© 2018 IJSRST | Volume 4 | Issue 2 | Print ISSN: 2395-6011 | Online ISSN: 2395-602X
Themed Section: Scienceand Technology

Lithological Mapping Using Aster Data In Kadavur Basin, KarurDistrict, Tamil Nadu

VarshaPrem, B.Gurugnanam
The Gandhigram Rural Institute, Deemed To Be University, Chinnalapatti, Tamil Nadu, India

ABSTRACT

ASTER VNIR – SWIR bands are used for the identification of rocks. Among the developed techniques of ASTER data analysis PCA technique is found to be useful for the identification of rocks. Analysis of ASTER data by using PCA, the band combinations of 8, 4 and 1 provides different tonal variations in different lithology. By using this band combinations in the Kadavur basin helps to identify the Anorthosite rocks. Thereby, ASTER data shows its potential in the discrimination of Anorthosite rock in Kadavur basin, Karur district, Tamil Nadu.

Keywords:ASTER, PCA,Anorthosite, Kadavur

I. INTRODUCTION

Satellite Remote Sensing has become a wide spread application in geological mapping and mineral recognition. Exploring the spectral behavior of rocks using reflectance spectroscopy is valuable tool in remote sensing analysis that praises traditional field mapping methods (M'hamed et al. 2013). ASTER data information that can be gathered about geological survey and mapping due to the number of spectral bands and high resolution (M'hamed et al. 2013). The Advanced Spaceborn Thermal Emission and Reflectance Radiometer (ASTER) have 14 bands where three bands are VNIR, six bands at SWIR region and five bands at TIR region having spatial resolution of 15m, 30m and 90m respectively. Abdeenetal. (2001) have used the ASTER band ratios (4/7, 4/1, 2/3 x 4/3) and (4/7, 3/4, 2/1) for the mapping of ophiolites, metasediments, volcaniclastics and granitoids. Rajendran et al. have been developed a simple RGB colour composite image by using the spectral bands 8, 4, 1 and used to map the occurrence and distribution of peridotites and the region of hydrothermal alteration and serpentinization. Based on this spectral bands, band 1 is used for the weathered iron minerals rich peridotites surface, band 4 occurrences of water and hydroxyl molecules bearing serpentine minerals in serpentinizedharzburgites / peridotitesand band 8 used for the occurrence of Mg-OH molecules bearing minerals and carbonates in the peridotites/ serpentinizedharzburgites. For the mineralization mapping VNIR wavelengths (0.4 - 1.0 µm) have been widely used. For the discrimination of clays, phyllosilicates, alunite and limestone SWIR wavelengths (0.9 - 2.5 µm) were used. For the determination of abundance of silica TIR wavelength (8 - 14 µm) isused. PCA technique is used for preparing mineral mapping by using ASTER band combinations. PCA is a statistical method used to reduce a set of correlated multivariate measurement to a lesser set where the features are uncorrelated to one another. PCA of a high resolution satelliteimagescansatisfy temporal autocorrelation, by this means increasing the constancy of the data for image segmentation and classification procedures. The PCA is useful in providing maximum visual separability of image feature (RashmiPrava Das). ASTER VNIR-SWIR reflectance data and spectral matched – filter processing were passed down to map more than a few lithological sequences discriminating by differentcollection of minerals that showcharacteristic spectral features (e.g. chlorite, epidote, amphibole and other ferrous – iron bearing minerals); extra sequences were identified by their weathering characteristics and associated hydroxyl and ferric – iron minerals, such as Illite, smectitic and hematite (Hubbard et al. 2007).

The main objective of the present study is to delineate the presence of the rock in the study area using remote sensing and GIS techniques. For the study VNIR – SWIR bands available in the ASTER data have been used.

E-commerce has become one of the vital parts of the modern life. Online payment is the supportive application for the payment of money for the products we buy. For the past years online security breach created a major problem and lots of money had been stolen. The proposed document deals by securing the payment through iris recognition [1]. This method also adds the method of using visual cryptography for securing the user credentials. This visual cryptography method was formerly invented by MoniNaor and Adi Shamir in 1994[6].

