

CURIE DEPTHS UNDER THE CRATONIC PARNAÍBA BASIN OF NE BRAZIL FROM SPECTRAL ANALYSIS OF AEROMAGNETIC DATA

Julià, J.; Dantas, A.J.S.; Moreira, J.A.M.
Universidade Federal do Rio Grande do Norte

RESUMO: Depths to the isothermal Curie surface under the Parnaíba basin of NE Brazil have been obtained from the spectral analysis of airborne magnetic anomalies. With an area of 675000 km², the Parnaíba basin developed in an intracontinental setting during the tectonic stabilization of the South American platform in the Paleozoic, with subsidence and deposition continuing well into Mesozoic times, and episodes of Cenozoic sedimentation marking its most recent depositional history. The airborne magnetic data considered in this study were obtained from the Brazilian Agência Nacional do Petróleo, Gás e Biocombustíveis (ANP), which were developed between 02/12/2005 and 08/23/2006 using a magnetometer Scintrex CS-3 along flight lines in the EW direction, with a spacing of 6.0 km, and intervals between magnetic readings of ~0.75 m. The total linear extension of the survey was 183,877.03 km, spanning an area of 748,612.4 km² and covering almost the entire area of the Parnaíba basin. Analysis of the aeromagnetic data was based on the asymptotic behavior of the average magnetic spectral density function at low and large wavenumbers, which lead to estimates of the top and bottom of a putative layer of magnetized material embedded in a semi-infinite medium of zero magnetic susceptibility. Our spectral analysis revealed that Curie temperatures may be reached at varying intracrustal depths - as far apart as 9 km - under the Parnaíba basin, and that topography of the Curie isothermal surface parallels topographic variations in Moho depth. The correlation between Curie temperatures and crustal thickness can be understood by some type of advection process that implies either heating of the lithosphere by mechanical stretching - consistent with a McKenzie type model of basin formation - or cooling of the lithosphere by graben formation, consistent with the location of a postulated graben under the basin. Moreover, sensitivity analysis of the parameters controlling the absolute depth of the Curie surface (cut-off frequency and window size) reveals that only relative variations in isothermal topography are well constrained by magnetic data. We show that using independent datasets, such as teleseismic S-waves recorded at broadband seismographic stations, may help in calibrating absolute depths for the Curie isothermal surface. Absolute depths are important in order to develop estimates of surface geothermal gradient, heat-flow and lithospheric thickness for the basin.

PALAVRAS-CHAVE: Curie isotherm, teleseismic S-waves, Parnaíba basin