



NEW FINDS OF RETORTS IN SHYANMANGLA AND BACHENHATTI AREAS, RAMNAGAR DISTRICT, KARNATAKA

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Abstract: Retort is an earthen device used for smelting of metallic ore minerals for the production of metals by ancient miners. We have found retorts and pieces of broken retorts, slag heaps and retort dumps from south east of Shyanmangla and east of Bachenhatti areas of Ramanagar district, Karnataka. These are cylindrical in shape with hollow or empty space inside, and varying thickness of outer shell and thick walled or thin walled. Retort have slag material. In the slag material crystals and fine radiating needles of pyroxene were observed. SEM-EDX study of polished section of slag material reveals presence of Gold (Au) flakes.

Keywords: Retort, Gold, SEM-EDX, ICP-AAS and Ramanagar.

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Introduction

India is endowed with rich heritage of ancient civilization, spiritual or cultural or mythological, historical, scientific and metallurgical. The mining and metallurgy dating back to the middle of first millennium BC. From very ancient times, the mineral resources in the earth's crust (metals, ores and minerals) were utilized for the metal extraction for household and during war time for making different tools. These are witnessed by old workings/ long-deserted ancient mines, huge slag heaps and ancient metallurgical artefacts scattered in different parts of the country (Dey, 2008). The ancient people were efficient prospectors and miners, and no sluggards in the metallurgical field either. Many of the present-day mines were discovered mainly on the evidences of the ancient miners and metallurgists. Evidences of extracting/winning metals right

from mining to crushing, washing, smelting and casting into ingots are strewn in various parts of the country. In metallurgy, India is pioneer in extracting metallic zinc by an ingenious method of downward distillation of zinc vapour from charged retorts (Zawar area, Rajasthan) and in the metallurgical marvel of producing 'rustless iron' and 'wootz' steel (in southern India). The ancient smelting devices used in widely divided parts of the country such as Rajasthan, Haryana, H. P., U. P., Andhra Pradesh and Tamil Nadu (Dey, 2008).

Present authors have found retorts and pieces of broken retorts, slag heaps and retort dumps from south east of Shyanmangla and east of Bachenhatti (56 H/5) areas of Ramanagar district, Karnataka during FS: 2009-10. However, Karnataka state is famous for gold deposits namely in Kolar Gold Field (KGF), Hutti Gold Field (HGF) and Gadag Gold Field (GGF). Retort is an earthen device used for smelting of metallic ore minerals for the production of metals by ancient miners. These retorts are strewn all over cultivate land and also buried in fields. The present paper aims to report the new finds of retorts and gold in the slag material.

Geology of the retort sites

The ground evaluated area forms part of the Precambrian Dharwar Craton in Karnataka covered by Sargur Group of rocks, Peninsular Gneissic Complex (PGC) and post Dharwar intrusives (clospet granite, pink and grey granite, basic dyke and quartz vein) and laterite. The Sargur Group comprises hornblende/chlorite schists, amphibolite, pyroxenite and quartzite. Peninsular Gneissic Complex (PGC) consists of migmatites grey granite, grey granite gneiss and dark colored biotite hornblende gneiss. Clospet granite batholith trends in N-S direction, forming a well-defined linear band in PGC (**Fig. 1 and 1 A**).

Pyroxenite

This occur as small elongated dyke of 30 mt length and width of about 10 mt to southeast of Shyanmangla ($12^{\circ} 47'08''$; $77^{\circ}26'54''$, 57 H/5). It is a melanocratic (dark green), coarse-grained and porphyritic rock. It is trending $N54^{\circ}W-S54^{\circ}E$. It consists of phenocrysts of prismatic and octahedral pyroxenes in ground mass of mafic minerals. It is traversed by numerous pink coloured and fine grained granitic veinlets. The phenocrysts of pyroxene show mineral lineation.