II. STUDY AREA

The area choose for the present study is Kadavur Basin, Karur district, Tamil Nadu. The study area covers the parts of Survey of India topographic sheet No. 58J/2 and 58J/6. The area comes under a portion of Madurai block. The Geological setting of the study area, according to Subramanian was:

The geological setting of the study area:

Recent	Soil cover and Kankar
Archaean	Quartz Veins and Pegmatites
	Anorthosite-gabbros mass with included mafic layers
	Quartzite, quartz schist, pyroxene granulites, metagabbro, amphibolites, calc-granulites and crystalline limestone.

The meta-sedimentary rocks comprising quartzites and quartz schist form a group of ridges which encircle a basin occupied by anorthosites and gabbros. Thin layers and bands of pyroxene granulites and metagabbro, representing older basic sills or sheets are found among these quartzites and quartz schists. Other rock types in the metasedimentary group are amphibolites, Calc-granulites and crystalline limestone (Subramanian A.P, 1956).

According to the Geological Survey of India, the study area contains Calc-granulites and limestone, Hornblende-biotite-gneiss, Kadavuranorthosite, Pink migmatite, Quartzite and Ultramafics. Most of the study area is covered by Ultramafics, which includes gabbro, pyroxinites, norites, etc.

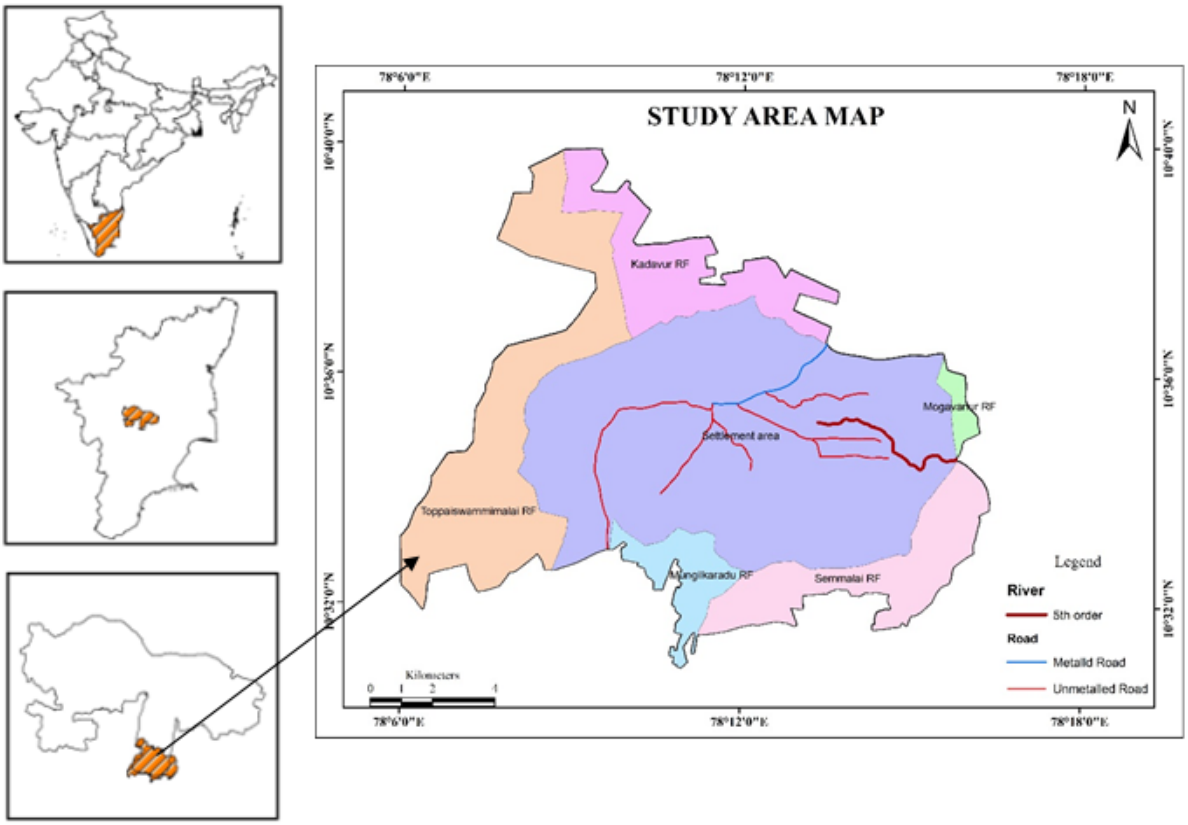

Figure 1. Study Area – Kadavur Basin

III. MEHODOLOGY

In the present study satellite data ASTER has been used. ASTER data have been analyzed exclusively for lithological discrimination, around Kadavur basin area. In the study ASTER data product of February 2001 has been used. PCA technique is a multivariate statistical technique that selects uncorrelated linear combinations of variables in such a way that each successively extracted linear combination, or principal component, has a smaller variance (Smith 2002, Ranjhar et al. 2003). To produce uncorrelated output bands for the separation of the noise component and decrease the