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Petrographic studies of basic and Ultra-basicrocks of adjoining Lahn river of Nandgaon area of Gondpipri Block, Chandrapur District, Western Bastar Craton, Central India

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Abstract: *Basic and ultra-basic rocks are an important feature of the crustal evolution in the stabilized Archaeancratons all over the world. They constitute a common expression of crustal extension in both oceanic and continental environments, and represent major avenues by which basaltic magma is transferred from mantle to upper crust. Mafic dyke swarms are an important feature of the crustal evolution in the stabilized Archeancratons all over the world.*
The geological andpetrological details of basic and Ultra Basic of Lahn river area of NandgaonGondpipri area of western Bastarcraton have been discussed and understand to the petrogenetic processes involved during the emplacement of basic and ultra-basic rocks of the study area.

Keywords: Basic, ultra-basic, Field Petrography, Lahn River,WBC

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I. Introduction:

The geologica,petrological and petrographical details of mafic rocks as well as ultra-mafics of Mul and Gondpipri area of western Bastarcraton have been presented in this research paper. This presented information suggests different petrological types of mafic dykes and mafic volcanics which might have different petrogenetic histories. In this reserch paper collected data is reflects a better understanding of petrographicalcharacteristics of the mafic and Ultra- mafic rocks. In this research paper mostly discussion on microscopic observation of mafic rocks as well as ultra-mafics rocks in study area.

Geological setting:

A Granulites suit of the study area is exposed rocks in the northern shoulder of Godavari graben are named as Gondpiprigranulites (Shashidharan, 2002, 2007). They represent the extension of Bhopalpatnam granulite (2450 Ma Rb-Sr age; Mishra et al., 1988) and have also been correlated with the KarimnagarGranulites (2500 Ma, Rb-Sr age; Rajesham et. al., 1993) across the Godavari graben in the DharwarCraton.

II. Methodology:

Field Study:

Several authors (Sinha, 1965; Thorpe and Brown, 1985 and others) have pointed out that random and inadequate sampling may lead to erroneous or even contradictory results while interpreting the data obtained from such samples. Present investigation is exclusively concentrated on the study of the mafic and Ultra- mafic rocks that are scattered in a vast granitic terrain of Gondpipri area of Chandrapur district, western Bastarcraton. In the present work, District Resources Map (DRM) published by Geological Survey of India (GSI, 2001). The toposheets used for the present study are M/10, having 1:50,000 scales.

PETROGRAPHIC TECHNIQUES

In the present work, total 10 samples are collected in the field out of which 04samples are selected for petrographic studies. The microscopic examinations of all the collected mafic and ultra-mafic rocks have been studied and a brief methodology

The petrographic study of 05 thin sections was carried out for petro-mineralogical studies including micro-structure and textures, constituent mineralogy, secondary alteration such as kaolinization, sericitization, mineral

zoning and reaction rim, (corona) etc are identified with the help of advance optical petrological microscope like Nikon, LeitzOrtholux and Zeiss Axiolab and photomicrography was also carried out on these microscopes.

Petrography of the study area:

Granulites

The basic - ultrabasic granulites are mainly metapyroxenites and mostly comprise of pyroxenes with or without plagioclase and hornblende. These rocks appear to have been intruded synkinematically with the granulite facies metamorphism (Sashidharan, 2000 and 2002).

Pyroxenites

In the present study pyroxenite samples are collected from Gondpipri area and east of Nandgaon along Lahn River. In hand specimen, the rock is massive and compact with medium to coarse grained texture and dark green to black colour. It is mineralogically composed of pyroxenes with minor feldspar and biotite.

Under the microscope it is coarse grained and consists of orthopyroxene (Opx), clinopyroxene (Cpx), plagioclase with minor olivine, plagioclase and hornblende (retrograded around Opx). Pyroxenes are subhedral to euhedral and show cumulate texture while plagioclase occupies the interstices of the earlier formed pyroxenes and is intercumulusThe rock is coarse to medium grained with granular texture and at places granulite texture with well-developed triple junction.

Meta-gabbro

Based on dominance of plagioclase and their composition three varieties are recognized in the field, namely gabbro, noritic gabbro and anorthosite gabbro. Megascopically rock is medium to coarse grained meso to melanocratic and dark grey in colour.

