Geophysical Research Abstracts
Vol. 15, EGU2013-1884, 2013
EGU General Assembly 2013

High resolution magnetic field mapping of complex magmatic rock suites and associated tectonic structures in the Southern Andes

Marina Díaz-Michelena (2) and Rolf Kilian (1)

(2) INTA, Space Programs & Space Sciences, Madrid, Spain (diazma@inta.es), (1) University of Trier, Geology, Trier, Germany

Magmatic and metamorphic rocks of the southernmost Andes (50 to 55°S) document a complex magmatic and tectonic history of an active continental margin during the past >140 Ma [1]. However, the regional distribution of the multiple magmatic intrusive rock suites and younger systems of basaltic dykes as well as the tectonic control of associated hydrothermal systems are widely unexplored. Since the rocks are often bare exposed they represent an ideal test site for a magnetic field investigation with significant implication for future aeromagnetic mapping. Thus we performed a high resolution near-surface grid of measurements with a scalar and vector magnetometer at selected sites which include different intrusive rocks, tectonic lineaments and hydrothermal alteration with an associated mineralization. The magnetic signature corresponding to the Natural Remanent Magnetisation (NRM) was measured on Mesozoic and Cenozoic gabbroid to granitic plutons with large range chemical and mineralogical variations [1], on distinct basaltic dykes, as well as on mylonites, gneisses and hornfels rocks. The whole-rock chemistry of the selected rock types was determined by Atomic Absorption Spectroscopy and X-ray Fluorescence. The analysed and mapped rocks include the SiO_2 range from 45 to 76 wt.%, FeO (tot) contents from 2 to 18 wt.% and Ti2O contents from 0.2 to 2.5 wt.%. The mineral assemblages were analysed by polarization microscopy, with an electron microprobe and X-ray diffraction. In the plutonic rocks the whole rock chemistry often is related to the amount of magnetite and NRM intensities [2]. However, measured magnetic intensities let us estimate the degree of chloritization and associated demagnetisation by magnetite alteration and transformation to maghemite and/or iron-hydroxides. For Miocene basaltic dyke systems of decimetre to several meters extension within granitic plutons, a high resolution magnetic mapping has been also performed. We expected a relationship of distinct cooling histories and related grain size distribution of magnetites in these dyke, but most of them have been demagnetized by hydrothermal alteration. However, many dykes include thin zones (a few centimetres) with hydrothermal mineralization (e.g. pyrrhotite) which have been formed at the interfaces between mafic dykes and granites. This hydro-thermal re-magnetization along the dykes and sometimes within the granites are characterised by significant and sharp defined positive magnetic anomalies. The regional mapping of these anomalies shows the orientation of the hydrothermal pathways which follow typical neotectonic crustal lineaments. Our results should improve interpretation of aeromagnetic mapping of crystalline basement rocks and hydrothermal pathways, also on other planets.

1 - Hervé, F., Pankhurst, R.J., Fanning, C.M., Calderón, M., Yaxley, G.M. (2007). The South Patagonian batholith: 150 my of granite magmatism on a plate margin. Lithos 97, 373-394.
2 - Alva-Valdivia L. M. and López-Loera, H. (2011). A review of iron oxide transformations, rock magnetism and interpretation of magnetic anomalies: El Morro Mine (Brazil), a case study. Geofísica International 50-3: 341-362.