dimensionality of the data set the Principal Component is used. The PCA is a procedure to produce uncorrelated output bands.One can calculate the same number of output PC bands as the input spectral bands. The first PC band contains the largest percentage of data variance and the second PC band contains the second largest data variance and so on. The last PC bands appear noisy because they contain very little variance, much of which is due to noise in the original spectral data (Bhadra et al. 2012). For the extraction of spectral information related to the alteration zones PCA is the important image processing tool. The ASTER satellite system provides 14 bands image data from 1 to 3 VNIR, 4 to 9 SWIR and 10 to 14 TIR. The bands has reduced to VNIR and SWIR by using PCA and then from these 9 bands three bands have been selected for RGB combination. 8, 4 and 1 band combination of ASTER data has been used by Rajendran et al. 2014 for the mapping of spatial distribution of peridotites and the associated rock formations.

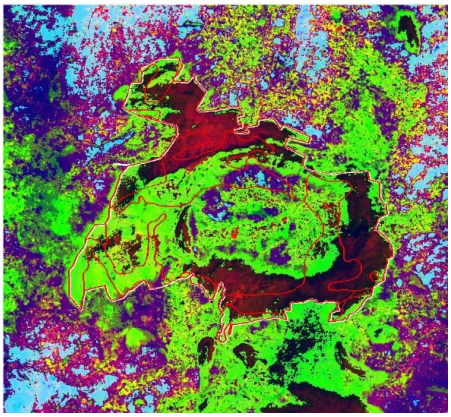

Figure 2. ASTER FCC – 8, 4, 1

IV. RESULT AND DISCUSSION

In the present study, ASTER data have been analyzed for the identification of rocks around Kadavur basin area, Karur district in Tamil Nadu. For the identification of rock the PCA technique is used by creating RGB combination by using 8, 4 and 1 bands of the ASTER data. Anorthosite rock has been identified by using this colour combination (Figure 3& 4). Anorthosite has been observed by using VNIR – SWIR (ASTER – 8, 4, 1) band combinations in PCA. In this band combination, it provides different tonal variations in different lithology. It has been observed that color composite in RBG mode (R=PC8, G=PC4 and B=PC1) shows Bright Turquoise colour for the presence of Anorthosite (Figure 5).For the conformation the spectral profile of the area has been created and compare with the spectral library (Figure 6) (jhu_lib → ign_fn.sli of wavelength 0.4 to 14.011 Micrometer).

