

Identification of Laterite Bauxite Deposits with Application of Remote Sensing Techniques

In the paper, the direct identification of potential bauxite deposits by the application of remote sensing techniques is described. The most important experiences in the application of this special methodology are discussed. The technology is based on the integration of RADAR DEMs and LANDSAT TM images by geographical information systems (GIS), which is technically a known technique. The novelty is in the inclusion of geological information in the process of converting imaging data into geological thematic layers. The applicability of the method has been proven by a suite of case studies taken from India, Vietnam, Ghana, Brazil, Guinea Bissau and Guyana. The combination of bauxite-geological knowledge with remote sensing techniques offers a relatively fast, accurate identification of potential bauxite deposits, reliable enough for target selection for bauxite reconnaissance and ranking of prospects.

A cikkben egy távérzékelési technológiát ismertetünk, amelyet a potenciális felszíni bauxittelepek közvetlen térképezésére lehet alkalmazni. Részletesen elemezzük e speciális technika alkalmazásának módszertani tapasztalatait. A módszer a SRTM műhold RADAR és a LANDSAT TM képek térinformatikai rendszerben történő integrálásán alapul, amely egy ismert technika. Az újdonság a földtani információk és képfeldolgozási folyamat összekapcsolása, amelynek révén geológiai tematikus térképet állíthatunk elő. A módszer alkalmazhatóságát India, Vietnam, Ghana, Brazília, Bissau Ginea, és Guyana bauxit előfordulásain esettanulmányok bemutatásával igazoljuk. A bauxit-geológiai tudás kombinációja a távérzékelési technikával viszonylag gyors, pontos azonosítást teszi lehetővé a potenciális bauxit telepek, amely megbízhatóan vehető be a bauxittelepek felderítő térképezése és a reménybeli földtani készletbecslés folyamatába.

Introduction

Global metal demand in the past years has significantly increased. In the past ten years the world bauxite production increased by 36%, from 110 Mt (1996) to about 150 Mt (2007). In the world an average about 2.6 t of bauxite is needed to produce 1 ton of alumina and 1.9 tons of alumina is necessary for 1 ton of aluminium. The aluminium demand from 1990 to 2004 expanded from 28 million to 40 million and by 2020 the demand is projected to have increased to around 65 million tons. Taking into account the trend of the increasing demand, the known bauxite resources (identified by exploration + hypothetical) may be enough about for 300 years.

One may think that the world economy is short of bauxite, however, the reality is much more complicated. The overwhelming majority of these potential bauxite sources need important developments in accessibility (i.e. construction of haulage systems, mine development, deforestation, etc.), with many of them found in tropical rain forests (where there are often significant environmental restrictions. Many of the large resources are also in politically or commercially unstable countries. Taking these factors into account the available bauxite deposits are considerably less. Intense competition exists amongst the bauxite, alumina producers to dis-

Identification of Laterite Bauxite Deposits with Application of Remote Sensing Techniques

cover new sources, located within reasonable distance from deep water ports and/or natural transport routes. The fuel and transport costs drastically augmented in the last years, so that, the geographical position (transport costs) has become increasingly more important factor in the industry.

The conditions for producing alumina at the possible lowest costs involve both quantitative and qualitative factors. For a green-field alumina plant the minimum aggregate minable resource requirements for tonnage is 300 Mt of gibbsitic bauxite (the more the better) within one mining unit or in multiple mining units which can be easily integrated. If the available resources are less than required then the potential for additional resources in the area must be assessed. These minimum size constraints further limit the resource base of economically exploitable commercial grade bauxite to such an extent that the known resources are much less than indicated by the global statistics. This recognition has led to the identification and acquisition of new commercial grade bauxite being one of the main tasks of the bauxite – alumina industries. In this work the direct identification of the possible bauxite deposits, by the application of remote sensing techniques, has been proven to be a suitable tool. In the following sections the most important experiences are summarised.

It should be emphasised that the delineation of possibly bauxite prospects based on the topography is not a new method. It has been done i.e. Geological Survey of India (GSI) in the sixties and seventies for the East Coast bauxites in Orissa using topographical maps at 1 inch to 1 mile scale and also for Vietnam by different companies and institutes at 1 : 25 000 scale. Trombetas bauxite (Brazil) was discovered by the Aluminium Canada – Montreal (ALCAN) in the sixties with the aid of aerial photos, which is also a “remote sensing” method. Remote sensing in mineral exploration

has been applied since the early seventies¹. Hyperspectral remote sensing method seeking the direct identification of aluminous minerals has also been applied for the direct identification of bauxite minerals cropping out the surface.

In the following discussion an approach is presented which basically is not new but which with the integration of geographical information systems (GIS) and bauxite geological knowledge offers a relatively fast, accurate identification of potential bauxite development, reliable enough for target selection for bauxite reconnaissance and ranking of prospects.

Generalities – Summary

- The procedure developed over the past years is solely related to the sensu lato plateau type deposits developed on quasi flat surfaces or present on undulating hill tops.
- For the LANDSAT interpretation contours of already explored (historical) bauxite deposits are needed (as verified situation, called actual bauxite contours) for which the procedure can be modelled.
- If no actual data are available, calibration of the map may be done later on when actual contours are obtained after initial field assessment.
- Calibration of the map must be done by measuring the predicted bauxite contours on site and the procedure modified accordingly. In this case measuring of several productive points (old pits, bauxite outcrops) and unproductive points (in valleys) help significantly the creation of a reliable map.
- There is no universally applicable method in remote sensing application as all of the deposits have their own morphological, geological and hydrogeological characteristics for which specific methods should be

elaborated. In several cases LANDSAT TM or SRTM by themselves are adequate but in others combined LANDSAT TM – SRTM methods lead to success.

- It is necessary to study potentially productive planation surfaces at different slopes and where available using previous exploration results.
- Planation surfaces should be selected as a function of the already identified parent protolith(s) and delineated accordingly where the bauxite is related to designated formation(s). For this purpose reliable geological maps are needed: preferably at a minimum 1 : 200 000 scale for preliminary investigation and for more detailed estimation a minimum of 1 : 100 000 scale maps are needed, mainly if the bauxite is related to a designated formation. Construction of so called geo-combined, geological-SRTM maps are most informative.
- No remote sensing method can be effectively used for bauxite deposit identification without general and local bauxite geological experience and knowledge.

