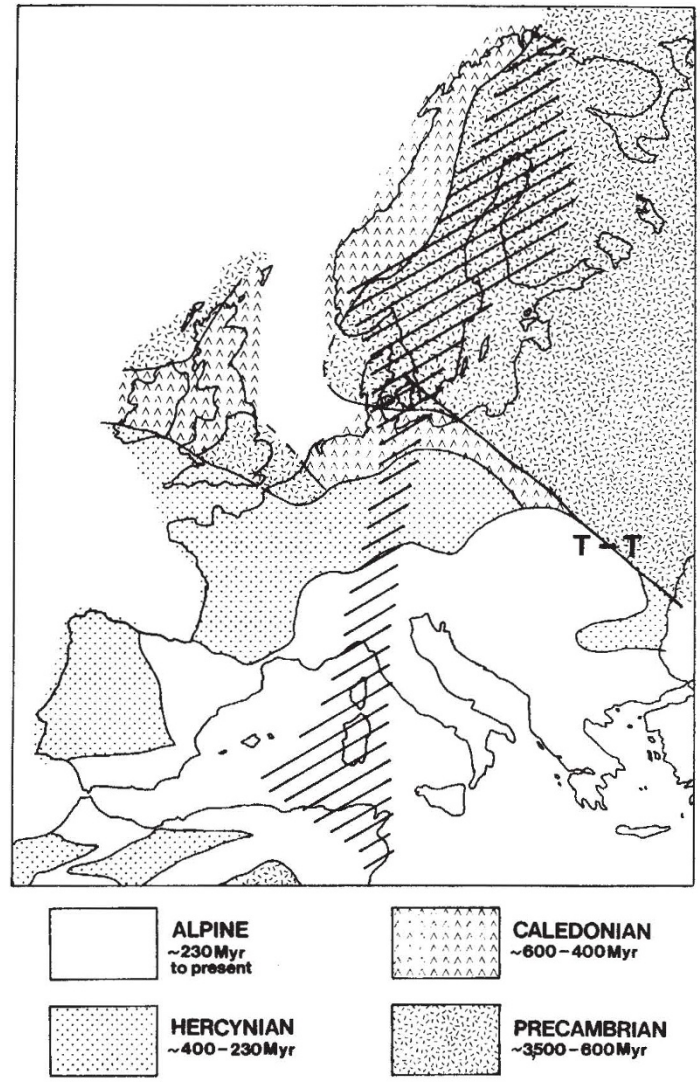
Continental regions are much less well understood than the relatively young lithosphere underlying the present oceans of the Earth. They contain what remains of the main time span of the Earth's history, and are composed of a mosaic of structurally characteristic tectonic provinces formed at various times through their history, the oldest Precambrian provinces more than 3,000 Myr old acting as nuclei around which successively younger ones have formed. The evolution of the continental lithosphere is complex, with successive thermal and deformational episodes superimposed, and the nature of the processes involved remains obscure.

Europe is particularly suited to a major project for it is made up of a number of tectonic provinces ranging in succession from the oldest Precambrian areas of Scandinavia to the currently active area of the Mediterranean. The Geotraverse Project will provide a continous integrated study of sufficient scale to give new information about both vertical and lateral variations of the whole lithosphere, both within and between adjacent provinces. Equally important, because the provinces occur in succession the project will provide an opportunity to follow the progression of tectonic activity over time and thus learn about the dynamics of the lithosphere.

For practical purposes the Geotraverse is divided into three segments (see the figure): the northern one covering the Precambrian provinces of Fennoscandia; the central one crossing the Hercynian realm of Central and Western Europe; and the southern one traversing the Alpine-Mediterranean region. It is located to take advantage of existing information, especially from the larger-scale geophysical measurements such as the Fennolora seismic experiment which has provided a regional pattern of the crust and upper mantle structure underlying Scandinavia.

Detailed studies will be made to attack key problems and broader-scale measurements will seek out regional variations. Geophysics features strongly on the experimental side to provide information on deep structures and on dynamic problems but geological and geochemical expertise will also be vital, especially in gaining an overall synthesis. The results will be integrated into a north–south section through the crust and upper mantle of Europe which will provide the basis for a reconstruction of the evolutionary development of the various tectonic provinces and their mutual interaction.

Projects include a multidisciplinary study of the contact zone (the Tornquist–Teissyre Line) between Precambrian and Hercynian Europe, covering southern Norway and Sweden, Denmark and northern Germany in 1984; mapping the full length of the Geotraverse with gravity, magnetic and geoelectrical methods; seismological observations and multidisciplinary studies of Corsica, Sardinia, the Southern Alps, the central European Hercynian province and the border regions between different tectonic units within it, the Sveconorwegian Caledonides and the Baltic Shield. Also within the programme are two experiments off the line of the Geotraverse but vital to it: a study of the anisotropy of seismic-wave propagation in the upper mantle, known to be present along the Geotraverse beneath southern Germany, but which can be studied better across the Iberian Peninsula; and a wide-aperture seismological array (NARS) which is being set up along a great circular route between Goteborg and Malaga to provide seismic surface-wave information with which to model lithospheric structure. □



The European Geotraverse (hatched area) crosses the major tectonic provinces of Europe. T-T is the Tornquist–Teissyre Line.

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