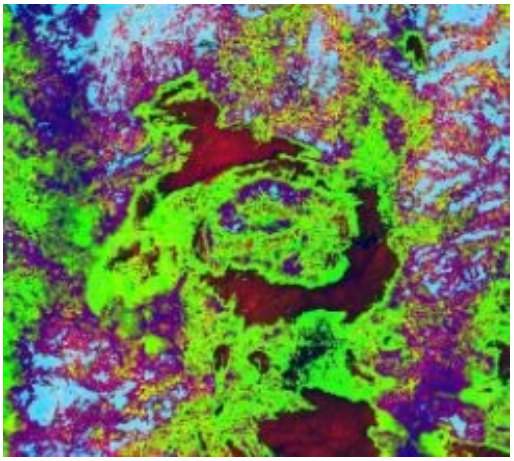

Figure 3. PCA of Kadavur basin

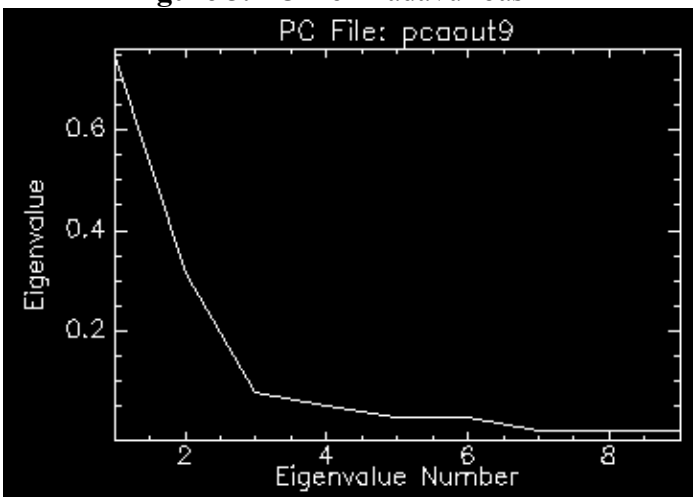

Figure 4. Eigenvalue of PCA Bands 8, 4 and 1

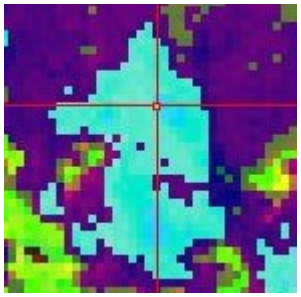

Figure 5. PCA colour for Anorthosite Rock

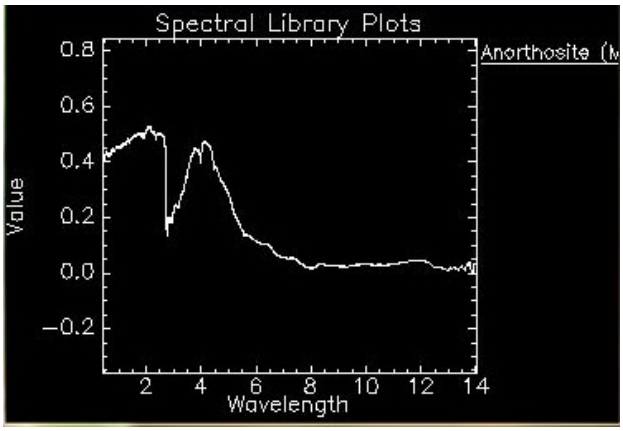

Figure 6. Spectral Library plot of Anorthosite from Spectral library

V. CONCLUSION

ASTER data is very useful for the identification of rocks and minerals. PCA technique is found to be very useful for the determination of rocks. PCA Band combination 8, 4 and 1 is good for the determination of Anorthosite rocks in the Kadavur basin.

VI. REFERENCES

[1]. Abdeen, M.M., Allison, T.K., Abdelsalam, M.G., Stern, R.J., 2001, Application of ASTER band-ratio images for geological mapping in arid regions; the NeoproterozoicAllaqi Suture Egypt. Geol.Soc.Am.Abstr. Programs 3(3), 289.

[2]. Azizi, H, Rasouli, A.A., and Babaei, K., 2007, Using SWIR Bands from ASTER for discrimination of Hydrothermal Altered minerals in the Northwest of Iran (Se – Sanandaj City): A key for Exploration of copper and gold Mineralisation. Research Jour. Of Applied Sciences, 2 (6): 763 – 768.

