Thermal Diffusivity of Rocks at High Temperature by the Laser Flash Technique

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In order to understand the heat transfer mechanism in the Earth, it is fundamental to have precise data of the thermal diffusivity of rocks. An analysis of the existing data reveals that the thermal diffusivity may vary by a factor of 2 or 3 for any given rock type. This is due to the uncertainty of the measuring devices and methods and also to a lack of the knowledge of the mineral content of the rocks studied.

This study is part of a project for measuring the thermal diffusivity of characteristic rocks from well-defined regions as a function of temperature and, in a second stage, to establish a relationship between the composition and this thermophysical property.

The method used is the laser flash technique. It was pioneered by Parker in the early 60ís and subsequently improved by means of technological development and correction schemes. The principle of the method is straightforward. A small sample with the shape of a disk is subjected to a sudden laser heat pulse. The temperature history of the rear face is monitored as a function of time by a high-speed data acquisition system connected to a temperature detection system. The thermal diffusivity is evaluated from the temperature/time plot and the knowledge of the sample thickness. The instrument used can operate between room temperature and 2470 K. In this first stage only the solid phase was studied.

This instrument was calibrated with several recommended samples such as Poco Graphite AXM-5Q1, pyroceram 9606 and fused silica. Measurements of copper and stainless steel samples were also performed. This paper presents a comparison with existing data in the literature. The thermal diffusivity of some rocks (granites, limestones, marbles, etc.) is presented as a function of temperature. A comparison with existing data is also presented.