Salient bauxite geological background – basis of the interpretation

Remote sensing interpretation is based on the investigation of four main factors, such as: parent rock, hydrology (drainage conditions), geomorphology, and vegetation.

Role of the parent rock and the ground water table fluctuation in bauxite forming

Many professional studies deal with the role of parent rock in bauxite genesis. Only the key fea-

tures applicable to exploration are summarised below:

- Physical properties (structure and texture: porosity, fissuring, stratification, bedding, and the hydrological conditions are the main determinants in bauxite formation rather than the chemical composition of the parent rocks.
- Horizontally layered rocks (Deccan basalts, Gondwana sediments) form thinner deposits (3 m–4 m) than layered and tilted rocks do (East Coast khondalite), the latter of which can form extremely thick bauxite deposits (10 m–30 m).
- Bauxite formation is controlled by the drainage conditions, that is, the effectiveness of leaching, as a consequence, clays never can produce bauxite, even if their Al_2O_3 content is above 30%, as they become impermeable when wet and there is no leaching. Silty claystones, silty argillites do not swell may preserve their permeability (water conductivity).
- In the contrast some rocks, even if their Al_2O_3 content (carbonatic rocks, phyllites, etc.) is very low, may form bauxite. Alkalis and alkali-earth content is important with higher alkali contents favourable for the formation of bauxite due to their greater solubility with the resultant collapse of the original crystal-structure of minerals.
- The SiO_2 content has only of minor importance. World class bauxite deposits developed on granites, diorite, granitic gneisses or gneisses, etc. of high silica content (>60%). There are no world class bauxite deposits on ultrabasic (mafic) rocks of low silica content (<50%).
- The chemical composition of the parent rock is significant for some bauxites in that the Al_2O_3 and $\Sigma\text{Fe}_2\text{O}_3$ ratio may play an important role. The iron is very mobile element

Identification of Laterite Bauxite Deposits with Application of Remote Sensing Techniques

in the exogenetic geo-facies, but only over a very short distance. The laterite profile, apart from several hypergenetic processes, is in general not able to be free from the iron. Bauxite is only developed in the horizon of the laterite profile which has been in the oscillation zone of the ground water table where from the iron is mobilised only in short distances (several meters) by both ascending and descending solutions. The iron content limits the relative alumina enrichment. This is responsible for the close negative correlation between the alumina and iron. Moreover the alumina+iron content is a quasi constant number most frequently ranging between 66% and 72% which is specific to each bauxite deposit. As a very general rule, that those parent rocks in which the $\text{Al}_2\text{O}_3 / \Sigma\text{Fe}_2\text{O}_3$ ratio is > 1 form bauxite, and when this ratio is < 1 mainly iron laterite forms. There may be exceptions under specific conditions.

- The above explain why rocks, such as basalt and dolerite develop different bauxitic profiles. Basalts are typical parent rocks in India (Deccan basalt) and Southern Vietnam. Dolerite sills and dykes of similar chemical composition are bauxite forming rock only in special cases e.g. sills in Guyana (Pakaraima Mts.) and dykes in Australia (Worsley), were hosted by granite or in Guinea were hosted by silty sand and claystone. Relating to this question two main remarks should be added:

(1) In the Deccan basalt, contrary to the others, in many cases the $\text{Al}_2\text{O}_3 / \Sigma\text{Fe}_2\text{O}_3$ is greater than 1. When it is not so, there is a special phenomenon, spheroidal weathering, which helps the lateritisation. The whole bauxite bearing laterite profile will not be poor in iron on average, but the weathered spheroids (boulders) are and the iron accumulates preferentially in the fissures filled in by iron rich clay.

Bauxite is extracted selectively. Bauxitisation of basalt may, in some cases, be helped also by the thin layered lava flows structure.

(2) Diabase and dolerite may form bauxite only in those places where the fluctuation of the ground water table is more than 4 m. Where it is less there is no space for Al – Fe separation and iron- or iron rich laterite form with less than 35% of Al_2O_3 . In those deposits, where dolerites dykes have intersected any bauxitic protolith the bauxite quality decreases above the dolerite dykes.

Geomorphology

Bauxitisation (chemical erosion) and planification are simultaneous processes which may be preceded by a degree of (not necessarily significant) physical erosion. The geomorphological development is the direct target of the SRTM interpretation. In this respect the following factors are taken into account:

(1) The shape (elongated, round-like or complex) and size of the plateau. Planation surfaces less 2–3 km² rarely contain industrial grade ore. Inside huge plateaux depressions of several hundred meters of diameter are common, where often no commercial grade ore occurs. There are commonly marked by swamps where ground water table is at the surface. These barren areas of several hundred meters in diameters can be detected by SRTM maps (see *Fig. 11*).

(2) Planation surfaces may be:

- (quasi) flat: such as Deccan and East Coast deposits (India, see *Fig. 1, Photo 2*), Bidikoum, Sinthiourou, (Guinea), Nyinahin – Kibi (Ghana), Trombetas (Brazil), Bronwsberg, Lely, (Suriname), etc.
- “whale back” surfaces: e.g. Los Pijiguaos, Suapure (Venezuela), Koumbia (Guinea), Pakaraima (Guyana,), East Coast – India (see *Fig. 1, Photo 2*).

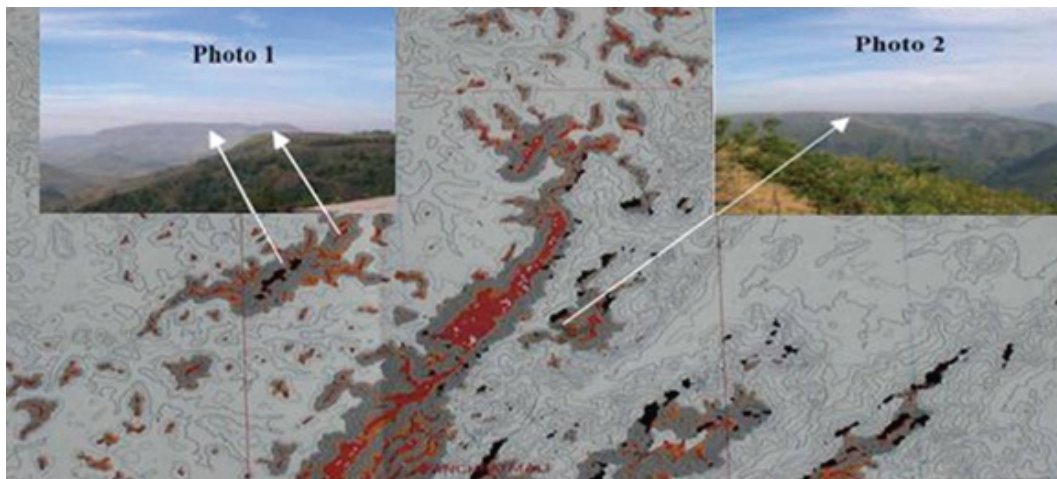


Fig. 1. Damanjodi (EC) with its “whale back” (Photo 1) and flat surface (Photo 2) satellite plateau