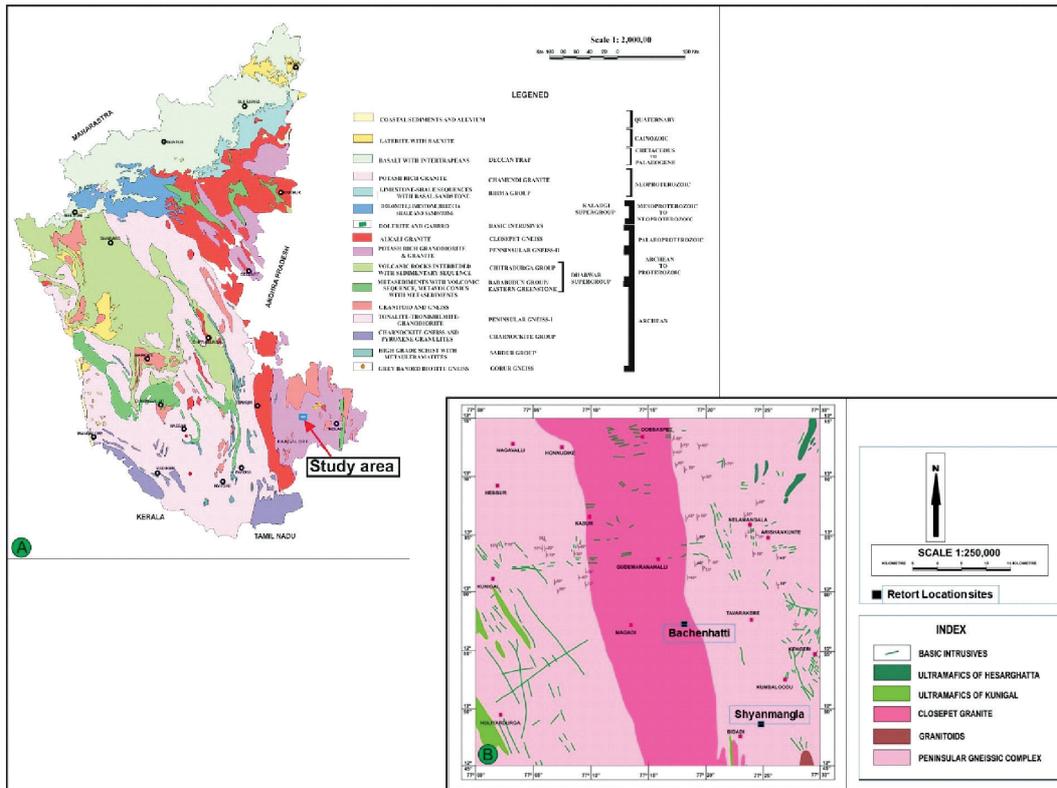


Fig. 1 (A) Regional geological map of Karnataka and Goa States showing location of study area (after GSI, 2014) and (B) Geological map showing location of two retorts sites (after Meshram and Rao, 2010).

Description of Retorts

These are cylindrical in shape with hollow or empty space inside, and varying thickness of outer shell and thick walled or thin walled might be used for gold recovery. Some retorts show central opening at broader end and tapering at the closed ends. These are made up of clay material. Retorts from Shyanmangla are brick red and grayish black in colour, cylindrical in shape with hollow space inside and varying thickness of outer shell (Fig. 2 A). The length of retorts is upto 17 cm and diameter is 33 cm at the center. The outer shell comprises thick coating of grayish colour iron slag (Fig. 2 B). In the slag material fine radiating scales of pyroxene were observed in the cavities. Vicinity to the retort melanocratic pyroxenite dyke was observed. This implies that pyroxenite and other mafic rocks of the area could be source for gold occurrences in the slag.

Local information gathered from the villagers that ancient people were done smelting for recovery of metals but exactly we do not know for what they have been extracted here.

The retorts from Bachenhatti area are red in colour, cylindrical to funnel like (tubular pipe) in shape with hollow space inside and thick outer shell (Fig. 2 C). The length of retorts is upto 23 cm and diameter is 23 cm at upper part and 16 cm at lower part. The outer shell consists of bluish coloured, hard and spongy iron material. Along with this slag some fragments of granitic material and amphibolite are observed. Some retorts are buried inside the ground (Fig. 2 D) indicating ancient furnace was used for smelting of metallic ores.



Fig. 2 (A) Brick red retorts from Shyanmangla area, (B) Retorts with slag coating, (C) Cylindrical to funnel like (tubular pipe) shaped retorts from Bachenhatti area, and (D) Burried retort inside the ground.