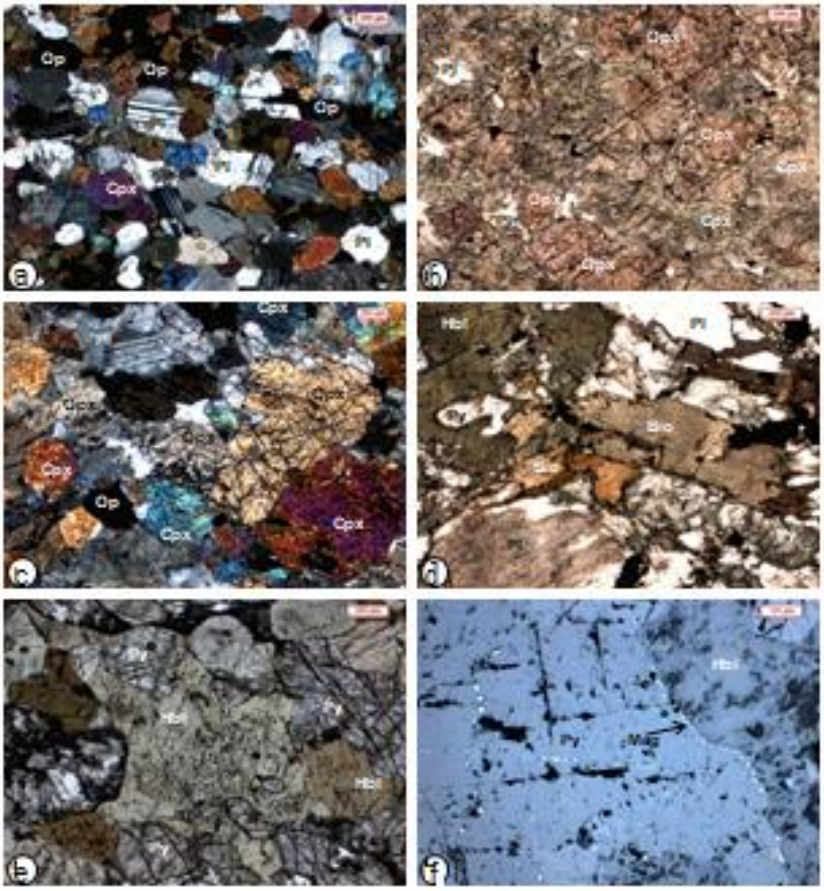
Under the microscope, rock is medium to coarse grained showing granular texture and at places granulite texture with well-developed triple junctions. It is predominantly composed of plagioclase and pyroxenes with subordinate amount of hornblende, biotite and opaquesBothclino and orthopyroxene (augite and hypersthene) are observed, but Cpx>Opx, while sometimes Cpx ≈ Opx. Plagioclase is of andesine to labrodorite composition (up to An_{50}) and is partially sericitized and sauseritized. Weak preferred orientation has developed in this rock. Plagioclase shows deformation in the form of bent twin lamellae and disappearance of twinning. Thus suggesting that rock has emplaced before on set of deformation.Uralitization of pyroxenes is common and has resulted in release of iron oxides in the form of magnetite along the cleavages and grain boundries. Biotitization of pyroxenes along cleavages and grain boundaries is also commonly observed.