- undulating surfaces – hill tops (which are really not plateaux): several deposits at Bao Loc – Than Rhai, Dac Nong, (in Vietnam), Tayan (in West Kalimantan – Indonesia).

The flat surfaces may preferentially form horizontally continuous ore bodies, whereas the undulating surfaces typically form multiple separated industrial grade ore bodies.

(3) Maximum slopes where bauxite may be preserved is about 15° . Exceptionally, it may attain even 25° m (at Pottangi, East Coast – India), but it is a very spatially specific case due to saw tooth shaped substratum.

(4) Bauxite deposits covered by younger sediments can also be identified with an acceptable reliability, provided, they are situated inside the detectable morphology, such as Lower Amazon Basin – Brazil or West Kalimantan (Indonesia). However, the same can not be applied in those areas where they have dropped below the surface morphology (Coastal Plain – Guyana, Suriname). There are, however, isolated cases where the surface expression the buried deposits are overprinted to the surface, due to their close proximity to basement outcrops (Guyana).

(5) The relative elevation is also an important factor. In general, the higher relative elevation

the better, as the zone of ground water fluctuation is wider producing thicker bauxite. Identification of prospective areas with remote sensing techniques is more accurate in areas with contrasted topography.

(6) Bauxite may occur also in plains where bauxite does not clearly relate to any designated morphology. This special case is Weipa – Australia. In this case very large area thin bauxite stratum is developed. These “pan cake” deposits are not readily detected by any morphology targeted remote sensing method based on morphology.

Hydrogeology

Apart from the physical properties of the parent rocks described in section “Role of the parent rock and the ground water table fluctuation in bauxite forming” the groundwater table fluctuation may depend on the following conditions:

- (1) the annual rainfall. Conditions are most favourable where it surpasses 1800 mm/a,
- (2) the absolute elevation locally controlling annual rainfall may play important role,
- (3) relative elevation of plateaux and hilltops.
- (4) distribution of the annual precipitation:

duration of the wet and dry seasons. It is considered if the relative duration is close to 1 : 1.

Of course, both the morphological and hydrogeological conditions may have considerably changed over the geological time, and past conditions can only be interpreted based on limited data. (laterite bauxite can be found also in actually semi-arid or even arid territories i.e. Mali and Saudi Arabia, resp.).

Vegetation

Investigation of vegetation plays role where there is a detectable difference between the possibly bauxite target- and unproductive areas. Such a case may exist where the relative elevation is significant. Typically the vegetation is very different between the elevated plateaux, slopes and valleys. In this case the thematic maps derived from remote sensing images may be very effective in identifying bauxitic domains. At the high level (700 m) East Coast bauxites (Orissa, India the plateau tops are grassland (shows as turquoise colour), the slopes are forested (brown) and the valleys are cultivated (multicoloured). Accurate delineation of bauxite contours is possible (see Fig. 2). Where the relative elevation drops below 300 m there is no distinct differences in vegetation over the possible bauxite domains. In the case of small relative elevation differences the plateau contours may become indistinct. Where the bauxite deposits are grassy or shrubby and the narrow valleys forested (Guinea). the LANDSAT TM maps can also be well used. Where the surfaces are evenly covered by forest e.g. Guyana Shield, Lower Amazon Basin, or the vegetation is not topography-, that is, "bauxite-specific" the LANDSAT TM is not informative.

Method and procedure

Geological basis

Based on geological maps areas of study are investigated and selected. It is very important that geological screening should be undertaken at the beginning, because, in some environments same or very similar geo-morphological image can be identified on different protoliths.

According to the geological background, formations can be divided into three main groups:

- (1) Planation surfaces on basement which has already been proven to be bauxite parent rock(s),
- (2) Planation surfaces locating on basement which theoretically can be bauxite forming formation,
- (3) Planation surfaces on non bauxite protoliths (see Fig. 15).

Topography

Planation surfaces are distinguished at different topographical levels (erosion surfaces of different ages). It is common (and widely known) that different types of ferralies can be formed on same parent rock and with the same morphology e.g. on upper level bauxite, on lower one lower grade bauxite or iron rich laterite can be found. (e.g. Guyana Shield, West African Craton).

In Venezuela identified bauxite is confined to the Nuria surface (600–750 m above mean sea level (MSL). The so called Intermediate Level (~400m) has not been yet investigated. The later one may also be prospective, however, is believed to be less prospective than that of the Nuria level. The situation is similar to Vietnam Dak Nong Province, main bauxite deposits de-

veloped between 700 m and 1000 m, while on the lower level (400 m–700 m) lower grade deposits have been. (e.g. Phuoc Loc, see Fig. 5).

In Guinea Bissau the Boé bauxite deposits relate to the topographical level of > 200m. On the same coffin-type plateau morphology on the lower level (<200 m) very hard iron rich laterite ($\text{Fe}_2\text{O}_3 = 45\text{--}60\%$) can be found.

These bauxite geological characteristics must be identified, preferably in advance, when LANDSAT interpretations made.

Planation surfaces are also contoured according to the maximum slope where bauxite may occur <5 degree with higher probability and <10 degree with lower probability.

