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'Sonapahar Group': a proposed new lithostratigraphic unit in the Precambrian rocks of the Shillong Plateau

M. NARAYANA RAO AND J. M. CHOUDHURY
Gauhati University, Gauhati, Assam

Abstract

A new lithostratigraphic unit—the 'Sonapahar Group'—within the Precambrian rocks of the Shillong plateau is formally proposed for the pelitic, basic, calc-silicate and banded ferruginous rocks showing evidences of medium (to high) grades of regional metamorphism and varying degrees of metasomatism.

Introduction

While reviewing the Precambrian stratigraphy of the Assam-Meghalaya region in an earlier paper (Choudhury and Rao, 1971), the authors recognised eight stratigraphic units, the oldest of which was called by them as the 'Older Metamorphic Group'. This stratigraphic unit consisting essentially of a variety of pelitic, calc-magnesian and basic metamorphites was recognised as a separate unit and differentiated from the other closely associated granitic rocks for the first time by the authors and they provisionally chose the above name in view of the similarity (discussed further below) between the rocks under discussion and those of the Older Metamorphic Group of the Singhbhum area (south of the Copper Belt Thrust).

The two main objectives of this paper are: (1) to propose formally this group of rocks as a new litho-stratigraphic unit in the Shillong plateau, in order to make it conform to the Code of Stratigraphic Nomenclature of India (1971, p. 2); and (2) to name this unit as the 'Sonapahar Group' after a landmark from within the region where the rocks are typically developed. Earlier work on these rocks was mainly concerned with occurrences in the Khasi and Jaintia Hills part of the region. They are mostly petrological accounts of these and associated granitic rocks. The more recent of these include Ghosh (1952), Banerjee (1955), Bhattacharjee and Barua (1969-71 & 1974), Gogoi (1971), Mazumdar (1971) and Choudhury and Rao (1974). Stratigraphically, these and some of the associated granitic rocks, particularly the granite gneiss, have generally been included under the omnibus term, 'Gneissic Complex'.

Geological setting

The Sonapahar Group rocks are intimately associated with granitic rocks. Though they must have at one time occupied large areas, they now occur mostly as disconnected bodies isolated by granitic rocks. The different bodies show a great deal of variation in size—from small lenses measurable in centimeters to relatively larger outcrops. While the smaller bodies are ubiquitous in the granitic rocks of the entire region, some of the biggest ones are encountered in a part of the Khasi and Jaintia Hills. The two major granitic types involved are: (1) a medium grained gneissic (sometimes grading into a granitoid) type, and (2) a coarse grained porphyritic type. Of these two, the former is more widespread. Migmatitic interlayering is common between the granitic and Sonapahar Group of rocks.

Numerous occurrences of Sonapahar Group of rocks are seen in the north-western part of the Khasi and Jaintia Hills of Meghalaya and Kamrup and Goalpara districts of Assam. They are also associated with the granitic rocks of Koilapahar, Silbhetta, etc., areas in Mikir Hills (Assam) and of Tura area in Garo Hills (Meghalaya). The same association is seen in the granitic rocks outcropping intermittently along the course of the river Brahmaputra from Tezpur to Goalpara.

The best development of these rocks, however, can be seen in the stretch of Khasi Hills between Hahim (25°51′N : 91°10′E) and Sonapahar (25°40′N : 91°4′E) where they exhibit a rich variety and also occupy relatively larger areas than in other parts of the region. Consequently, this part of the Khasi Hills may be considered as the type area for this group of rocks.