Dolerite and Meta-dolerite

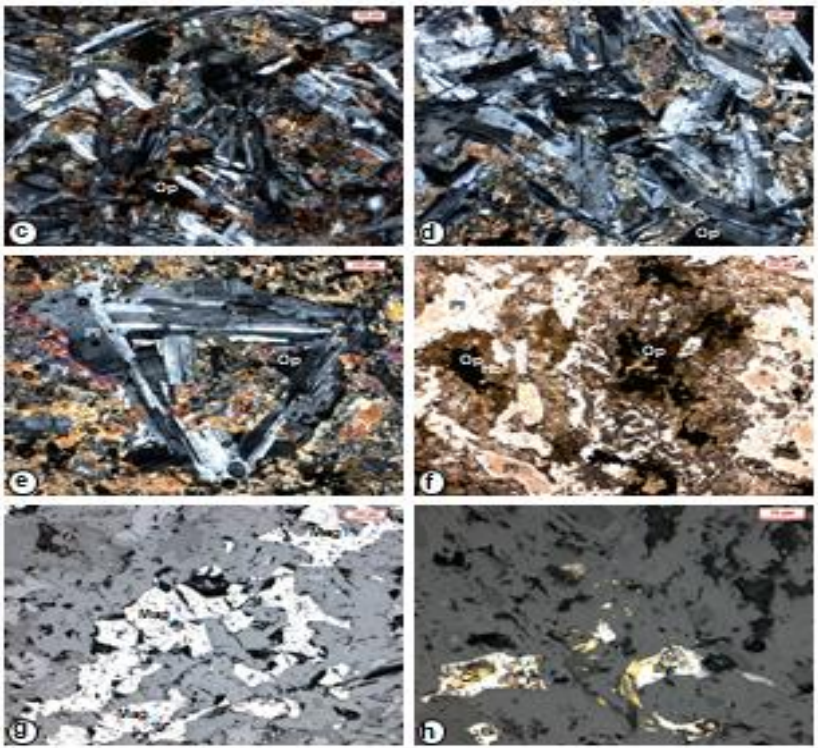
Megascopically rock is fine grained, hard, compact, melanocratic and looking like dolerite. It is predominantly composed of mafic minerals and plagioclase. Under the microscope rock is fine grained and sometimes shows relict subophitic texture. Crude foliation imparted by preferred orientation of mafic minerals, plagioclase and quartz is also visible. Mafic minerals are mostly hornblende, which is pleochroic from pale green to green to slight bluish green with extinction angle up to 22^o. Plagioclase with extinction angle up to 27^o is common. It is recrystallised during metamorphism and therefore appear fresh. Deformation of relict plagioclase has resulted into deformation and disappearance of twin lamellae. Such grains show sericitisation and saussaritisation. Secondary quartz released during metamorphism is dispersed all over the rock. Opaques are mostly magnetite which are sometimes oriented along the direction of foliation and may be primary or secondary epidote is also common.

Ganeshpipri, Gondpipri Mafic-Ultramafic complex (Western BastarCraton) Ni-Cu-PGE mineralization was recorded from mafic-ultramafic rocks (i.e. norite-gabbronorite-anorthositic gabbro- olivine gabbro) around Ganeshpipri and Gondpipri area in Chandrapur District, Maharashtra (Mukherjee et al., 2007; Dora, 2012). They occur as a number of linear elongated bodies in the TTG andcharnockitic terrain. The host rocks in Ganeshpipri area are olivine gabbro and anorthositic gabbro. The length of these lensoidal bodies varies from 10 m to 100 m and width between <1 m and about 10 m. These are medium- to coarse-grained and exhibit layering at places defined by parallel alignment of plagioclase laths and tabular pyroxene. Gabbro exhibits abrupt variation in the modal proportion of plagioclase and pyroxene. The exact field relationship of gabbro with the surrounding charnockite could not be convincingly established due to paucity of outcrops. Two phases of nickel minerals were already identified and confirmed by ore petrography followed by SEM- EDS and EPMA studies in olivine gabbro and anorthositic gabbro in Ganeshpipri block but unfortunately chemical values are not at all supporting