Depending on geology and topography (elevation, relative elevation, slope) bauxite deposits and planation surfaces has been ranked into three main groups expressing their prospects such as:

- (a) probably productive surfaces
- (b) possibly productive surfaces.
- (c) non-bauxitic planation surfaces: high level and low level (coastal plains)

Identification of bauxite deposits and screening of planation surfaces (case histories)

India – East (Coast bauxites)

For this 400 km long bauxite district LANDSAT TM 453 RGB composite images and SRTM slope maps were prepared. Bauxite deposits are closely related to tilted khondalite (mezo-kata meta-sediments) and charnokites, between the range of 600 m and 1400 m at different planation surfaces, which were developed between the Tertiary to Upper Miocene. Landsat interpretations were initially made and then known (explored) contours collected and the maps calibrated at site. Both morphology and vegetation are extremely well contrasted.

The yellow line in Fig 2 shows the actual (explored) contour of the deposit, which perfectly fits to the SRTM slope map <10 degree. The TM map shows the grassland of the plateau with relative elevation of about 700 m. Brown coloured areas indicate forested surroundings of the plateau. Multicoloured valleys are cultivated.

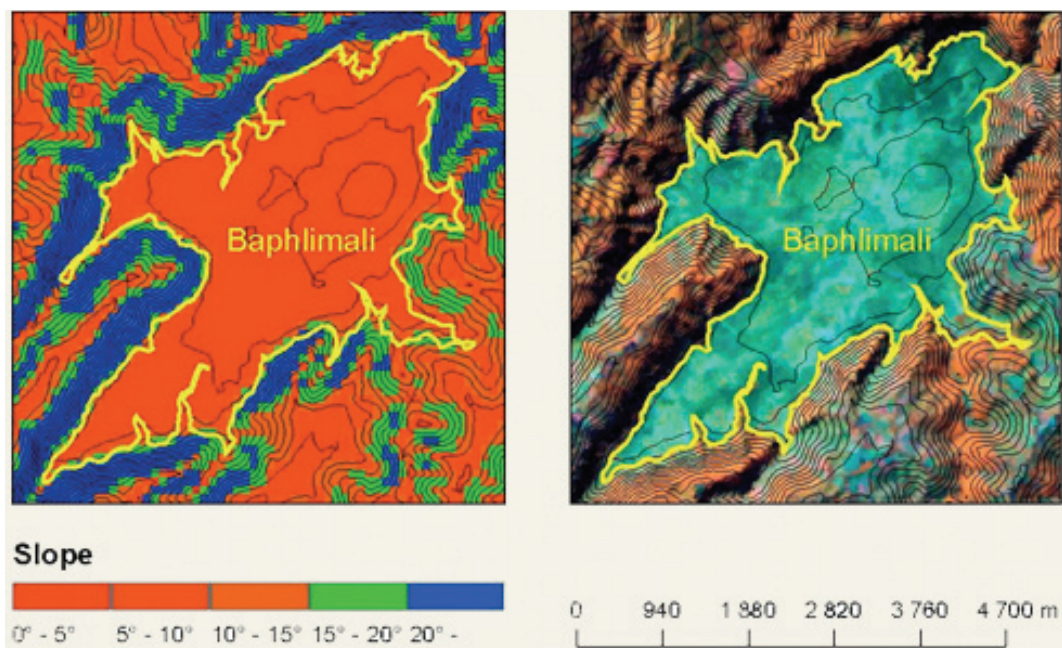


Fig. 2. DEM slope (left) and TM 453 RGB (right) maps of Baphlimali deposit

Identification of Laterite Bauxite Deposits with Application of Remote Sensing Techniques

The white contour in Fig 3. shows the productive area (forecast) established on the analogy of explored (actual) contours (i.e. Baphmali Fig 2). Relative elevation is 300 m – 400 m, the LANDSAT TM map is less contrasted than that of Baphmali is, the plateau surface is cultivated over Sijimali.

Vietnam

Bauxite deposits in Dok Nong and Lam Dong Provinces relates to Pliocene-early Pleistocene (N₂-Q₁) basalts. There is no bauxite identified on the N₂ and Q₂ basalts with only non bauxitic laterite recognised. The accuracy of the prognostic maps depends on the accuracy of the geological maps.

Bauxitic laterites developed on slightly undulating surfaces of hilltops forming amoeba-like ore bodies. Most productive areas are found above 700 m, whereas on the lower levels thinner deposits have been developed. Relative elevation between 30 m and 70 m is common.

SRTM predictions fit very well in the contours of the explored areas, which fact serves reliable bases for identification of not yet discovered territories.

There is very good correspondence between the geological section (actual) and DEM map (forecast).

West Africa – Ghana

Bauxite developed on the West African Craton (Precambrian slate, siltstone, gneiss), (Upper Cretaceous – Lower Tertiary) locating at 500–600 m above MSL with 300–400 m relative elevation. The four main deposits (two of them are groups of deposits) have been identified by the previous explorations i.e. Aya – Nyinahin, Kibi Atewa Range, Awaso Group and Mt Ejuanema. They have been well delineated by a combination of SRTM and TM (453 – RBG) maps (see Fig. 10). Based on this model, it is clear that there are no other analogous significant bauxite in Ghana, apart from several small bauxitic do-