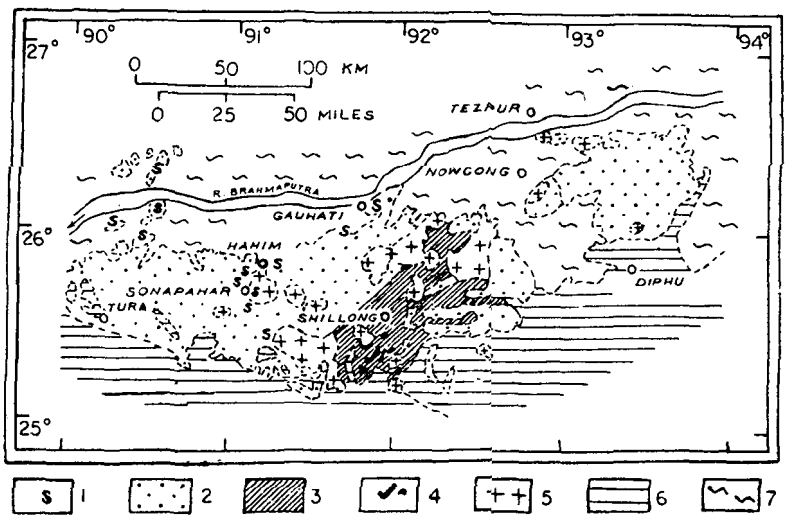

Figure 1. Geological sketch map of parts of Assam and Meghalaya (based upon the G.S.I. map, 1973)

Explanation: 1. Sonapahar Group, 2. Granite Gneiss, 3. Shillong Group, 4. Khasi Greenstone, 5. Granite, 6. Cretaceous and Tertiary rocks, and 7. Alluvium.

Within this type area, the best known place is Sonapahar which is a well-known name in Indian geology because of its commercially important sillimanite deposits and it would thus be most appropriate to name this group of rocks as the 'Sonapahar Group'.

The Sonapahar group includes mainly pelitic, semi-pelitic, basic, calc-silicate, and banded ferruginous rocks which have undergone medium (to high?) grades of regional metamorphism and which also show the effects of varying degrees of metasomatism.

Pelitic rocks, which are generally schistose, show besides quartz, feldspars and micas, garnet, cordierite, corundum and sillimanite. Staurolite and kyanite are notably absent. As is well-known, corundum and sillimanite occur abundantly in the form of commercial deposits around Sonapahar (25°40′N : 91°4′E). Epidote, hornblende, clinopyroxene, plagioclase, garnet, calcite and sphene in different combinations characterise the calc-silicate rocks, which are generally granulitic, while some

magnesia rich metasediments show minerals like cordierite, anthophyllite, sapphirine, spinel, etc. The banded ferruginous rocks (generally magnetite-quartz schists) contain irregularly seggregated quartz, iron oxides (mainly magnetite) as well as garnet and amphibole (Bhattacharjee and Barua, 1974). Included under the broad heading of 'basic rocks' are amphibolites and hornblende schists and gneisses with varying amounts of hornblende, clinopyroxene, biotite, plagioclase and quartz.

The rocks show schistose, gneissic, banded, granoblastic and porphyroblastic textures/structures.

Mineral assemblages, in most cases, suggest metamorphism under amphibolite facies conditions (cf. Banerjee, 1955; Gogoi, 1971; Mazumdar, 1971; Bhuyan, 1974). Some pyroxene granulites have, however, been mentioned (Krishnan, 1968, p. 134) and a hypersthene granulite has been described from the Mikir Hills (Ahmed, 1971). Thus, while the general grade of metamorphism of these rocks appears to be that of amphibolite facies, it is probable that somewhat higher grade conditions prevailed locally. Most of these rocks show mineralogical changes pointing to a period of diaphthoresis following the metamorphism.

Development of potash feldspar (microcline) interstitially replacing a number of other minerals, as well as in the form of porphyroblasts, is a common feature of many of these rocks. Other effects of granitisation include increase in the amount of quartz which also develops at the expense of most other minerals and the change from hornblende to biotite accompanied by a decrease in the anorthite content of plagioclase in the basic rocks.

Rocks of this group are quite different from those of the younger group—the Shillong Group. The latter are lithologically simpler—mainly psammo-pelitic, low grade (Green schist facies) metasediments—with a simpler metamorphic history. The present rocks, on the other hand, show much more lithological variation and evidences of a more complex metamorphic and tectonic history. Though the lithological distinction may not be always so easy in the case of some basic rocks of the present group and those of a younger stratigraphic unit—the Khasi greenstone, the latter, in general shows more relict minerals and/or textures indicative of its igneous parentage while the former lacks such features due to thorough recrystallisation and metamorphism.

There seem to be some common features between the Sonapahar Group rocks and those of the Older Metamorphic Group of the Singhbhum area of Bihar. Besides similarity in lithology and metamorphic grade (cf. Sarkar, 1968, p. 4), they also show a similar geologic set-up as, in both cases, the rocks mainly occur as isolated outcrops in a predominantly granitic and gneissic terrain. They are also the oldest recognised lithostratigraphic units in their respective areas.

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