

POTENTIAL OF RADARSAT DATA FOR GEOLOGICAL APPLICATIONS IN THE
TROPICAL RAIN FOREST ENVIRONMENTS: FIRST RESULTS FROM CARAJÁS MINERAL
PROVINCE, BRAZILIAN AMAZON REGION

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ABSTRACT

As part of the ADRO Program, RADARSAT data has been acquired in the Carajás Mineral Province, easternmost border of the Brazilian Amazon. The Province encompasses the world's largest iron deposits and important Brazilian deposits of Salobo (Cu-Au-Mo-Ag), Pojuca (Cu-Zn), Azul (Mn), Bahia (Au-Cu) and Vermelho (Ni), among others. Despite the great volume of previous geological data, the geology of the Province is not completely known and has not been fully mapped. The area is related to an Archean Shear belt, with metasediments, metavolcanics, gneisses and granulites. Anorogenic granites with Middle Proterozoic ages are scattered throughout the region.

The vegetation is typical of tropical upland rain forest communities with complex and multilevel canopies with numerous species of trees and plants. Previous investigations with CCRS SAR 580 (SAREX' 92) have shown that airborne C-band SAR data provided an effective data source for geological mapping and is consistent with published large scale maps. New information on structures and lithologies were obtained and provided improved information for current geology of the area. Although these findings were obtained under airborne conditions, it is expected that RADARSAT will provide similar results for systematic geological mapping, mineral exploration, monitoring and the environmental control of the mining activities in the area.

The main objectives of the ADRO project are: (1) to evaluate the performance of the various modes of RADARSAT (ScanSAR, Fine and Standard beams) aiming at tectonical/structural analysis and geological mapping; (2) to develop RADARSAT digital integrated products with ancillary data (Landsat TM and aerogeophysical) for mapping in heavily-vegetated tropical rainforest terrain; (3) to evaluate the potential of RADARSAT High Resolution data (Fine Beam) in the mapping of surficial laterite units related to iron mineralizations.

The main regional litho-structural domains in the Carajás area have been distinguished through visual analysis and these are: (1) the southern domain or Serra dos Carajás imbricated sinistral shear zones with rocks related to the Xingu Complex, Pium Complex, Plaquê Granitoids and Sapucaia Group; (2)

the central domain with a transcurrent nature, with thrusting records represented by the several rock systems (Serra dos Carajás, Cinzento, Tapirapé and Bunitirama) and (3) the northern domain characterized by overthrusting of mainly granitic rocks tectonically mixed with portions of the Xingu Complex.

A 55 kilometre square area in the Central Carajás Mountain Range was selected for the digital integration of RADARSAT with Landsat TM and Airborne gamma ray (Total Count, U, Th). The SAR data was radiometrically corrected (Antenna Pattern) and orthorectified with speckle suppression filtering (Fgamma). The Landsat TM was also orthorectified and a 30 m pixel size was chosen for the geological digital integration. The integration was based on IHS/RGB transformation. The combination of RADARSAT with Landsat TM shows geobotanical controls, i. e., spectral variations closely related to vegetation responses and displayed in gradations of hue while radar enhances the relief. The integration of RADARSAT with isolated gamma ray channels has favored insights between terrain (morphology/bedrock) radiometric properties and lithological units, rock types and also hydrothermal metasomatic processes. The first results of this investigation emphasize the importance of using digital integration based on RADARSAT data as an effective tool in systematic geological mapping in the Amazon Region.