

MINERALISATION OF CORUNDUM AT GOBBAGURTI: A GEOSCIENTIFIC APPROACH

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ABSTRACT

Semi-precious Corundum, (ruby and abrasive variety) occurs in and around Lakshmipuram and Gobbagurti areas of Khammam District of Andhra Pradesh. . The nature of occurrence of corundum in these areas represents in-situ, float, and placer concentrations.

Corundum occurs along with biotite gneisses, amphibolites, and sillimanite-cordierite-diopside bearing rocks, and magnesium-aluminium rich pelitic granulites. Tonalitic gneisses, cordierite- corundum rock and sillimanite schists form small lenticular bodies. The host rocks of corundum are intruded younger pegmatite veins which also have cut through the Precambrian suite of rocks.

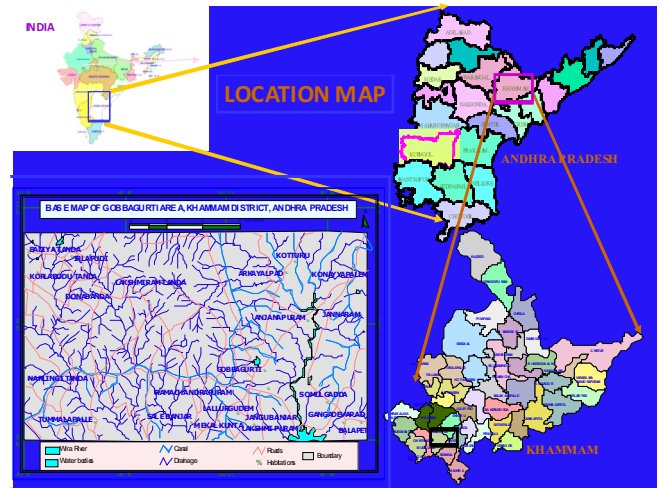
A detailed and comprehensive geological studies on the sporadic occurrences of precious and semi-precious corundum over wide areas associated within the zones of metamorphosed supracrustals has been attempted. Although corundum has been reported and excavated at different places in Konijerla Mandal, no comprehensive model for its genesis has been evolved.

In view of the complexities involved on the nature and controls of mineralisation of corundum, in the mined out areas, as well as in the inaccessible virgin areas, particularly the Gobbagurti Reserve Forest, systematic investigations comprising remote sensing, petromineralogical and geochemical investigations were carried out to explore the geo-genetic relationship so as to identify newer occurrences in a similar geological set-up.

INTRODUCTION

Corundum, in the form of ruby and abrasive variety is occurring in and around Lakshmipuram and Gobbagurti areas (170 10': 170 20': 800 15': 800 25') of Khammam District (Fig. 1) within the Khammam Schist Belt., which is a part of the Indian Peninsular Shield (Ramam, P. K. and Murthy, V. N, 1997).

The State Department of Mines and Geology and Andhra Pradesh Mineral Development Corporation (APMDC) have investigated these areas for sustainable economic development. (Dayashankar, P. Rajasekhar Reddy and Satyanarayana, 2001).



GEOLOGICAL SETTING

The area is a part of KSB which mainly consists of metamorphosed felsic and mafic volcanic, now preserved as quartzo-felspathic gneisses, hornblende schists and schistose amphibolites, with or without garnet. Lithological variations include the pelitic meta-sediments manifested in sillimanite-kyanite schists, sillimanite- cordierite-orthopyroxene-corundum bearing rocks , pegmatites and banded iron formations (quartz-magnetites). Garnet bearing quartzites are rare and insignificant in the KSB. The dominant lithology comprises amphibolites, which may be described as banded, foliated, garnetiferous or massive based on its field appearance and form a basement for the proterozoic pakhals and phanerozoic gondwana sediments. (Fig.2)

