

association between their molecules is stronger than with water molecules so that strength of interaction decreases in these systems. This contention receives support from the Gruneisen parameter and excess internal pressure values for the same systems evaluated by Murthy *et al*^{1,2} using thermal pressure coefficient and isothermal compressibility data.

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OCCURRENCE OF SKARN ROCKS IN THE CHAUR AREA, HIMACHAL HIMALAYA, INDIA.

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THE Jutogh metamorphites, exposed in the Himachal Himalaya, form a large thrust sheet resting over the Chails in the Simla Hills and Chaur Mountain. In the Chaur area, south-east of Simla, the Jutogh consists of

metasediments with occasional bands of marble/crystalline limestone and are associated with gneisses and granite which are traversed by metabasic sills and dykes. The granite occupies the top of the Chaur Peak. The metasediments together with the carbonate rocks belong to greenschist and amphibolite facies and show Barrovian type of metamorphism reaching upto sillimanite-muscovite zone of Turner¹.

The carbonate rock in the high-grade zone is metasomatically transformed into skarn rocks which outcrop along Sarpat nala and at other places in sillimanite-bearing pelitic schist intimately associated with gneisses. It is about 20–60 feet in thickness and often intensely folded. The typical skarn is heavy, medium-grained, dark green to pinkish in colour. The green and pink colours are mainly on account of clinopyroxene and garnet together with a little amphibole with or without sphene and epidote. This rock has been misidentified as eclogite by Srikantia *et al*² and later redesignated as calc-silicate by Bhargava and Chopra³ on the basis of grossularite instead of pyrope garnet. A detailed petrographic and chemical study of these rocks, especially electron microprobe data, revealed that the rock reported as eclogite consists of hedenbergite ($\text{Ca}_{0.446-0.510} \text{Fe}_{0.433-0.442} \text{Mg}_{0.035-0.136} \text{Mn}_{0.003-0.008} \text{Si}_{0.964-1.015} \text{O}_3$), ferrohastingsite (100 Mg: Mg + Fe²⁺ + Mn 5.77–13.88) and grossular (48.64–65.02 mol. %)-almandine (32.65–49.84 mol. %) garnet and subordinate calcite with or without sphene, epidote, quartz, microcline, plagioclase, etc. Some such rocks essentially consist of clinopyroxene, grossular-almandine garnet with little calcite and amphibole, are surrounded by banded rocks; the dark bands being rich in amphibole and scarce in clinopyroxene while the light bands consist of epidote, quartz, calcite, sphene, scapolite, k-feldspar, plagioclase and sometimes garnet. This rock is highly variable in mineral constituents in volume percentage. Such rocks are dominant in amphibole and contain garnet while others are scarce in amphibole and rich in epidote, clinozoisite, quartz, sphene and calcite. Srikantia *et al*² seem to have designated some of these rocks as pyroxenite and garnetiferous amphibolite.

Despite a considerable iron enrichment in the skarn, relative to the original carbonate, iron oxides are absent from the skarn of the Chaur area. Garnet and clinopyroxene are replaced by symplectic intergrowth of iron-rich amphibole, calcite and quartz and the amphibole shows replacive relation with calcite. It also replaces epidote and scapolite replaces plagioclase. In a

* Total iron as Fe²⁺

few specimens of banded skarn there is evidence of amphibole replacing biotite which may have been derived from metapelitic rocks in which it interbeds. The biotite is otherwise extremely rare in the skarns of the area.

The skarn is generally believed to have been formed as a result of metasomatic interaction between magmatically derived fluids and carbonate rocks^{4,5}. However, formation of skarn by other processes such as diffusion, infiltration, direct marble-metasedimentary rocks reaction etc are also reported⁶. The absence of sequential monomineralic bands adjacent to marble and non-existence of the latter do not support diffusion hypothesis. Development of skarn by direct carbonate-pelite reaction is also not feasible on the chemical, mineralogical and field characters. The predominance of hedenbergite, ferrohastingsite and grossular-almandine needs high iron (ferrous) source and the released calcium from the carbonate rock during skarn-forming process does not show expanding skarn zone in the study area as reported from Garnet Hill by Brock⁶. Further, the skarns are in very close proximity of the gneisses and the occurrence of calc-hornfels is also not reported indicating direct metasomatism of the calcareous rocks in contact with Chaur granite. The mineralogy of the skarn, presence of Ca-bearing phases such as epidote, sphene and hornblende in the proximity of gneisses and metasediments, absence of characteristic banding suggest transport of the elements Si, Al, Mg and Fe through moving fluids derived from magmatic source giving rise to infiltration skarn in the terminology of Korzhinskii⁷. The predominance of hedenbergite, ferrohastingsite and grossular-almandine garnet indicates ferrous-dominated skarn. This is also evident from the whole rock chemistry of skarn in which Fe_2O_3 ranges from 0.66 to 3.59 and FeO from 2.26 to 21.22 attesting to the fact that the skarns were produced in a relatively low fO_2 environment.

Calc-silicate and marble are reported from many parts of Himalayas but the occurrence of skarn rock in Himalayas in general and Chaur area in particular is not known. Hence this report is very significant as it records the first skarn deposit in Himalayas which has been misidentified as eclogite.

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PEARSON DISTRIBUTION OF NITROGEN-FIXING POTENTIAL AMONG *NOSTOC* STRAINS

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BIOLOGICAL nitrogen fixation in natural or agricultural ecosystems is rarely limited by a lack of nitrogen-fixing micro-organisms. Nevertheless, very little nitrogen is fixed in nature. Apart from the ecological stresses, the efficiency of the strains themselves may play an important role. The present communication deals with the frequency distribution of nitrogen-fixing potential (acetylene reduction) of 86 strains of *Nostoc* belonging to 14 species complex.

All the strains were grown in Fogg's nitrogen free medium¹ supplemented with A_5 solution² under a constant temperature of $30 \pm 1^\circ\text{C}$ and illumination of 2,000 lux.

Acetylene reduction activity (ARA) was measured using a gas layer chromatograph (Nucon Model 5500) with a Porapak R column³. Acetylene equal to 10% of the total volume was injected and the vials were incubated for 90 min at 30°C under 2,000 lux. The reaction was terminated by injecting 0.1 ml TCA (50%) and the gas phase was analyzed for ethylene.

Table 1 shows the range of ARA values among 14 species complex. The overall range of variation was from 0.03 to 6.19.

Table 2 groups the ARA values in the form of frequency distribution with unit ARA value as the class