Petrography, mineralogy and geochemistry of slag

Trace analysis were carried out by ICP-AAS at Chemical Division, erstwhile AMSE Wing, Geological Survey of India, Bangalore (NCEGR, Bangalore) and

SEM-EDX study were carried out at SEM-EDS Lab, GSI, CHQ, Kolkata. The polished section studies of slag material indicate presence of magnetite, which shows different textural morphological features. For example magnetite display skeletal & comb shaped texture (**Fig. 3A**), (**Fig. 3B**), subhedral to anhedral and partly netted broken crystals (**Fig. 3C**) and flower like elongated magnetite. Gold flakes (dendritic pattern upto 1 micron) in the slag material and SEM micrographs showing peak of Cu, Fe, Au (**Fig. 3 E & F**). The geochemical analysis of 1 no. of slag material shows Cr- 213ppm, Ni-47ppm, Zn- 29ppm, Cu- 24ppm and Pb- 10ppm. However the concentration of Au < 25ppb is observed.

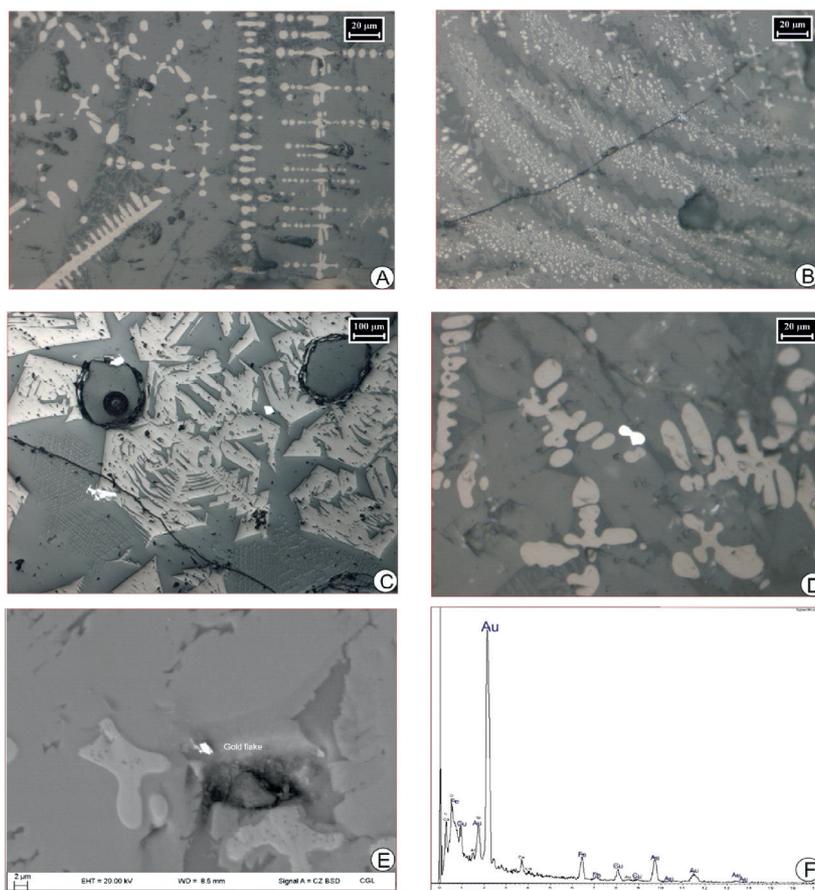


Fig. 3 Textural features of magnetite under reflected light (A) Skeletal and comb shaped texture, (B) Dendritic pattern, (C) Subhedral to anhedral and partly netted, (D) Flower like elongated to balloon shaped, (E) Back scattered electron image showing gold flakes, and (F) Scanning electron Micrographs showing presence of gold (Au) along with copper (Cu), cobalt (Co) and iron (Fe).

Conclusion

These findings of retorts from two areas signifies that there might be mining activity in the vicinity in the past for metal extraction. The mineralogical and geochemical studies of slag material indicate occurrence of Au and chemical analysis may indicate mafic rocks which were used for extraction of metals.

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