

LECTURE

Deep geology of Britain

Summary of lecture presented to the Society on Saturday 12th January 2002 by Dr Alfred Whittaker, formerly of British Geological Survey.

The deep subsurface geology of Britain was a major research topic of the last two decades of the 20th Century. New and improved types of relevant data from British and international deep drilling projects, in combination with related ultra-deep seismic reflection profiling, led to the development of various national programmes and much international discussion and collaboration.

The UK programme was initiated by the British Geological Survey whose Deep Geology Unit carried out onshore seismic reflection surveys recorded to 12 seconds of Two Way Travel Time and giving data to the base of the continental crust. The seismic programme was later extended considerably by the offshore seismic surveys carried out by the BIRPS group at Cambridge. Interpretations divided the British crust vertically into three zones of different reflection character. The lowermost crustal zone was characterised by laterally persistent strong reflections, and was interpreted as comprising rock material subjected to ductile types of deformation, while the two overlying (and probably seismogenic) middle and upper zones show brittle deformation characteristics. The upper (sedimentary, 'layer cake') zone displays many normal growth faults that commonly overlie low-dipping seismic reflection features of the middle zone (in turn interpreted as important thrust faults and detachment surfaces). The structural relationships in the upper and middle zones indicate reactivation of faults in both normal and reverse senses following successive periods of tectonic compression and tension during Phanerozoic time.

In addition, many boreholes (in the depth range 2-3 km) were sited, prognosed and managed by the Deep Geology Unit, sometimes as stratigraphic 'step-out' wells to encourage oil prospection in parts of Britain and funded by the Department of Energy. Also drilled were geothermal exploration and production wells as part of the UK Geothermal Programme. The development of an international programme of continental scientific drilling in the 1980s and 1990s brought about much scientific collaboration and ultimately proposals for a British programme discussed in depth at a Geological Society meeting in London in 1987.

Related projects, now belonging to the current International Continental Scientific Drilling Program (ICDP), were the 12km-deep Soviet/Russian borehole in the Kola peninsula, which proved unexpected mineralisation and hydrological activity at much greater depths than was previously thought possible, and the German deep drilling project (KTB) which drilled to 9 km depth in the early 1990s. The lecture ended with a brief description of the Chicxulub ICDP drilling project (which began in December 2001) located in the Yucatan peninsula of the Gulf of Mexico. At the time of writing the Chicxulub borehole was at a depth of 500m, about half way to the expected Cretaceous-Tertiary (KT) boundary, rich in the platinum-group mineral iridium. The drilling target is a well-defined impact crater presently considered to be the site where a major asteroid or meteorite fell to Earth 65 million years ago and caused the mass extinction at the KT boundary.

Literature

Chadwick, R.A., Kenolty, N. & Whittaker, A., 1983. Crustal structure beneath southern England from deep seismic reflection profiles. *Journal Geological Society London*, 140, 893-911.

A north-south geoseismic crustal section across the Variscan fold belt of southern England to 18 km deep.