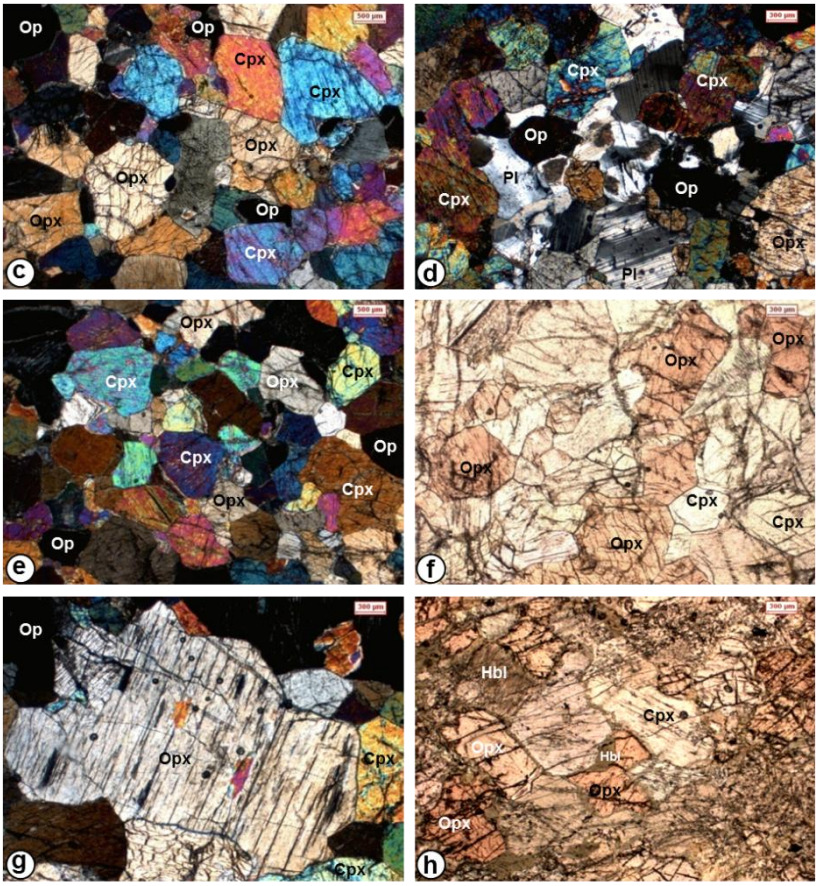
to the modal proportion of sulphide present in these rocks. The nickel content from bed rock analyses is around 800 ppm but shows very poor PGE mineralization, the highest being 15 ppb. However, some PGE values reported from this area vary from 50 to 559 ppb (n=20) (Mukherjee et al., 2007).Higher values were reported from diorite-tonalite-charnockite and lesser values found from pyroxenite (see Table1).



Photomicrographs of Metagabbro (Thin Section from a to f)



Photomicrographs of Dolerite and Metadolerite (Thin Section from c to h)



Photomicrographs of Pyroxenite (Thin Section from c,d,e,g) and Granulite (Thin Section from f and h)

III. Discussion And Conclusion

Mafic and ultra-mafic rocks of lahn River area are an important feature of the crustal evolution in the stabilized Archeancratons all over the world. It constitute a common expression of crustal extension in both oceanic and continental environments, and represent major avenues by which basaltic magma is transferred from mantle to upper crust.The mineralogy and petrology the study area suggested the significant ultra- basic and basic composition ofrock types:

Pyroxenites show granulitic texture,cumulate texture is also visible where pyroxenes are cumulus, while plagioclase is intercumulus. Meta-gabbros associated with pyroxenites also show granulitic texture with well-developed triple junctions. Pyroxene granulite, mafic-ultramafic complex consisting pyroxenite, meta-gabbro and anorthosite are the main components of the granulite belt mafic enclaves in DQDT sometimes show gradational diffusive margin with apparent addition of mafic components into the felsic rich zones. This is due to partial mixing of mafic and felsic magmas. The rock types of the area show polyphase deformational history and have left their imprints in the form of various structural features noticed in basement rocks.

Mafic intrusive present in the area belong to two episodes of intrusive activity viz. pre-metamorphic and post- metamorphic. The former (older mafic intrusive) are seen as metamorphosed bodies such as hornblendite, meta-gabbros, meta-dolerite etc exposed as dykes and oval shaped intrusions within the gneisses (showing crude ophitic to subophitic texture), where as the post -deformational ones (younger mafic intrusive) are relatively fresh with original igneous textures (ophitic to sub-ophitic) well preserved and represented by gabbro and dolerite. Younger mafic intrusive are cutting the Mul granites (1550- 1650Ma, Dora, 2012) and therefore younger than the Mul granite. No mafic dykes are reported to cut Neoproterozoic sedimentary basins. This suggests that all mafic dykes of study area are emplaced before the Neoproterozoic time.

The BastarCraton has a potential for hosting smaller PGE deposits. Research work is carried out preliminary investigation for Ni, Co and PGE in the ultrabasic intrusive around study area.

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