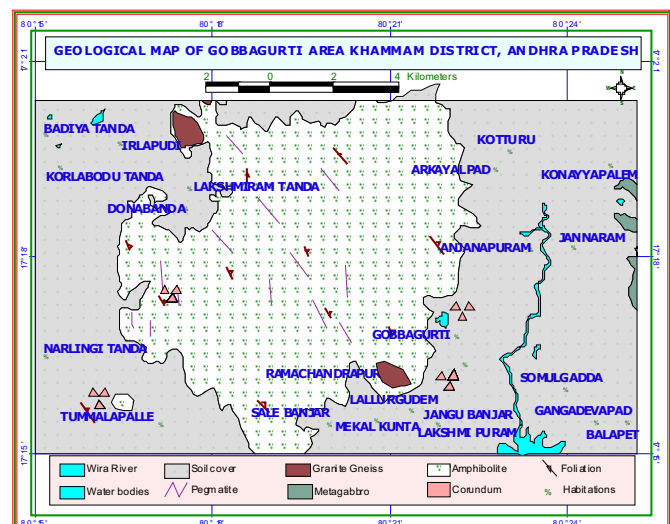


Fig. 2 Geological Map of Study Area

In the area, corundum is found enclosed in tonalitic gneisses within which, sillimanite schists and cordierite- corundum rock form small lenticular bodies, pyroxene granulites and biotite gneisses. The host rocks for corundum are pegmatite veins which have cut through the archaean suite of rocks. (Pavanaguru, R and Narayan Sangam, 2005).

METHODOLOGY:

The mineralization of corundum has been studied formulating an appropriate methodology. The method of studies involved includes:

- (i) The Nature of occurrence of corundum in the Field area.
- (ii) Studies on the geology, geomorphology and structure associated with rock types in the area.
- (iii) Preparation of thematic layers on the geology, geomorphology and structures.
- (iv) Petrographic studies on corundum bearing formations.
- (v) SEM studies and EDX analysis of corundum samples.
- (vi) EPMA of rock samples associated with corundum occurrences.
- (vii) Studies related to the origin and nature of corundum occurrences in the area.

DATA USED:

The following data were used:

- (a) Survey of India Toposheets Nos. 65C/7 & 65C/8 on 1:50,000 scale.
- (b) IRS IC/ID LISS-III FCC (Feb.1999) of 65C/7 & 65C/8 on 1:50,000 scale.(Fig. 3)
- (c) Existing geological information.
- (d) Softwares such as RockPic, Arc GIS (9.0) and MS Office-98.

Parts of IRS IC/ID LISS III FCC-BAND (32 1) IMAGERY OF -65 C/7,8

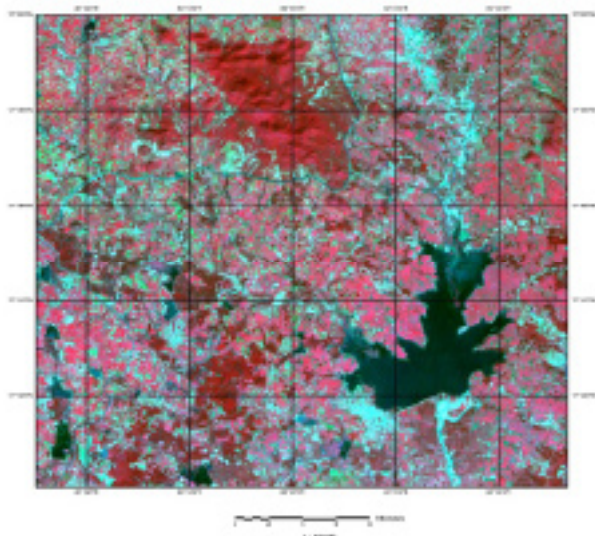


Fig.3 IRS IC/ID LISS III FCC of study area

NATURE OF OCCURRENCE AND MINERALISATION

Semi-precious-commercial grade corundum (Ruby Variety) is localised in and around Gobbagurti area, Khammam District, Andhra Pradesh. Unscientific exploitation of corundum over few decades and

improper open pit mining activity without understanding of the nature of mineralisation is being carried out around Gobbagurti and Wyra areas.

Corundum mineralisation is essentially controlled by lithology and structure of the host rocks of Khammam Schist Belt. The prime mineralised area is in close proximity to the Wyra lake and the incoming drainage carry considerable quantities of transported corundum. Lithologically, the area is comprised of hornblende schists, schistose amphibolites, garnetiferous-amphibolites, tremolite-actinolite-talc-chlorite schists, tonalite gneisses and pelitic gneisses, younger anorthosites, amphibolite dykes, mafic and felsic granulites, meta-dolerites, tonalites and cordierite-sillimanite-quartz-schists/gneisses, are intruded by gabbroic cryptic anorthosites, aplites, granites and pegmatites.

The association of corundum both with pelitic schists and tonalites suggests its intimate lithological control with the SiO₂ depleted rocks and its occurrence along well defined planes of structural weakness is noteworthy. Corundum is observed in association with felsic rocks in these areas and suggests its affiliation to primary nature and reflects its occurrence and origin from felsic rocks and metamorphosed pelitic schists. The occurrence of corundum along the contacts between the intrusives (felsic rocks) and the schists and gneisses is generally observed. Garnets in association with amphibolites are commonly observed.

Prospecting activity by panning along the structurally controlled nallas (drainage) is the testimony to the wide spread placer concentrations of corundum in this area.

