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Geological mapping by using ASTER data in Tonota area, North-East Botswana

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The purpose of the study was to distinguish various lithologies using Advanced Spaceborne Thermal Emission and Reflection Radiometer (ASTER) data around Tonota area in Botswana to update geological map. Different processing techniques were used to map various lithological units in the study area. ASTER Visible Near Infrared (VNIR), Shortwave Infrared (SWIR) and Thermal Infrared (TIR) were used. Principal Component Analysis (PCA) technique was performed to distinguish geological units by using the VNIR and SWIR bands. Before performing PCA, clouds and water were masked out. From the PCA image (R:G:B=Kaolinite, Sericite, Chlorite/Calcite), mixed meta-sedimentary formation, granitic gneiss,

Amphibolite were distinguished (Figure1). Thermal Infrared (TIR) data is useful for identifying silicate and mafic/ultramafic rocks from lattice vibration and thermal inertia respectively (Yajima and Yamaguchi, 2013). False colour composite image R:G:B= 14:12:10 was used to identify mafic units like dolerite which appeared to be whitish on the map. Silicate and carbonate rock were distinguished from other rocks by using quartz, carbonate and mafic index which managed to map marble calc-silicate units found in the area. From the image quartz rich silicate rocks appeared to be reddish while carbonate rocks are pale green. The ratio of reflected radiation from the surface to incident radiation called albedo was calculated using the formula; Albedo= 0.484*b1+0.335*b3-0.324*b5+0.551*b6+0.305*b8-0.367*b9-0.0015, (Liang, 2000).
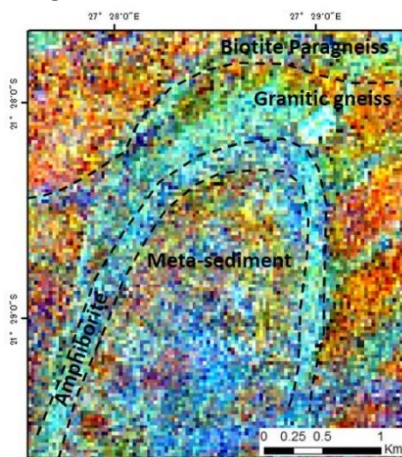
Figure 1: PCA image in the Tonota area

Albedo image was able to distinguish mafic rocks low albedo (dark grey) while units high in silica like gneisses appeared to be moderate to high albedos. Ground truthing has shown that the method used is very effective from mapping geology as most of the rock units were correctly interpreted.

Reference:

[1] Liang S. (2000) *Narrowband to broadband conversions of land surface albedo 1 algorithm*: Remote. Sens. Environ. 76: 213-238
[2] Yajima T. and Yamaguchi Y. (2013) *Geological mapping of the Francistown area in northeastern Botswana by surface temperature and spectral emissivity information derived from Advanced Spaceborne Thermal Emission and Reflection Radiometer (ASTER) thermal infrared data*: Ore Geology Reviews 53: 134-144