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Sedimentary Basins and Crustal and Upper Mantle Reflectors North, West, and South of Britain

Many of the basins crossed in nearly 2,000 km of 15-sec profiling by BIRPS are half grabens formed against Caledonian and Variscan thrust faults that have been reactivated as normal faults during Mesozoic stretching.

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Deep Seismic Sounding in Europe

During the past 3 decades, several seismological techniques have been used to explore the deep structure of Europe. Profound lateral variations in the lithosphere-asthenosphere system became immediately apparent from the observed delay of teleseismic P-waves. On the basis of a uniform dispersion analysis of all the presently available long-period Rayleigh wave observations and applying a new method of regionalization, a map outlining the thickness of the elastic lithosphere in Europe could be constructed.

Regions of markedly thinned lithosphere are the Tyrrhenian and Balearic basins of the western Mediterranean Sea. Another extensional structure of particular interest is the "Central European rift system," which extends from the western Alps to the North Sea. In contrast, an increased lithospheric thickness has been found beneath the Betic Cordillera and the Alps which must be ascribed to underthrusting and subfluence leading to the formation of a pronounced lithospheric "root" reaching to a depth of about 200 km. Long-range seismic refraction profiles have permitted insight into details of upper mantle structure to depths of nearly 400 km in a few tectonic provinces.

Travel-time and amplitude data obtained in crustal seismic refraction experiments, supplemented by wide-angle and near-vertical reflection observations, have made it possible to study the major features within the continental crust of Europe. Regions selected for detailed studies include the southern part of the Iberian Peninsula, the Pannonian basin, the Rhine graben rift system, the northern Alpine foreland, and the Alps.

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Rank of British Coalfields in Relation to Geothermal History and Geologic Structure

Most coals in the United Kingdom were formed during the Carboniferous; the majority are of Westphalian age. The coalfields display a great diversity of size, geologic structure, and rank. Examples include: (a) certain coalfields of the Midland Valley of Scotland, where rank is generally low but capricious because of widespread igneous activity in the form of sills and dikes, (b) the contrasting low-rank Northumberland coalfield and higher rank Durham coalfield to the south, the former lying in a deep sedimentary trough, the latter situated on the eastern margin of a stable block that has a complicated geothermal history, and (c) the South Wales coalfield with its easterly low-rank coals extending to a western area of high-level anthracitization, the cause of which has never been explained satisfactorily. The small Kent coalfield, the Yorkshire coalfield with its northeasterly extension to the new working Selby coalfield, and the new Oxfordshire coalfield, which is at present undeveloped, will also be discussed. Rank variation will be illustrated by vitrinite reflectances measured in borehole sections and by reflectance maps that are not generally available for British coalfields. Some of these maps are based on actual measured reflectances undertaken for marketing purposes by the National Coal Board. Others have been prepared from coalfield seam maps, originally constructed from coal chemical parameters, using what are now acceptable chemical parameter-reflectance correlations.

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Thermal Gradients in Sedimentary Basins

The major features of many sedimentary basins can be understood in terms either of lithospheric stretching or of tectonic loading of the lithosphere. These models allow broad predictions to be made concerning the thermal evolution and the hydrocarbon-maturation histories of the basins in question.

In any particular basin, however, the conductive temperature structure is liable to be modified significantly by the convective transport of heat by circulating pore fluids. Even very slow flows that are too small to be detected during drilling or by conventional hydrologic techniques may have a significant influence if they persist over long periods. Such flows have been demonstrated in the North Sea and the Alberta basin and may operate over a depth of several kilometers and have horizontal dimensions of tens of kilometers.

Much remains to be learned about the causes and behavior of circulations of this kind. By disturbing the conductive distribution of temperature, they delay the maturation of hydrocarbons in some areas and accelerate it in others. They may influence the migration of hydrocarbons, both directly and indirectly, through modification of the permeability structure by solution and precipitation. It is not possible to interpret the fine structure of sedimentary basins and the distribution of hydrocarbons within them without an understanding of these processes.

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Geodynamics of French Oil Basins

The Paris basin, the Aquitaine basin, and the Rhine graben share at least some slices of their geologic histories, even though the diversity of their complete histories largely commands the large variations in their petroliferous characteristics.

The Triassic and Jurassic series belonging to a rifting type basin are favorable to the deposition of both source and reservoir rocks.

The slowing down, then stoppage of subsidence during the Cretaceous and Tertiary Eras in the Paris basin has limited the maturation of source rocks and the formation of structures.

In the Aquitaine basin, the renewal of subsidence during the middle Cretaceous produced large strike-slip faults and the formation of narrow folded troughs. Later, the Tertiary orogenesis renewed the subsidence and formation of structures, resulting in a diversity of traps and the formation of a tar belt on the northern margin of the basin.

The Rhine graben was formed during the Tertiary between 2 large faults nearly north-south in direction. This renewal of subsidence resulted in a new generation of hydrocarbons within a complex faulted structural context.

Subsidence accompanied by fairly high thermal flux appears as one of the main conditions for the generation of hydrocarbons; subsidence may also generate block faulting favorable to their trapping.

On the other hand, too strong a subsidence may produce a poor petroliferous province, because of over-heating, erosion, or loss by seepage.

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Italian Oil and Gas Resources—Present Situation and Future Development

The sedimentary sequences of the Italian region were deposited mostly on the African continental margin and in the contiguous ocean that was generated by Jurassic spreading. The lithology and thickness of the carbonate deposits were controlled from the Triassic to Early Cretaceous by tensional tectonics that preceded and accompanied the oceanic opening. In later times, the prevalently clastic sedimentation was conditioned by the position of the areas subject to erosion and by the morphology of the basins or, in other words, it was the consequence of the compressive tectonics and the Alpine and Apenninic orogeny. Six major structural units can be identified: the Island of Sardinia, a fragment of the European continental margin that escaped the Alpine compressive tectonics; the Tyrrhenian Sea, a Miocene-Pliocene tensional area with an oceanic-type