It is premature to comment on the actual brominating agent in this reaction with the present data—it is certainly not free molecular bromine; Harrison (*loc.cit*) is of the opinion that Br_2 even if formed would be converted into H_2O Br in strong sulphuric acid which would be the brominating agent.

$$Br_2 + H_3O^{\oplus} \rightarrow H_2O^{+}Br + HBr$$

Further work on the elucidation of the mechanism of this reaction is in progress.

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THE FIRST RECORD OF EARLY STONE AGE TOOLS OF MAN FROM GHUMARWIN, HIMACHAL PRADESH

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HARITALYANGAR area of Ghumarwin in the district Bilasput (Himachala Pradesh) is well known for fossils of the earliest hominoid ancestors of man but stone tools of palaeolithic man are not reported so far from this and other adjoining areas. The present author discovered the first evidence of stone tool[1] (see Figure 1) during July 1979 but subsequently recovered some more tools (Figure 2, 3, 6 & 13 to 15) during a search for hominoid fossils in the years 1980 and 1981. It was however, only very recently (February 1982) that the author recovered a large number of stone tools and artefacts some of which are illustrated in the figure (Figure 4, 5 & 7 to 12). The present communication is the first report of these findings from Ghumarwin area and is significant as it provides an intermediate bridge between the two well known prehistoric sites of Himachal Pradesh, *viz* the Beas–Banganga valley in Kangra[2-4] and the Sirsa Valley in Nalagarh[5].

The stone tools were recovered near Baron, west of Bhapral (No. 1), Kasohal (No. 2), Tarauntra (nos. 3 & 6) and the rest near Lehri Sarail. The latter locality has yielded a large number of artefacts and discarded chipped pebbles. The tools were recovered from slopes of the Sivaliks in the vicinity of the *choes* which meet *Sir Khad*- a tributary of the Sutlej. Typologically