Ruby Corundum (semi-precious) occurs in the areas of Lakshmipuram, Gobbagurti, Singaraipalem, Lalapuram, Mekalkunta, Tumallepalle, Wyra and adjoining areas of Khammam District, Andhra Pradesh. (170 10' - 170 20': 800 15' - 800 25')

The occurrence of corundum in these areas has attracted the attention of a number of prudent entrepreneurs since few decades and exploratory mining is the order of the day. However, there is no proper scientific method of extraction and open pit mining activity was observed in these areas without proper understanding of the nature of mineralisation.

Based on the nature of occurrence of corundum (all varieties) it can be categorized into three different types, namely, float, insitu, and placer occurrences.

Float occurrences are observed in close proximity to the primary occurrences and are admixed with soil within the weathered profile of the rocks.

They are also observed as colluviums mixed with pebbles of quartz and it is very difficult to identify these deposits unless the eyes are properly trained as they are coated with films of ferruginous material. They generally occupy gentle slopes and sheet wash areas.

In situ occurrence of corundum is noticed in association with felsic, gneissic rocks and along the contact zones of weak structural planes of amphibolites which appears to be the controlling factor that localized the mineral corundum. The contact between felsic rocks and garnetiferous amphibolites forms major in situ occurrences. The dug material shows the presence of weathered felsic rock associated with the amphibolites. Petrographically, corundum with lamellar twinning is associated with coarse-grained felsic rock.

Placer concentrations are worked out along the nalla courses. Large scale panning of alluvium is observed and the recoveries are also encouraging particularly during rainy season. It is conspicuously observed along the culverts where prospecting pits by the local people amply justify the transportation of corundum from the upper reaches of the stream network.



1. Float Corundum
2. Placer Corundum
3. Panning for Corundum

Occurrence of semi-precious corundum of abrasive variety and rare occurrences of gem variety are observed in the exploration pits at Lakshampuram where the host rock is sillimanite-corundum schistose rock. At Gobbagurti and Singaraipalem corundum occurs in association with kyanite schists. However, at Lallurgudem corundum is occurring locally in the soil cover accounting for placer concentrations. The contact zones of altered basic rocks and pelitic schists host corundum at Salebanjar. The Donabanda area exhibits similar occurrence along the contact zones of pegmatitic veins and schists. The Tummalapalle occurrence is associated with pyroxene granulites and gneisses.

In the Mekalkunta area, sillimanite schists and gneisses host corundum. At Wyrā, corundum occurs with cordierite-sillimanite schists and gneisses. Majority of the occurrences are observed in the silica deficient geogenic system and account for its concentration.

CONCLUSIONS

1. The area, part of the Khammam Schist Belt, hosting corundum mineralisation, predominantly consists of a wide variety of schists and gneisses namely; garnetiferous biotite schists, quartz-biotite schists and gneisses, garnet-muscovite chlorite-schist, garnet-kyanite-muscovite schist (metapelites), Calc silicate rocks, hornblende schists and felsic gneisses (tonalite), and quartz chlorite schists (metavolcanics). Besides these, there are streaky biotite gneisses, hornblende gneisses (migmatites) and talc-tremolite-actinolite schists.
2. The area is endowed by economically viable corundum and garnet occurrences which are significantly controlled by both lithology and structures. (Shears fractures and faults).
3. Structurally, the area exhibits N.E-S.W and WNW-E.S.E, trends which dominantly control the mineralization of corundum at Gobbagurti and the contact zones of gneisses and amphibolites form the loci of mineralisation.
4. Petrographically, the tonalitic gneisses possess primary corundum and the reconstituted metamorphic assemblages also enclose corundum in schistose rocks.
5. The felspathic intrusive (tonalite, corundum syenite) hosting mineralisation of corundum is observed along the contact zones of sillimanite-corundum and kyanite-corundum rocks.
6. Unscientific exploitation of corundum over few decades and improper open pit mining activity without understanding the nature of mineralisation is observed around Gobbagurthi and Wyrā areas.
7. Thematic layers of geology, geomorphology and structure were prepared with the help of Remote sensing and GIS techniques which facilitated to delineate the favourable extended areas of mineralisation to explore full potential of mineralisation.
8. Detailed petro-chemical studies of the different rocks helped in unraveling the genetic aspects of mineralisation in the area. Studies on prospecting exploration pits from shallow surface diggings in the soil to a depth of 0.3 to 0.6m helped to locate the host rock for corundum in the vicinity of Laxmipuram and Singarayapalem areas and confirm the nature and controls of mineralisation.

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