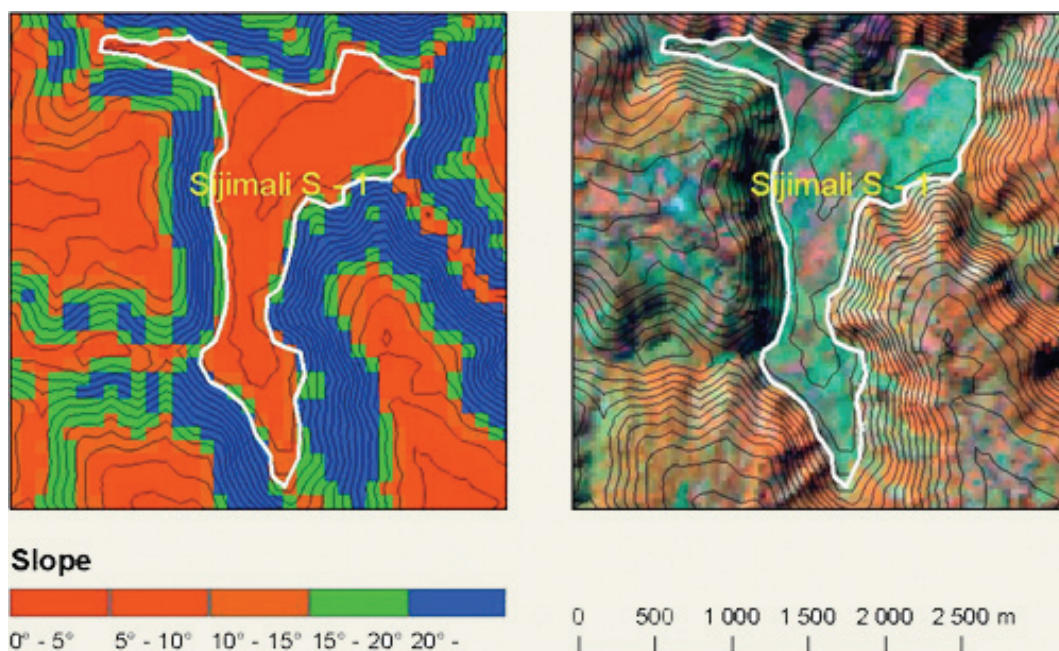


Fig. 3. DEM slope and TM 453 RGB maps of Sijimali S deposit

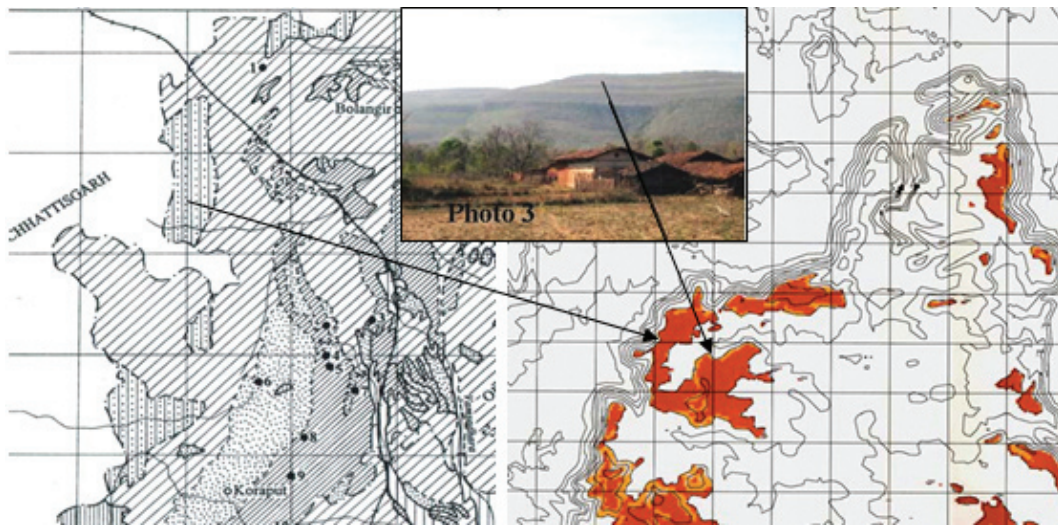


Fig. 4. Planation surfaces of Upper Proterozoic sandstone without lateritisation
(Photo 3. Kolupari village – Nawapara District – Orissa)

main on very narrow planation surfaces of ranges running parallel to the main deposits (NE–SW in direction).

Guinea Bissau

Planation surfaces are situated >200m above MSL are bauxitic (red) on the lower level (100 m–200 m) iron rich laterite was formed as checked during the site visit in 2007, however the morphology shows typical bauxitic plateau.

Lower Amazon Basin - Brazil

The known outline of the Trombetas bauxite ore bodies is clearly identified by SRTM mapping.

On the basis of Trombetas' analogy new deposits have been pointed out in the LAB (Fig. 13)

Guiana Shield (Guyana)

The Guiana Shield and its surroundings comprise approximately 2 million km². On the geo-combined SRTM map (Fig. 14) the planation surfaces of different geological formations in

the Pakaraima Mts. (Guyana–Venezuela) are clearly identified.

Conclusions

Bauxite deposits can be directly identified using SRTM or LANDSAT TM (453 RGB composite images), and their combination at some places so precisely that even potential resources estimate are possible (East Coast India, West Africa, Indonesia, etc.) in hypothetical category, provided sufficient control on likely thickness is known. In other cases the accuracy is somewhat less, however, they are applicable when areas are studied for reconnaissance or prospective areas compared and selected for licence application. Geo-combined SRTM maps are necessary when the basement is built up by different formations. In this case the accuracy of the geological maps leaves its mark on the reliability of the SRTM maps. Bauxite deposits established as prospective ones must be checked on field and map corrected accordingly: “No hay amor sin tocar” (Spanish saying², Cuba). Basis of the evaluation is the already identified contours (actual data) from which the forecast, based on their analogy, can be derived.

Identification of Laterite Bauxite Deposits with Application of Remote Sensing Techniques

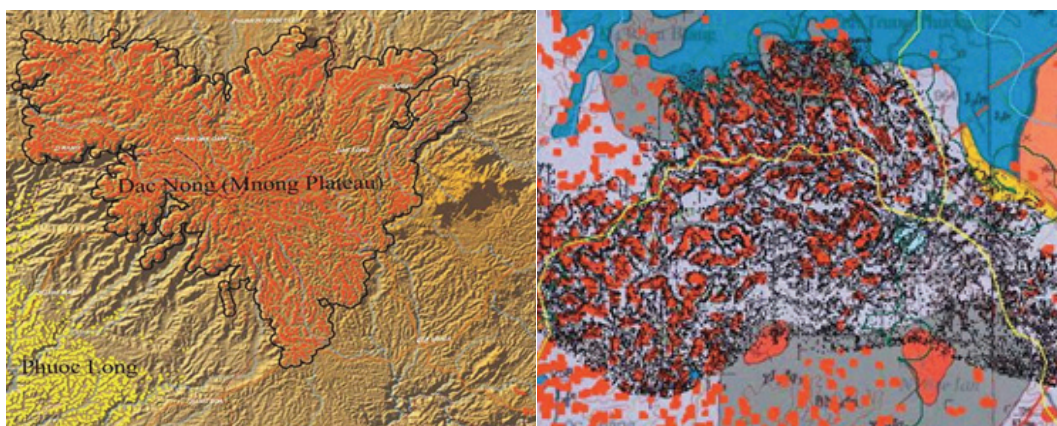
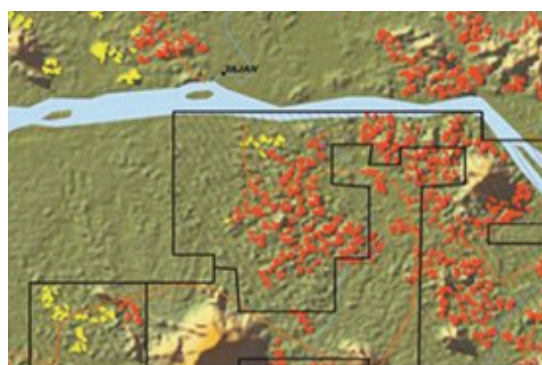


