

Lecture Notes in Earth Sciences

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Paleogeothermics

Evaluation of Geothermal Conditions in the Geological Past

Edited by Günter Buntebarth and Lajos Stegena



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PREFACE

During the last decades, remarkable progress in heat flow studies has been made and a rough picture of the global surface heat flow density distribution can now be drawn. Simultaneously, the question of over which time period the surface heat flow is constant arose.

There is a big field of model calculations, based on the changes in radioactive heat generation of the Earth, on plate motions, on stretching hypotheses or on other ideas, which result in geotherms in the geological past. Although these speculative paleogeotherms seem to be realistic especially in oceanic areas they do not belong to the scope of this book. In continental areas however, it is not possible to find a simple time dependence of the surface heat flow density. However, petroleum research and tectogenetic studies are very interested in the geothermal history of sedimentary basins and other continental areas. To obtain satisfactory results, a more or less direct determination of paleo heat flow density or geothermal gradient would be necessary to give more certain boundary conditions for calculating oil generation, and for controlling tectogenetic hypotheses.

There are many methods available in the geosciences to determine temperatures in the geological past. Most of these models are able to estimate temperatures at which a mineral or a mineral assemblage was formed. These methods, however, are mostly unsuitable to reach the main goal of paleogeothermics in general, which is to determine the (regional) heat flow density variations during the geological past for bigger geological units, such as sedimentary basins.

The methods applied most in sedimentary basins have been deduced from the degree of coalification of organic matter. Although much effort has been made to explain analytically the organic metamorphism, the results found up to now have been insufficient. However, the widespread application of this thermometer to estimate ancient thermal conditions is also reflected in the contents of this very volume where the interpretation of the degree of coalification of organic matter plays an important role.

As well as this geothermometers, other methods are reviewed from a geophysical viewpoint which favours methods suitable to determine a paleothermal state of the upper crust.

Further contributions of this book deal with

- the history of the earth's surface temperature whose change provides an essential correction factor in heat flow density determinations,
- isotope geothermometers and their application to various environments to evaluate thermal conditions in the past geological history,
- an application of the radiometric dating method to retrace the paleothermal condition of the Central Alps.

Most of the contributions were presented at the symposium "Paleogeothermics" which was held at the 18. General Assembly of the International Union of Geodesy and Geophysics, August 15-27, 1983 in Hamburg/FRG.

It has been the first time that such a symposium has been organized by the International Heat Flow Commission, and this book presents an attempt to define paleogeothermics under the auspices of the International Heat Flow Commission.

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