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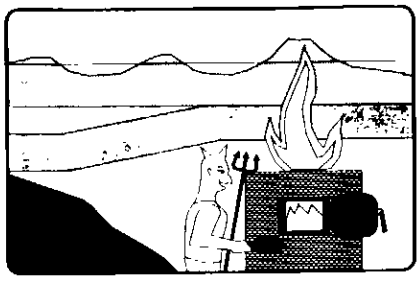

Terrestrial Heat Flow and the Structure of the Lithosphere

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An international meeting on "Terrestrial Heat Flow and the Structure of the Lithosphere", convened by Vladimir Cermak of the Geophysical Institute, Czechoslovak Academy of Sciences, was held 1-6 June 1987 in the Bechyne castle, near Prague. This meeting was attended by more than 100 specialists from 32 countries and it was an exceptional opportunity for interaction between scientists from eastern and western countries. The participants at the meeting were welcomed by Prof. A. Beck (U Western Ontario) who is the chairman of the International Heat Flow Commission. The Canadian participation involved eight researchers from universities and various branches of the Geological Survey of Canada (GSC).

The heat flow data provide important constraints on geodynamic models of crustal evolution and on contemporary tectonics, and the main focus of the conference was on the tectonic interpretation of geothermal studies. The conference covered the reliability of heat flow measurements and corrections, new heat flow data from different parts of the world, the significance of the heat flow-heat production relationship, modelling the present thermal regime of the lithosphere, the effect of heat flow on rheology, the tectonic and geodynamic implications of heat flow data.

Many of the difficulties of making climatic corrections and obtaining reliable heat flow data were illustrated by Allan Beck and S. Nielsen who presented several examples and proposed a method to extract useful information from data affected by climatic noise. Allan Jessop (GSC) presented field examples of the problem of heat flow in sedimentary basins; David Chapman (Pacific Geoscience Centre (PGC)) and his coworkers (U of Utah) presented numerical models of the effect of convection on heat flow in basins.

The linear relationship between heat flow and heat production has been the key to our understanding of the distribution of heat sources in the stable continental crust. All the interpretaions based on this relationship ignore horizontal transport of heat and this was questioned by Jaupart several years ago. Several authors have suggested that lateral transport of heat is important and affects the estimates of the thickness of the heat-producing layer; numerical models illustrating these problems were shown by Furlong (Penn State). Many workers, however, still prefer to refer to the linear heat flow-heat production relationship: data presented from different regions were interpreted in terms of this relationship. This was the case for new data from Brittany (Vigneresse, Nantes), from New England (Decker, Maine) and from the Canadian Shield (Drury, GSC) A poster by Drury tried to reconcile the observations with models that would include the effect of horizontal heat transport and differential erosion.

The vertical distribution of radiogenic elements could be determined by deep drilling. The superdeep hole in the Kola peninsula has provided the first direct knowledge on distribution of heat sources and other geothermal parameters with depth. The presentation of the data by Milanovski and his coworkers was expected with interest. The data shown at the meeting did not fit any of the previous speculations on heat sources distribution; quite surprisingly, the heat sources were found to increase at some level and did not exhibit the expected decrease with depth. Whether this situation is specific to the geology of the Kola peninsula or is general will certainly be the focus of debates before other drillholes answer the question.

The thermal regime of the crust and the temperature of the Moho can be computed if the distribution of radioelements and thermal conductivity are known. Rybach (ETH, Zurich) and Cermak have proposed that the petrology implies a relationship between seismic velocity and heat sources; they have used this constraint to compute Moho temperatures in Europe. Mareschal discussed direct inversion and downward continuation techniques that include source and horizontal conduction effects.

The tectonic importance of heat flow was demonstrated by papers relating the rheology of the lithosphere to the thermal regime. Cull (Monash U) presented rheological profiles for different regions of Australia; he suggested that variations in the thickness of the shallow brittle layer influence the seismicity of the Australian plate. Giorgio Ranalli (Carleton U) demonstrated that overthrusting affects the rheology of the lithosphere and discussed the effect on the evolution of decollements in orogenic belts.

The difficulty of interpretation of heat flow data from tectonically active regions was illustrated by many contributions. The complexity of the tectonics of the Mediterranean region is more than reproduced in the heat flow. Burrus (Institut Français du Petrole) presented heat flow profiles across the Ligurian sea, between Corsica and France: the high heat flow is compatible with the recent rifting, but quantitative modelling seems hopeless as the formation of basins, convection, and non-uniform rate of extension seem to have affected the spatial variation in heat flow. The data from Italy (Mongelli, Bari) and from the Thyrrennian and Ionnian basins (Della Vedova, Trieste) also seem difficult to interpret; the cause of recent extension in the Thyrrennian is poorly understood and the question is not clarified by the contrast between high heat flow in the Thyrrennian Basin and low in the Ionnian Basin. Heat flow measurements performed along the LITHOPROBE profile across Vancouver Island were presented by Lewis and his co-workers at PGC; there too, the variability of the heat flow does not fit any of the simple models but it could perhaps be explained by dehydration of the subducting oceanic crust and intrusion of magmas in the continental crust. Heat flow measurements, performed in Tibet and interpreted by French and Chinese teams were presented by Wang (Academia Sinica); local heat flow variations are correlated with the transient effects of the intrusion of young granites.

These and many other contributions at the meeting demonstrated that heat flow data contain much important information on complex crustal and lithospheric processes. The intensity of the debates and discussions also showed that a consensus is still very far from being reached on many crucial points. Hopefully, the debate will continue and be as animated and exciting as it was in Bechyne for many years to come.

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