Fig. 5. Mnong Plateau (Cambodia, Vietnam) SRTM map: planation surfaces at $<10^\circ$ slope. Bauxite plateaux on $N2-Q_1$ basalts at different elevation: red: >700 m, orange: 400–700m, yellow: 200–400 m

Fig. 6. Geo-combined SRTM Map Than Rai, Lam Dong Province Bauxite deposits strictly relate to $N2-Q_1$ basalts (light grey). Bauxite free laterites are on planation surfaces of $Q2$ basalts (dark gray). Black contours show the actual (explored) ore bodies. SRTM map underestimates the bauxite potential both in Dak Nong and Lam Dong Privonces.



Bauxitic hilltop at Kaupas river

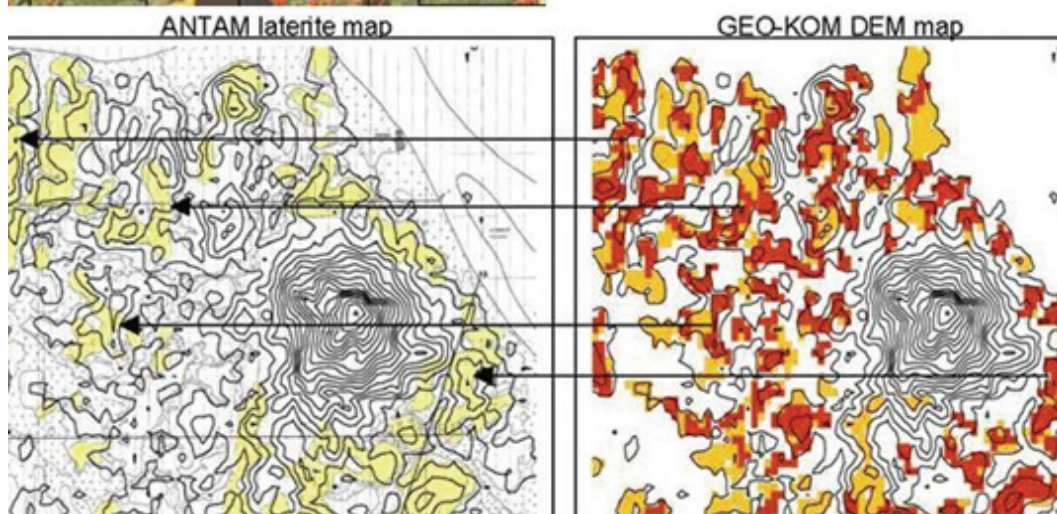


Fig. 7 and 8. In west Kalimantan the bauxite occurs on the undulating surfaces of hilltops between 20 m and 70 m MSL Bauxite bearing planation surfaces are locating on Mesozoic diorite (red colour). On young sediments, no bauxite can be found (yellow in colour) Laterite map by ANTAM Mining and Metals Company, Indonesia and GEO-KOM DEM map.

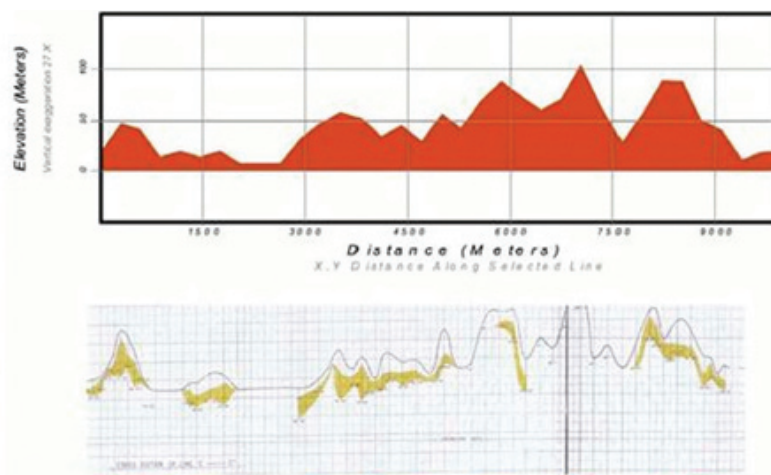


Fig. 9. Topography (exaggerated) of bauxite section explored by pits and DEM map along the section

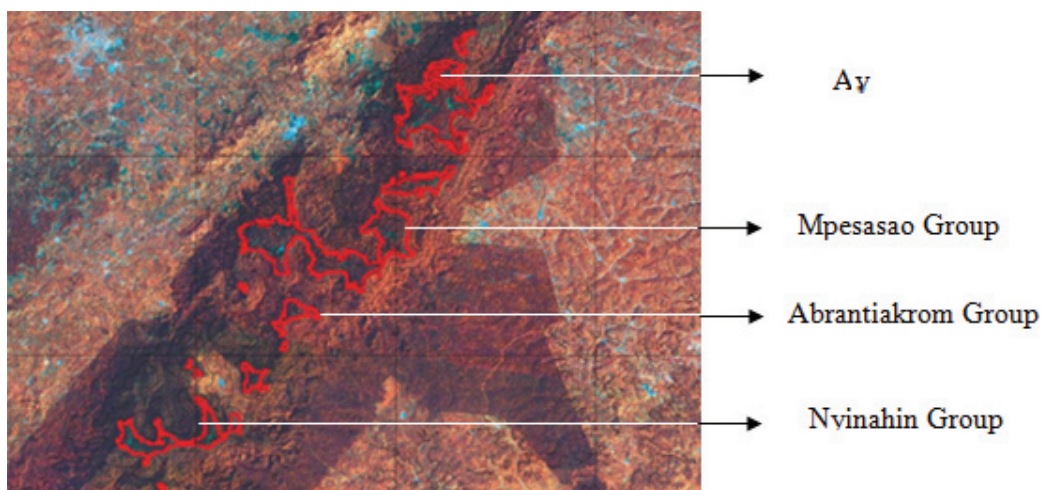


Fig. 10. Aya Nyinahin bauxite occurrence with combination of SRTM and LANDSAT TM (453 RGB)

