APPLICATION OF AEROMAGNETIC AND REMOTE SENSING DATA TO MAP RANNA ROCK UNIT

A PROJECT REPORT PRESENTED BY

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to the Board of Study in Earth Sciences of the

POSTGRADUATE INSTITUTE OF SCIENCE

in partial fulfilment of the requirement

for the award of the degree of

MASTER OF SCIENCE IN GIS AND REMOTE SENSING

of the

UNIVERSITY OF PERADENIYA

SRI LANKA

2009

INTEGRATED AEROMAGNETIC AND REMOTE SENSING IMAGES FOR GEOLOGICAL MAPPING

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ABSTRACT

Conventional mapping includes interpretation of aerial photographs prior to field work and mapping of geology in the field. Remote sensing methods which involves digital image processing, image enhancement and automated image analysis techniques can be used to minimize cost and time spent on field work. In this study, aeromagnetic data, SRTM data and Landsat ETM+ imagery were used to test the applicability of modern remote sensing methods for geological and structural mapping and thus delineate a distinct lithological unit around Ranna in Hambantota District of Sri Lanka.

Ranna rock unit is a distinct patch of rocks which belongs to Vijayan Complex and surrounded by Highland Complex rocks. It consists of amphibolite facies rocks, mainly orthogneisses, amphibolites and granitic gneisses which are different in composition and age to granulite facies Highland Complex rocks, mainly charnockite, charnockitic gneiss, garnet-biotite-sillimanite gneiss, marble and garnet-biotite gneiss.

Relief shaded DEM produced from SRTM data yields good results for interpretation of structural features such as shear zones and fractures, which are defined by the break-in-slopes and tonal variations. Landsat images were enhanced using contrast enhancement and edge enhancement techniques. They were interpreted using different band combinations and band ratios. Edge enhancement resulted in enhanced linear features which were useful in identification of structural or lithological boundaries. Band combination 7-3-1 yielded best results for identification of rock boundaries.

Total magnetic intensity map indicates a clear anomaly depicted as a magnetic low around Ranna area. This is interpreted as a result of lower metamorphic grade in Ranna unit than that of the surrounding high grade Highland rocks, as high metamorphic grade facilitates

formation of magnetite, which in turn results in high values of magnetism. The 3D analytic signal and relief shaded total magnetic intensity result a high magnetic relief around Ranna, within the surrounding of low magnetic relief. These two images were used to demarcate the exact boundary of the two lithological units which can be traced very clearly.

SRTM data and Landsat images also support the boundary demarcated based on high and low magnetic relief areas shown in 3D analytic signal.

The boundary between the two units demarcated by remote sensing data was compared with the 1:100,000 geology map of the area. About 68% of the boundary matched with the published map. Two parts mismatched compared to the mapped boundary, which is about 32% of the total length of the boundary. The mismatched area in the north-east has a shift about 3.4km from the mapped boundary. This area is highly disturbed by human activities which may have affected field mapping. In southern part, the mismatched area lacks field observations and the shift of the boundary is about 2.4km.

The study concludes that SRTM and aeromagnetic data can be successfully integrated and used for interpretation of geological structures and the lithological boundary of Ranna rock unit with supportive field evidence.