MITT.ÖSTERR.MINER.GES. 151 (2005)

PETROPHYSICS – POSSIBILITIES AND LIMITS IN MINERALOGICAL INTERPRETATION

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Petrophysical investigations play an important role for the interpretation of geophysical measurements leading to a more accurate subsurface model and formation evaluation. As almost every geophysical method has its origin in mining numerous petrophysical models exist linking the physical behaviour of host rocks with their iron content and dominant ore mineralogy.Although the main part of petrophysical investigations is still carried out for exploration purposes, physical properties of rocks and sediments are nowadays used in vast fields of application, e.g., environmental studies, engineering and groundwater exploration.

The objective of this paper is to give an overview of recent developments in petrophysics concerning the mineralogical analysis of consolidated rocks and sediments. In the context of the improvement of measurement accuracy and technologies a new quality of interpretation has been reached enabling petrophysics to distinguish between clay types and to deliver information about the content of some of the most abundant minerals.

The most relevant parameters for mineralogical analysis are magnetic susceptibility, ultrasonic velocity, thermal conductivity, gamma-ray spectrometry and complex electrical conductivity. As an example quartz has a major influence on the physical properties of rocks. It is a paramagnetic mineral, characterised by a high thermal conductivity and zero response of the imaginary part of complex electrical conductivity.

Recent research in environmental magnetism at the Chair of Geophysics at the University of Leoben (HANESCH & SCHOLGER, 2002) revealed that the magnetic susceptibility of soils and leaves is an indicator for heavy metal contamination and that a linear correlation between this parameter and the content of, e. g. lead, mercury, exists. As a consequence susceptibility mapping is a fast and inexpensive method for the evaluation of spatial distribution of heavy metals.

These examples should give an impression of new possibilities and fields of application for petrophysical investigations. As the main field of research in the petrophysics laboratory at the University of Leoben the development of improved models concerning mineralogical interpretation is one major goal. This of course can only be done in close collaboration with other earth scientists, especially mineralogists.

References

HANESCH, M.& SCHOLGER, R. (2002): Mapping of heavy metal loadings in soils by means of magnetic susceptibility measurements. Environmental Geology, 42, 857-870.