Geophysical Research Abstracts
Vol. 16, EGU2014-1136, 2014
EGU General Assembly 2014

Changing temperature and maturation degree of organic matter in sedimentary rocks of trap provinces - the effect of duration of trap formation

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Modeling of thermal regime and maturity aureoles in the sedimentary host rocks of some well-dated intrusions (Cape Verde Rise and others) shown that typical size of maturity aureoles formed by intrusion heat depends strongly on duration of the intrusive body formation. In particularly, the model of instantaneous emplacement of intrusion, often cited in the literature, greatly overstate the distance of thermal influence of the intrusion and the size of maturity aureole too. We have conducted similar study for the areas of trap distribution. The special program package was developed that allows a numerically simulation of thermal history of sedimentary rocks in the under-trap complexes along the seismic profiles crossing the Decan Plateau and Bombay Bay. The Deccan Traps are a large igneous province located on the Deccan Plateau of the West-Central India (17–24N, 73–74E). The trap thickness ranges from several hundred meters to 2000 m. Geological and geophysical studies show that series of eruptions related with Decan Trap may have lasted less than 30,000 years. Gondwana subtrappean sediments are expected to form the main source and reservoir facies in the Deccan Syneclise as in the adjoining Pranhita-Godavari graben and Satpura rift basin. In our paper, an influence of probable duration of the trap formation on size of maturity aureole in the subtrappean sedimentary complex is numerically studied. The study for clay host rocks shows for example that aureole size of the trap of total thickness of 1000 m reduces from 1360 m for instantaneous trap formation to 1340, 634, 189 and less than 1 m for trap formation during 11.4, 56.8, 227 and 1200 and more years, correspondingly. The calculations were carried out with actual rock composition of the basins changed with depth and time and consider the basins evolution before and after trap formation. Application of the developed software package allowed numerically study a maturity evolution of the host rocks as before trap formation as during its formation and subsequent cooling. The sections with outcropping of traps and the ones with thick post-trap sedimentary cover typical for the west passive margin of India are analyzed in the study. Calculations show that organic matter in the sedimentary rocks under trap can remain immature even close to the contact surface if duration of the trap formation was enough long. Application of the developed software package allows for a new approach to the assessment of the petroleum potential of the host rocks of the trap complex.