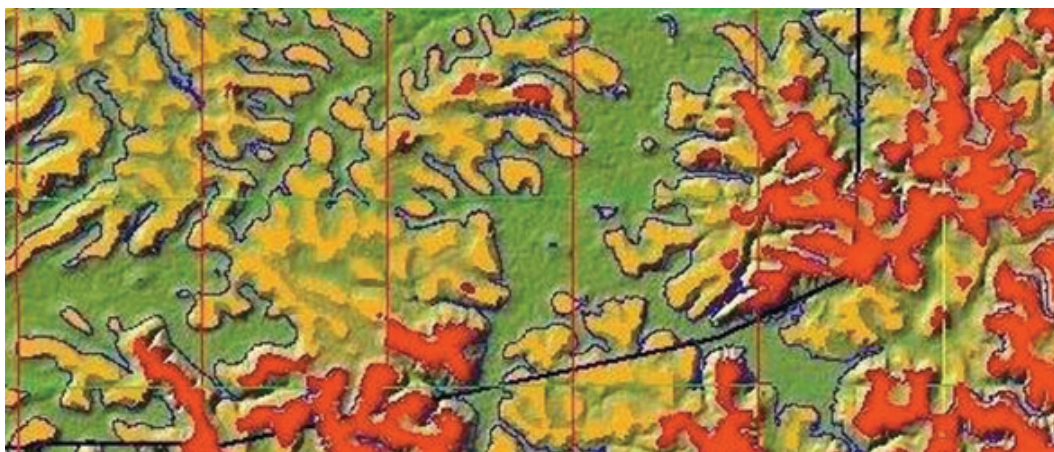


Fig. 11. Boé bauxite district in Guinea Bissau. Even the depressions of plateaux (barren for bauxite) are identified on the map (see white arrows)

Identification of Laterite Bauxite Deposits with Application of Remote Sensing Techniques

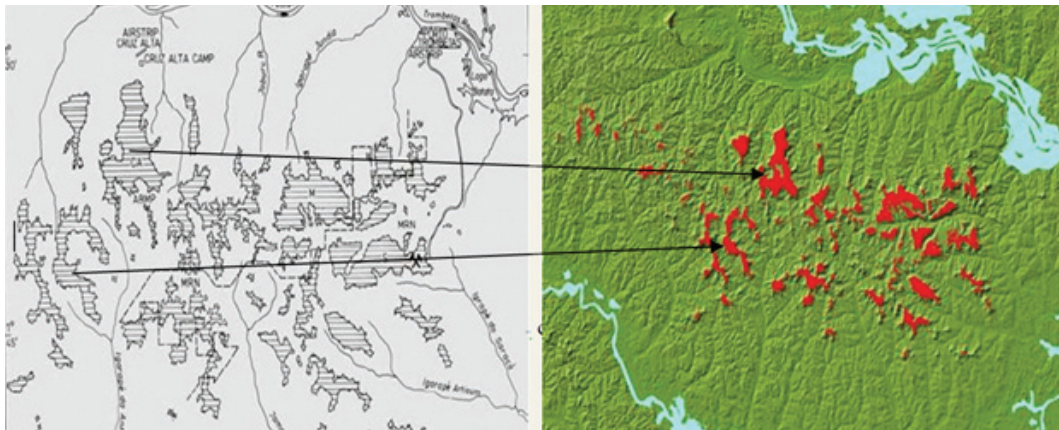


Fig. 12. Trombetas bauxite ore bodies (left) is clearly identified by SRTM mapping (right)