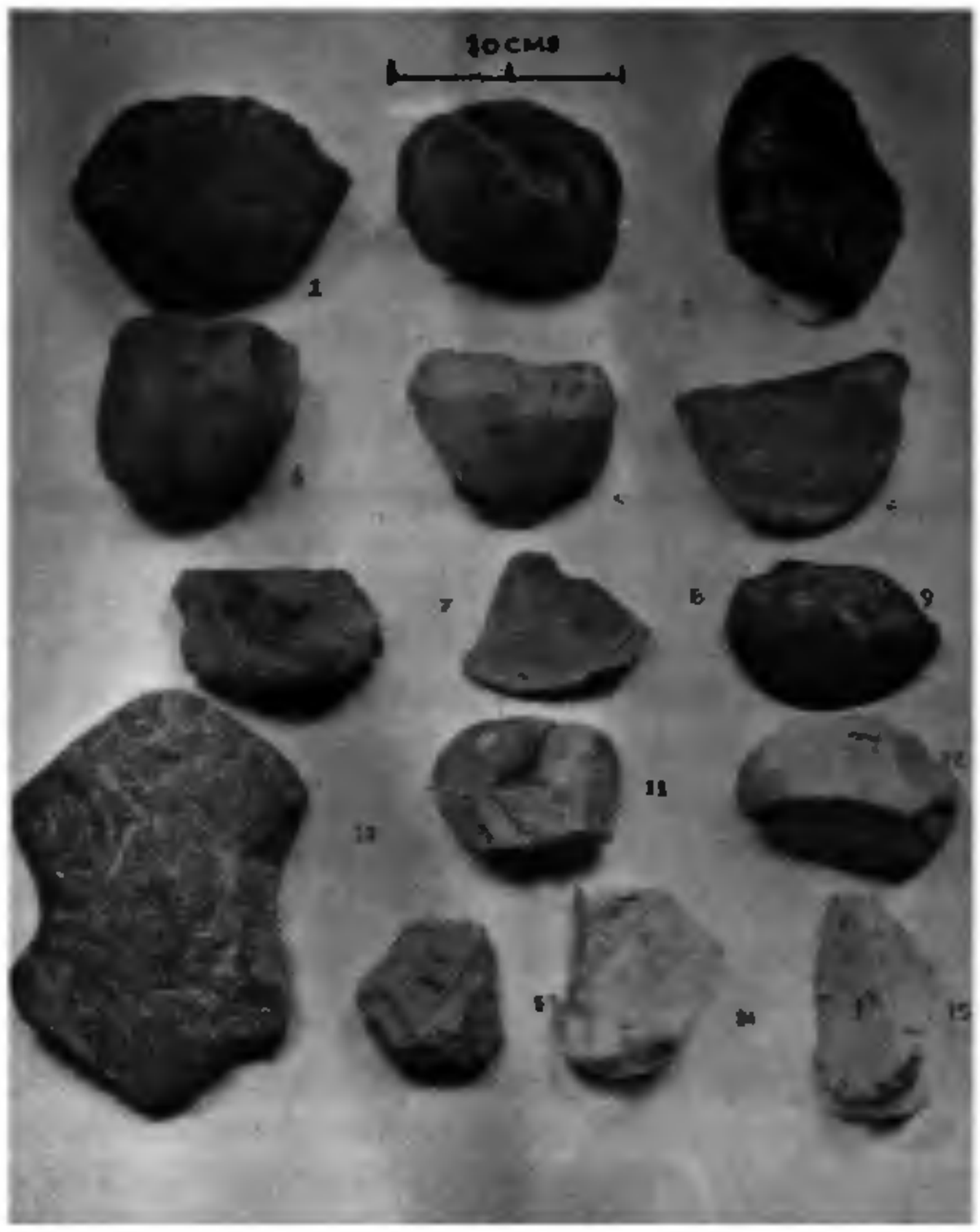

Figure 1 to 15 Early Stone Age Tools from Ghumarwi.

the implements sampled as chopper–chopping tool or bifacial chopper (No. 1), choppers (Nos. 2 to 4), cleaver (No. 10), and several cores and flakes which could serve as scraping devices. Except a few chert cores and flakes (Nos. 13 to 15) recovered from Lehri Sarail, all tools are made with quartzite pebbles. Multiple scars of free primary flaking are noticeable on the tools with minor retouching in some cases.

Typo-technologically the present findings are comparable with the Beas–Banganga tools and equatable to the Early Soanian pebble tradition of Potwar region. The present evidence reveals a continuously southwardly movement of Soan Man through the sub-Himalayan terrain. Detailed studies of the tool collection and more systematic investigation of the area are contemplated for further details.

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A NOTE ON FLUORINE IN BIOTITE FROM A GRANITE-BIOTITE SCHLIEREN SUITE OF SIKKIM

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CHEMICAL affinity between various members of a migmatite suite has been amply demonstrated for metal ions[1]. However, very little is known on the behaviour of volatiles during migmatization. This is surprising in view of their role, especially that of fluorine, in petrogenesis[2]. Substitution of OH^- by F^- in hydrous silicates such as micas and amphiboles accounts for most of the fluorine content of the rock[3]. A study on the chemical behaviour of fluorine in biotite during metamorphism and migmatization in West Sikkim, has been described in the present note.

The samples are from three localities within a migmatite terrain in the vicinity of Soreng, West Sikkim. A high grade sequence (Darjeeling Formation) consisting of foliated granite alongwith kyanite, garnet and biotite schists, biotite schlieren, quartzite and amphibolite characterize the area. The geologic setting is similar to that of the other Himalayan migmatite areas[4-6].

Both granitic and the schistose rocks maintain parallelism of foliation and their contacts are gradational. Many comparatively thin schist beds and numerous biotite schlieren are present within the granite. Granophyric intergrowths of quartz and feldspar, their segragation in discontinuous bands and the occurrence of kyanite in the *paleosome* indicate a very high temperature environment?

TABLE 1

Some physical and chemical characteristics of the biotites of the present study

Sample No	Source Rock	Specific Gravity	*doo5* (A°)	F-Content (ppm)
SG1/2	Foliated Granite	3.34	2.02989	1400
SG7/36	Foliated Granite	3.52	2.00770	1260
SG1/1	Biotite Schlieren	3.30	2.00770	1260

Fluorine determinations were made on pure biotite fractions obtained by means of conventional mineral separation techniques. An Ionically Selective Electrode (Crytur, 09-17) was used alongwith a *pH* metre for making measurements. Comparison was made with a series of standard solutions of NaF with concentrations from 10^{-1}M up to 10^{-6}M. The sensitivity of the instrument was 1ppm. The results are presented in table 1.

The biotite samples have similar values of specific gravity, *doo5* spacings and also similar optical properties. The close resemblance between F values of table 1 can be explained when geologic setting of the sample source is considered together with the geochemical behaviour of halogens. The foliated granite and biotite schlieren, from which present determinations have been made, are believed to have a common sedimentary origin and have arisen during a stable thermal regime[8]. Initially all halogen species must have been present as pore fluids in sediments. Part of the halogens later on would get fixed by substitution for hydroxyl in hydrated minerals such as mica. The halogen content of a given mineral, should be characteristic of a given environment. According to Fyfe *et al*[9], who have discussed the behaviour of halogens during metamorphism at high temperatures, the reactions will involve molecular species of halogens instead of ionic.

Under such circumstances, fluorine will have the tendency to remain in the solid phase. Hence original constancy in F values of biotite is bound to be retained within a given environment. The data of the present study shows close similarities, confirming the above assumptions about the conditions of migmatization and nature of behaviour of fluorine.

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