[3]. Baloki, M. and Poormirzaee, R., 2009, Using ASTER Image Processing for Hydrothermal Alteration and key alteration minerals mapping in Siyarhrud, Iran. Int. Jour. of Geology, 3(2): 38-43.

[4]. Bhadra, B.K., Suparn Pathak, Karunakar, Sharma, J. R., 2013, ASTER Data Analysis for mineral potential mapping around Sawar-Malpura area, Central Rajasthan. Journal of Indian Society of Remote Sensing, 41 (2): 391 – 404.

[5]. Crosta, A. P. and Moore J McM., 1989, Enhancement of Landsat Thematic Mapper imagery for residual soil mapping in SW Minas Gerais State Brazil: A prospecting case history in greenstone belt terrain. In proceedings of the 9th Thematic Conference on Remote Sensing for Exploration Geology, Calgary, pp: 1173 – 1187.

[6]. Crosta, A.P., De Souza Filho, C.R., Azevedo, F. and Brodie, c. 2003, Targeting key alteration minerals in epithermal deposits in Patagonia, Argentina, using ASTER imagery and PCI. Int. Jour. Remote Sensing, 24(21), 4233 – 4240.

[7]. Gupta, R. P., 2003, Remote Sensing Geology, 2nd Edition. Springer – Verlag: berlin, Heidelberg, New York.

[8]. M'hamed El Janati, AbderrahmaneSoulaimani, Hassan Admou, NasrrddineYoubi, AhmidHafid and Kevin Patrick Hefferan, 2014, Application of ASTER remote sensing data to geological mapping of basement domains in arid regions: a case study from the Central Anti-Atlas, Iguerda inlier, Morocco. Arab. Jour. of Geosci. 7: 2407 – 2422.

[9]. RajasimmanBalasubramanian, U.A.B., Saravanavel, J., Gunasekaran, S., 2013, Ore mineral discrimination using hyperspectral remote sensing – a field-based spectral analysis. Arab. Jour. of Geosci 6: 4709 – 4716.

[10]. RajendranSankaran and Sobhi Nasir, 2014, Hydrothermal altered serpentinized zone and a study of Ni-magesioferrite-magnetite-awaruite occurrences in WadiHabi, Northern Oman Mountain: Discrimination through ASTER mapping. Ore Geology, PP: 211 – 226.

[11]. RajendranSankaran, Thirunavukkarasu, A., Balamurugan, G., and Shankar, K., 2011, Discrimination of iron ore deposits of Granulite terrain of Southern Peninsular India using ASTER data. Journal of Asian Earth Scienxces 41. 99 – 106.

[12]. Ranjbar, H., Shahriar, H., and Honarmand, M., 2003, Comparison of ASTER and ETM data for exploration of porphyry copper mineralization: A case study of SarCheshmesh areas. Kerman, Iran: Map Asia Conference in 2003.
[13]. Rashmi Prava Das, Principal Component Analysis in Multispectral satellite images.
[14]. Smith, 2002, A tutorial on Principal Component Analysis, Source: www.cs.otago.ac.nz/cosc453/student _tutorials/principal_components.pdf.
[15]. Subramanian A P, 1956, Petrology of Anorthosite - Gabbro Mass at Kadavur, Madras, India, Geol.mag, 93, 287-300.
[16]. Vinodkumar M, Kumar R S, Rajaprian K, Kuldeep Singh, 2013, Geological and petrological studies of pegmatites rocks of in and around Kadavur, Karur district, Tamil Nadu, 2, 182-191.
[17]. Vinodkumar M, Kumar R S, Rajaprian K, Kuldeep Singh, 2014, Mineralogical studies of plagioclase feldspar in Kadavur Anorthosite Complex, Tamil Nadu, International journal of Advanced Geosciences, 2 , 31-37.
[18]. Vinodkumar M, Kumar R S, Rajaprian K, Singh Kuldeep, 2013, Petrography and major geochemical studies of Anorthosite, Kadavur and adjoining area, Tamil Nadu, India, International Research Journal of Earth Science, 1(5), 15-22.