

PETROLOGY AND GEOCHEMISTRY OF EARLY
PRECAMBRIAN CARBONATE ROCKS FROM
THE UMPAVALLI AREA, EASTERN GHATS,
INDIA AND THEIR COMPARISON WITH
ANTARCTICA (ABSTRACT)

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Precambrian granulite terrain of the Umpavalli area forms a portion of the Eastern Ghats province of the Indian Shield in between latitude 18°20'39" and 18°25'08" and longitude 82°54'07" and 83°04'43" in the Survey of India toposheet numbers 65J/15 and 65N/3. The granulite terrain of the Eastern Ghats province encompasses mainly khondalite and charnockite groups of rocks, and the Umpavalli area is one of the best areas to study the supracrustal rocks of the Precambrian.

The carbonate rocks (dolomites and marbles) and calc-silicate rocks are included in the khondalite group of metasediments. Other members of this group are garnetiferous and non-garnetiferous quartzo-feldspathic granulites/gneisses (leptynites and leptites), cordierite gneisses, quartz-K-feldspar-garnet-sillimanite ± graphite gneisses (khondalites) and quartzites. The Archaean carbonate and calc-silicate rocks often show sharp contacts and intrusive relationship with khondalites. The carbonate rocks sometimes show sharp contacts with calc-silicate rocks. Khondalite enclaves are observed in the carbonate rocks in several localities, and they preserve the original alignment or deformed and folded. Carbonate rocks are pegmatitic, banded and foliated. Occasionally, the rocks show flow lines and flowage.

In view of controversial reports describing intrusive carbonate rocks as metasediments and carbonatites of magmatic origin, the present study is aimed to evaluate the original parental material for these rocks. In this connection petrological association, mineral assemblages and geochemical criteria (major, minor, trace, REE, ⁸⁷Sr/⁸⁶Sr ratios) are taken into consideration to find out the parent material. Absence of certain essential features such as association of alkaline (feldspathoidal miassic) rocks, fenitization with the introduction of alkali pyrobole and diagnostic minerals (pyrochlore, baddeleyite etc.) makes it difficult to state the intrusive carbonate rocks as carbonatites. These carbonate rocks have usual metamorphic mineral assemblages (diopside, phlogopite, fluorapatite, forsterite, humite group of mineral(s), magnesian tourmaline, graphite, pyrite etc.) of marbles and dolomites. Abundances of Ba, Sr, P, Ce, La, Y and Zr in the carbonate show no marked collective enrichment and the elemental concentration comparable to those of limestones, marbles and dolomites. Further, Ce/La and Ce+La/Y ratios are not comparable to those of carbonatites and there is no marked enrichment of Y over Ce and La suggesting metasedimentary parentage for the investigated carbonate rocks. ⁸⁷Sr/⁸⁶Sr ratio (average value 0.7067) supports the metasedimentary origin for the carbonate rocks; this ratio is higher than the majority of the known carbonatitic occurrences (0.7035).

The investigated carbonate rocks on the whole can be regarded as allochthonous, as they show signs of displacement. This is the first report on allochthonous carbonate rocks from the Umpavalli area as well as from the Eastern Ghats province. The carbonate and calc-silicate rocks are considered originally associated with the basal strata of khondalites, and are prone to tectonic squeezing and diapiric rise during folding and refolding stages. The intrusive nature of the carbonate rocks may be due to their rheomorphic behaviour during metamorphic or deformational episodes. Hence, the carbonate rocks may be considered as tectonites rather than stratigraphic marker horizons.

$^{87}\text{Sr}/^{86}\text{Sr}$ vs. Al and Mn vs. Sr/Ca relationships show that the investigated carbonate rocks are similar to those of sedimentary carbonates from Archaean greenstone terrains. However, these rocks show higher radiogenic ^{87}Sr isotopic composition than that of Archaean mantle, contemporary seawaters and many Archaean greenstone carbonates, suggesting higher radiogenic strontium in the waters of the basin; perhaps it had been contributed from continents through rivers. The deviation of $^{87}\text{Sr}/^{86}\text{Sr}$ values of the investigated carbonate rocks from many Archaean sedimentary carbonates can also be explained in terms of second and higher order oscillations (in response to tectonic phenomena), superimposed on first order secular oscillations, which modulated the F_C/F_M fluxes around a given steady state (see J. VEIZER: *Rev. Mineral.*, **11**, 265, 1983).

These allochthonous carbonate rocks from the Eastern Ghats province can be compared with carbonaceous rocks (marbles) from Skallen in the polymetamorphic Lützow-Holmbutka region, East Antarctica (M. YOSHIDA: *J. Geosci.*, Osaka City Univ., **22**, 97, 1979). Here the marbles intrude granulite facies rocks similar to those from the Eastern Ghats province. Many workers have described marbles and calc-silicate rocks from East Antarctica, but geochemical data are scanty. Further geochemical data are necessary among Gondwana fragments to facilitate better comparison of carbonate rocks.

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