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Editorial to the third issue of "International Journal of Terrestrial Heat Flow and Applied Geothermics"

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The third issue of the *International Journal of Terrestrial Heat Flow and Applied Geothermics – IJTHFA* has been useful as a step further in bringing together several important works on geothermal research. It is indication that IJTHFA is a closer to being recognized as the most convenient and useful forum for dissemination of research results and information within the IHFC community.

The papers appearing in this third issue are focused on improving our understanding of heat flow variations in parts of the Earth, vital for promoting international geothermal research. These include Antarctic continent, area of Poland, Norte basin in Uruguay, Absheron Peninsula in Azerbaijan and Beiras region of Portugal. Also discussed is nature of subsurface thermal signals generated by recent climate changes in Ajameti, Georgia.

This issue also brings out an updated heat flow data set for Brazil, which has been organized following the traditional scheme adopted by IHFC for global compilations. However, a multiprong referencing system has been introduced that allow citations of recent works on improvements in data acquisition, progress obtained in analysis and interpretation techniques and advances in instrumental techniques.

With publication of the third issue of we expect to inform scholars of recent advances, evolving trends and new ideas being put forward in our own particular areas of specialty, both for enlivened discussions and for promoting research by next generations of experts.

The academic world is mostly driven by cross-disciplinary visions and models, but the importance of intra-disciplinary approach cannot be underestimated. The approach embraced in IJTHFA is expected to provide a broadened and modern perspective of international geothermal research.

The organizers of the International Journal of Terrestrial Heat Flow and Applied Geothermics (IJTHFA) received seven manuscripts, which after due review process were accepted for publication. Given below is a brief overview of the accepted contributions.

Overview of Accepted Contributions

Suzi Guimarães, Fabio Vieira and Valiya Hamza presents a reappraisal of terrestrial heat flow variations in the Antarctic continent, based on recent advances in data analysis and regional assessments. The data considered include those reported at the website of IHFC and 78 additional sites where measurements have been made using a variety of techniques. These include values based on the Method of Magmatic Heat Budget (*MHB*) for 41 localities in areas of recent volcanic activity and estimates that rely on basal temperatures of glaciers in 372 localities that are known to host subglacial lakes. The total number of data assembled is 491, which has been useful in deriving a 10^ox10^o grid system of homogenized heat flow values and in deriving a new heat flow map of the Antarctic continent. The results reveal that the Antarctic Peninsula and western segment of the Antarctic continent has distinctly high heat flow relative to the eastern regions. The general pattern of differences in heat flow between eastern and western of Antarctic continent is in striking agreement with results based on seismic velocities.

Jacek Majorowicz and Marek Grad discuss differences between heat flow Maps of Poland in the light of deep thermo-seismic and tectonic age constraints. To begin with they note that the area of Poland is a place of contacts between three continental scale tectonic units. The Trans-European suture zone between east European craton and the west European platform is a deep-seated discontinuity reaching at least down to a depth of about 200 km. The conjunction of these continental scale tectonic units is reflected in the complex tectonic structure of this area. This area is also associated with pronounced gravity, magnetic and heat flow anomalies. Significant differences in heat flow of 20 to 30 mWm^{-2} exist between heat flow maps of Poland published in recent works. Examples are differences in heat flow based on thermal conductivity models using well log interpreted mineral and porosity content and assigned world averages of rock and fluid thermal conductivity versus ones based on averaging thermal conductivity measured using borehole cores only. The significance of such differences in heat flow between both methods used are discussed in the context of their relationship with tectonic age. Also considered are resulting thermal depth differences of lithosphere – asthenosphere boundary (LAB) *vs* seismological constraint. They conclude that higher heat flow estimates reaching more than 100 mWm^{-2}, based on conductivity values derived from well-logs, are found to be quite improbable.

Ethel Morales, Agostina Pedro and Ricardo De León discuss progress obtained in a partial update of geothermal gradient and terrestrial heat flow values for the Norte Basin (Uruguay). It is based on results of temperature measurements carried out in deep water wells. Most of the wells considered

in their work have intersected the southern part of the Guarani Aquifer System, at depths varying from 200 to 1500m. The results indicate that temperature gradients fall in the range of 15 to 45°C/km and the thermal conductivity of basalts have a mean value of 2.2W/m/K. Analysis of temperature distributions indicate that heat transfer takes place not only by conduction but also by upflow of groundwater with velocities in the range of 10^{-9} to 10^{-8} m/s. The representative mean heat flow values fall in the range of 30 to 85mW/m^2. Maps of spatial distributions of geothermal gradients and heat flow values have been considered as indicative of the possible existence of an anomalous geothermal zone in the central-northwestern part of the Norte Basin. There are indications that this anomalous geothermal zone extends also to the eastern parts of adjacent regions in Argentina. There are indications of relatively low heat flow in the adjacent regions of Norte Basin.

