Geophysical Research Abstracts,
Vol. 10, EGU2008-A-05682, 2008
SRef-ID: 1607-7962/gra/EGU2008-A-05682
EGU General Assembly 2008

Remote sensing applied to geological mapping and tectonics: a study in the Viseu region (Central Portugal)

A. Pereira (1,2), P. Venâncio (1), L. Neves (1,2), M. Godinho (1), N. Ferreira (3) and P. Castro (3)

(1) Department of Earth Sciences, University of Coimbra, Portugal, (2) IMAR-CIC, Coimbra, Portugal, (3) INETI, Department of Geology, S. Mamede de Infesta, Portugal. (apereira@dct.uc.pt)

Geological mapping at a detailed scale of the Viseu region (Central Portugal) has been developed since the seventies by several authors, and it is partially published; unpublished areas have been already object of preliminary field work. The region is largely dominated by Hercynian granitic rocks (80%), which can be broadly divided in two main series: syn- to late-orogenic muscovite-biotite granites (MBG) and late-orogenic porphyritic biotite granites (PBG). Small outcrops of gabbro to granodiorite rocks can also be found. Schists and graywackes of pre-Ordovician age (CXG) are also present (12%), sometimes with amphibolite intercalations. Cenozoic sediments and alluvium deposits correspond to the remaing 8% of the area.

With the goal of completing the 17-A geological map of the 1:50.000 national grid with 160 km^2 (Viseu), an integration of the available information was carried out through GIS techniques; it become immediately apparent that important differences of criteria have been used through time by different authors, specially in what concerns fault pattern recognition. The purpose of the present work was to evaluate the effectiveness of remote sensing techniques in order to improve the harmonization of the cartographic information, as well as to reconstruct the most dominant tectonic features of the region with unique criteria. For this objective, optical and microwave data, collected from sensors onboard of Landsat 7 ETM+ and ENVISAT (ASAR) satellites, was used. Digital elevation models build from topographic maps supported the geometric correction of satellite images and were also used in the structural lineament

analysis. All images were georeferenced to UTM projection with good results and low quadratic deviations. Optical data was enhanced through RGB, HSI and Tasseled cap transforms, as well as principal component analysis. Besides the use of the elevation data, lineament analysis was also performed on the basis of the application of directional filters on the optical data (panchromatic band). The polarization of the radar image is HH and is of the PRI type and was digitally manipulated to remove speckle effect and enhanced using several filters such as enhanced Lee and enhanced Frost.

Several combinations of different optical data bands were tested to identify geological units. The best separation between metamorphic rocks (CXG) and granites is provided by the RGB321 and HSI transform of RGB751 compositions, and between the two series of granites by RGB754, RGB543 and RGB123 of principal component analysis; however, the quality of the separation is limited and not sufficiently effective to be used at the working scale of 1:50.000. An attempt of supervised classification based on the available geological information was carried out using the HSI transform of RGB751, but final results are still limited for a detailed separation of the geological units. Radar data provided less useful results, showing no capabilities to distinguish between different geological units. Intense weathering of the rocks in this region, as well as vegetation, are likely explanations for the poor response of spectral data (optical and radar).

Better results were obtained in the identification of structural lineaments with both types of spectral data. Optical information of Landsat 7 ETM+ panchromatic band, with the application of directional filters, allow for a detailed identification of the fractures affecting the region (more than 4.000), and shows that dominant directions are comprised between N30ºE to N60ºE, followed by N50W. Radar data is quite effective in the identification of the most important tectonic structures, with less detail than optical information, and enhancing the recognition of some older structures not so well defined in the manipulated panchromatic band.