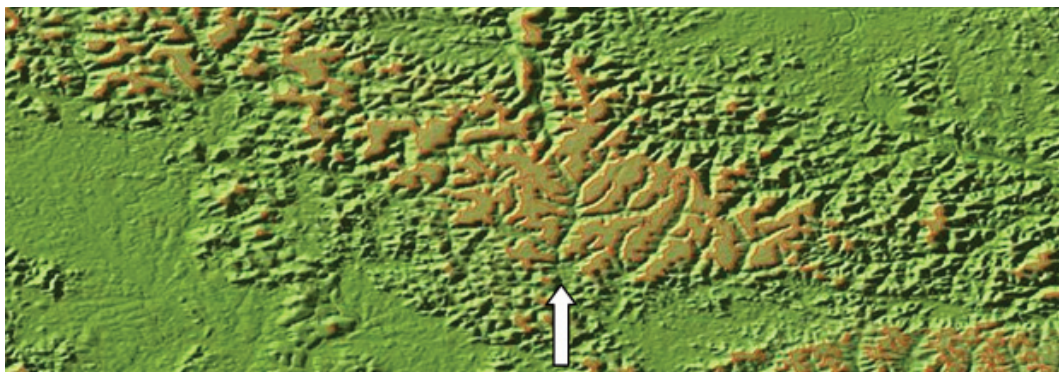


Fig. 13. New potential deposits evaluated in Laboratory

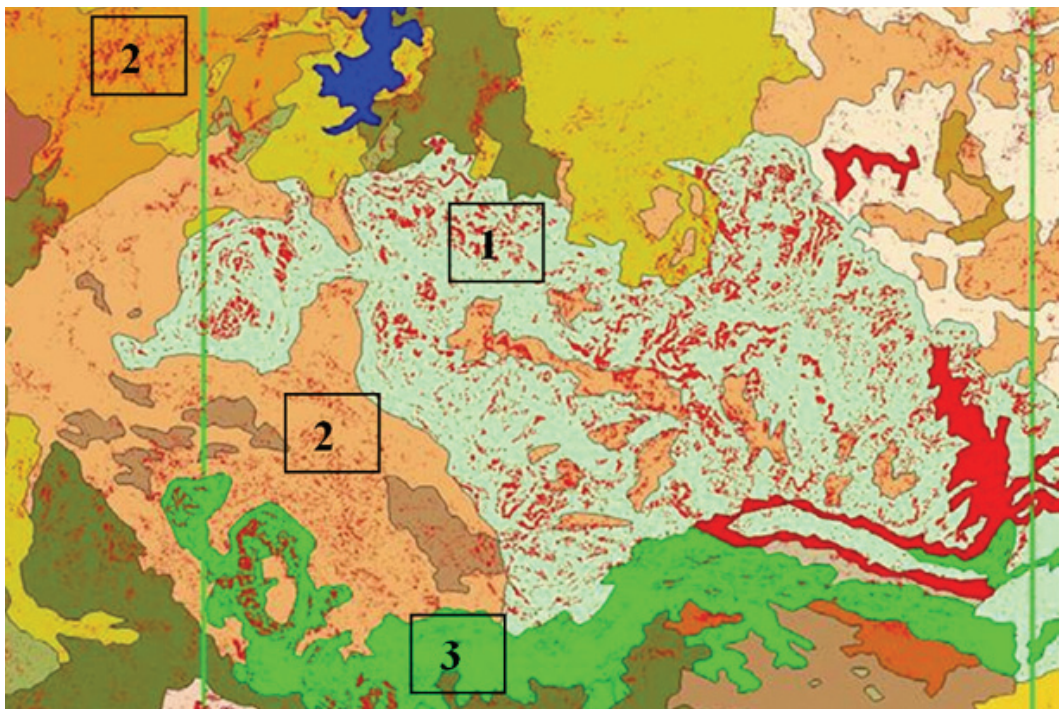


Fig.14. 1 Roraima sandstone: no lateritisation. 2. Intrusive rock of mafic composition (sills and dykes in the Roraima sandstone); there is lateritisation and baxitisation identified. 3. Felsic volcanics: bauxite may occur, but there is no evidence of bauxite, 4. Felsic intrusives bauxite may occur, there is no evidence.

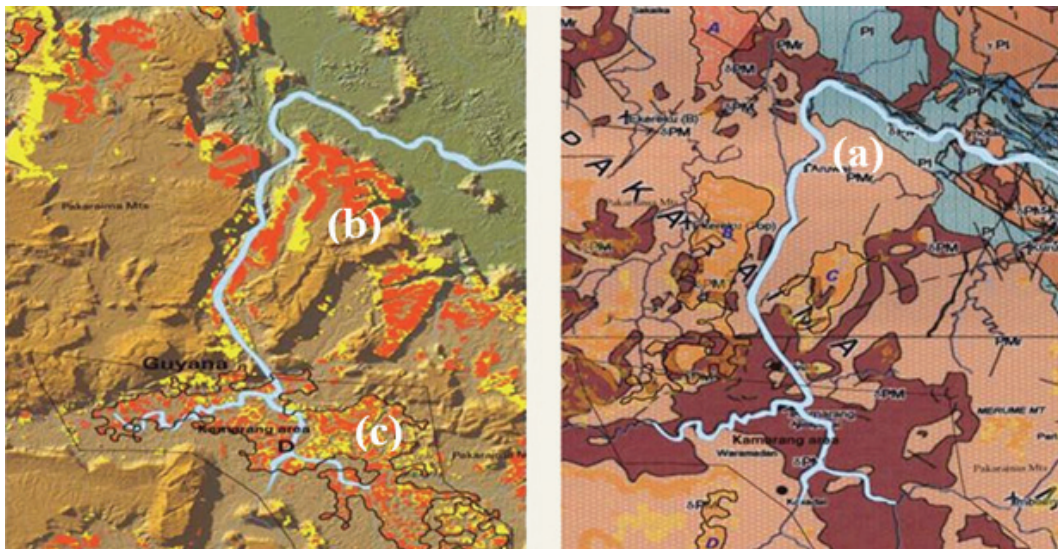


Fig. 15. Pakaraim Mts. Kopinang, Guyana. Planation surfaces on Roraima (a), sandstone/conglomerate suite (b), Bauxite bearing laterites on dolerite sills >700 m MSL (c)

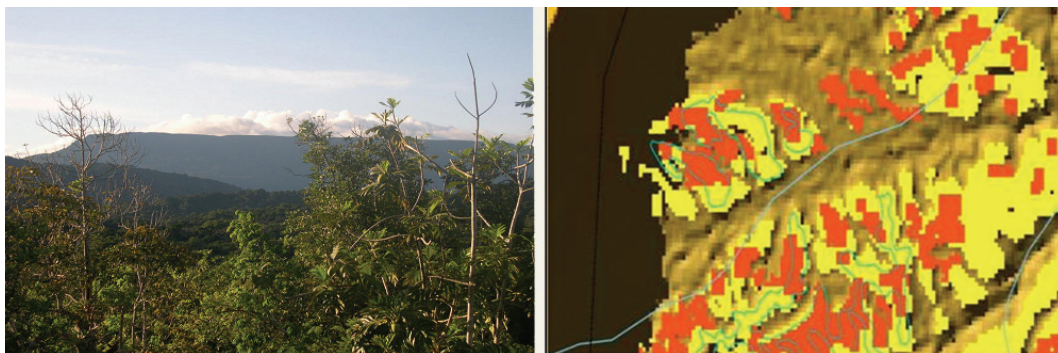


Fig. 16. Pakaraima Mts. Makwaik village Photo 5. (left), explored bauxite (right)

Acknowledgements

The Author desire to express his gratitude to his GIS experts Mr. Gergely Maucha and Mr. Róbert Pataki (Remote Sensing Division of the Agricultural Ministry, Hungary) who were very inventive and untiring when they had to satisfy the continuously changing wishes of an old bauxite geologist. Sincere thanks are expressed for Dr. Ashok Kumar Nandi Indian bauxite geologist colleague and also for the NALCO local mine management making possible a special site visit at Damanjodi, when the idea of the direct identification of bauxite deposits with SRTM and TM method emerged in 2005.

Several companies helped the Author and his GIS co-workers in developing the remote sensing methods by their related requests.

Reference and Note

- 1 Blodget, H. W., Mineral exploration from high altitude imagery, NASA, 1972.
- 2 „No hay amor sin tocar”: There is no love without touching” meaning, that „There is no reliable geological information without touching the rocks”, i.e. going in the field.

Dr. György Komlóssy
Geo-Kom Ltd.
geokom@mail.datanet.hu