Aygun Mamadova discuss Geothermal field of the Pliocene complex in the Absheron peninsula, Azerbaijan on the basis of temperature distributions in over 50 deep wells. Data analysis include variations in geothermal gradient and heat flow within complexes of Absheron formation of upper Pliocene in age. Geothermal gradients are in the range of 17 to 25°C/km. The heat flow values fall in the range of 50 to 80mW/m^2. Estimates have been made of geothermal energy resources up to depths of 6000 meters. The main productive strata of hot fluids are of middle Pliocene in age. The results have allowed identification of geothermal resources with temperature above the 20°C and at depths less than 110-180 meters. Model simulations point to perspectives for widespread utilization of geothermal energy in the Absheron peninsula.

Maria Rosa Duque discuss results of numerical simulations of heat flow in the Beiras Region, Mainland Portugal. The procedure adopted is based on results of deep crustal geophysical surveys and consider that the heat flow measured at the surface results from the addition of heat generated in the crust by radioactive sources and that coming from the mantle. Radioactive heat sources in the region are heterogeneous and heat flow values at the surface depends on the thickness of upper crustal layers. The models employed make use of data derived from geophysical surveys of Moho depths and detailed results related to seismic velocity distribution in the crust. In addition, results of radiometric surveys are employed in deriving heat production values for upper layers of the crust. The resulting heat flow density values are similar to those found for areas with similar tectonic characteristics in Southern Portugal.

Günter Buntebarth, Tamar Jimsheladze, Genadi Kobzev, George Melikadze discuss daily temperature variations at the subsurface combined with water level records, in Ajameti/Georgia. In this work, daily variations are analyzed for time periods of February/March 2018 and April 2018. Their frequency spectra demonstrate that the diurnal and semi-diurnal variations are generated by earth tides. The enhanced amplitude of the diurnal period at depth of 100 m coincides with the growth phase of vegetation. Frequent rainfall did not affect the temperature at 100 m or deeper but raises the water level. Daily surface temperature variations relate to the temperature variation at the subsurface during the growth phase of vegetation in April and down to 175 m. No relation is detected in records obtained during February/March and at 250 m in both cases. Temperature fluctuations are translated to vertical water movements in the borehole after removal of the effects of temperature gradient. The estimated water flow yields an amplitude of 0.1 m at 250 m but increases continuously to 0.16 m at 100 m. However, the water level variation reaches only 0.03 m at the surface. It is likely that the free surface of the water level has an additional degree of freedom which causes the lower magnitude of fluctuation.

Valiya Hamza, Fabio Vieira, Jorge Gomes, Suze Guimaraes, Carlos Alexandrino and Antônio Gomes presents an updated heat-flow database for Brazil is presented providing details of measurements carried out at 406 sites. It has been organized as per the system proposed by IHFC. The data sets refer to results obtained using methods referred to as interval temperature logs (ITL), underground mines (UMM), bottom-hole temperatures (BHT), stable bottom temperatures (SBT) and pumping wells (AQT). Additional information on data sources are provided in a separate table. A new heat flow map of Brazil has been derived based on the updated data set. Complementary information on references and year of publication are provided in separate tables.

In addition, a multiprong referencing system has been employed in citing references. The indexing scheme adopted for this purpose provides information on not only the primary work on heat flow determination but also later improvements in measurements of the main parameters (temperature gradients, thermal conductivity and radiogenic heat production) as well as techniques employed in data analysis.

Concluding Remarks

The editors of this journal are indebted to members of the International Geothermal Community who contributed to successful publication of this issue.

Special thanks are due to those who took part in reviewing the manuscripts. The list of distinguished reviewers for this issue includes Antonio Correa (University of Evora, Portugal), Jan Safanda (Institute of Geophysics, Academy of Sciences, Czech Republic), Ladislaus Rybach (Earth Science Institute, Switzerland), Maria Rosa Duque (University of Evora, Portugal), Massimo Verdoya (Department of Earth, Environment and Life Sciences, University of Genova, Italy), Sven Fuchs (Thermal Petrophysics Lab, Geo Forschung Zentrum, Potsdam, Germany), Shaopeng Huang (Xi'an Jiaotong University, China and University of Michigan, USA) and Vladimir Cermak (Institute of Geophysics, Academy of Sciences, Czech Republic).

We also thank the editorial staff of IJTHFA in contributing with suggestions for improving the grammatical structure and style of writing in the original versions of most manuscripts. These have been most useful for producing this volume.