Table 1. Whole rock analyses (wt%) of representative rock samples from Jasra, Karbi-Anglong District, Assam

Rock type	SiO_2	Al_2O_3	FeO	Fe_2O_3	TiO_2	MnO	P_2O_5	Na_2O	K_2O	CaO	MgO	H_2O	LOI
Syenite	61.87	15.82	1.76	3.63	0.81	0.08	0.22	5.20	5.76	2.30	1.14	0.16	0.52
Nephelene syenite	50.86	18.86	1.58	5.51	1.05	0.19	0.03	8.66	7.49	2.62	0.57	0.16	2.58
Fenitized syenite	58.40	11.67	1.80	7.99	1.25	0.14	0.19	3.20	5.47	5.82	1.93	0.12	0.45
Olivine gabbro	44.00	10.40	10.33	4.87	4.57	0.23	0.21	2.89	1.13	12.41	8.77	0.08	0.04
Pyroxenite	38.82	8.68	6.57	8.26	7.06	0.26	0.47	2.60	1.60	19.74	4.47	0.12	0.49
Pyroxenite	33.82	9.92	6.25	10.62	6.69	0.34	0.39	3.47	2.14	19.80	5.92	0.26	1.17
Titano magnetite rock	0.83	9.83	18.14	21.96	20.83	0.46	0.02	1.16	0.06	18.03	5.37	0.23	2.62
Titano magnetite rock	16.17	8.02	5.96	19.19	30.68	0.07	0.02	1.44	0.05	12.81	4.11	0.14	1.05
Hornblende andesite	60.7	17.5	1.65	3.73	1.05	0.19	0.17	7.31	4.52	2.2	0.81	0.09	0.13
Trachyte	47.33	12.83	4.56	11.7	4.87	0.38	0.51	2.60	0.95	21.17	4.21	0.15	1.15

Analysed by conventional wet chemical procedure.
Analysts: Adarsh Kumar, AMD, Shillong.

i.e. basic centre to sub silicic/silicic margins. (ii) The occurrence of prominent alkali gabbro bodies running parallel to the boundary of the complex. (iii) The presence of gabbroic layers in pyroxenites. (iv) The presence of layers and lenses of titano-magnetite in pyroxenites as manifestation of magmatic sedimentation in a magma chamber and (v) The presence of macroscopic and microscopic layering in pyroxenites.

Rare metal (niobium and thorium) and rare earth element potentialities related to the complex include magnetite, ilmenite, perovskite and thorium-bearing minerals. The titano-magnetite on an average contains 26.17% FeO, 43.42% TiO_2, 0.07% ThO_2 and 2468 ppm of niobium. Soil cover over this lithounit approximately contains 8053 ppm of total rare earth elements. Ubiquitous sulphide mineralization, occurring as dissemination, veins and fracture fillings in pyroxenites was also noticed. The sulphide minerals identified include pyrite, chalcopyrite, bornite and covellite.

The Shillong Plateau–Mikir Hills massif is studded with atleast four alkaline-carbonatite complexes viz. Sung Valley[2], Samchampi[3], Darugiri[4] and Swangkre[5]. The alkaline-carbonatite magmatism in this region belongs to two distinct episodes during Late Jurassic (156 ± 16 Ma[6]; 149 ± 5 Ma[7] and 105 Ma[8]), a period marked by crustal upheaval resulting in the rifting and fragmentation of the Gondwanaland and the northward drifting of the Indian Plate, after being separated from Antarctica.

In view of the similarities in geological setting and regional tectonics together with petromineralogical attributes of the Jasara complex with the other known alkaline-carbonatite complexes in the Shillong Plateau, this newly discovered alkaline complex seems to represent a part of the widespread alkaline magmatism which took place during the Jurassic period.

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Epithermal stratabound barite mineralization around Doon Valley

Rajesh Sharma and H. K. Sachan
Wadia Institute of Himalayan Geology, Dehra Dun 248 001, India

Fluid inclusion studies on barite mineralization suggest a temperature of deposition at 100° to 140°C for the parent hydrothermal fluid, with a salinity range 9 to 14 wt.% NaCl equiv. and density around unit value. The field, petrographic and inclusion studies show a stratabound epithermal nature for this mineralization.

The barite mineralization located in the Tons valley and in the Song valley (Sirmaur Dist., H.P. and Dehra Dun Dist., U.P.) occurs within the Proterozoic Nagthat

Quartzite Formation of lesser Himalaya. This mineralization was reported in 1985 by Nagar and Rawat[1]. The host Nagthat Formation, constitutes an integral part of the Krol belt succession[2] and represents the uppermost litho-unit of the late Proterozoic Jaunsar Group. The rocks overlie the phyllites of Chandpur Formation while Blaini conglomerate rests over the Nagthats. The Nagthat Formation forms a part of broad syncline (Nagthat–Pauri syncline), exhibiting open asymmetrical to symmetrical folds[3]. The barite mineralization occurs in the form of veins, pockets and stringers. The barite veins in Tons valley are upto 5 m thick whereas in the Song valley, they are only a few inches thick. The barite veins are found in shear zone along bedding joints and in fractures in the Nagthat Quartzite. The pockets of barite are common at both places. Mineralization shows typical epigenetic discordant field textures. Barite is found replacing the host quartz along cleavage planes and along grain boundaries showing cleavage and rim-type structure (Figure 1). A few wall rock alterations are also noticed in Tons valley where chlorite, sericite and talc are observed along the margins of barite veins and pockets. The forms of barite vary from fine-grained massive to tabular crystalline and occasionally fibrous variety. The mineral does not show any deformational feature.

The fluid inclusion studies of these barite samples have been conducted to find out the nature of mineralizing fluid. The inclusion characters of these two occurrences, i.e. Tons and Song Valleys near Dehra Dun, are similar and do not exhibit any change in fluid composition and depositional temperature conditions. The inclusions present in these samples are genetically classified into two types following Roedder[4].

(i) Primary biphase liquid-vapour inclusions classified as Type I inclusions. They are isolated, subrounded to irregular in shape and commonly 5 to 10 μ in size. These inclusions consist of 90% liquid and 10% vapour by volume (Figure 2).

(ii) Secondary biphase liquid-vapour inclusions are classified here as Type II inclusions. They occur in trails and in fracture planes cutting across the boundary of barite grains. These are very small (2–5 μ), subrounded and consist of liquid 95% and vapour 5% by volume.

It is considered that the primary Type I inclusions entrapped the parent fluid which was involved in barite deposition. Thermometric experiments were carried out using USGS gas flow heating-freezing system. Their homogenization occurs at a temperature range of 100° to 140° C into liquid phase (Figure 3). The final ice melting temperature in these inclusions range from –5° to –11°C, which corresponds to a salinity of about 9 to 14 wt.% NaCl equivalent[5,6]. The average density of this fluid estimated using temperature and salinity values lies around the unit value (0.99 to 1.05 g/cm^3)[7]. Though the bubble movement is common in a few inclusions, their compositional and thermometric data suggest that they entrapped the fluids of single generation. The pressure correction to the temperature of homogenization would be insignificant for low-temperature low-saline inclusions[8]. Hydrostatic pressure around 500 bars for such cases would result in a pressure correction of about 10 to 15° C higher than the observed temperature of homogenization[9]. Thus the temperature of homogenization may represent the temperature of deposition.

Type II inclusions homogenized at relatively low temperatures (60 ± 10° C) into liquid phase. These inclusions entrapped a late meteoric water which is indi-

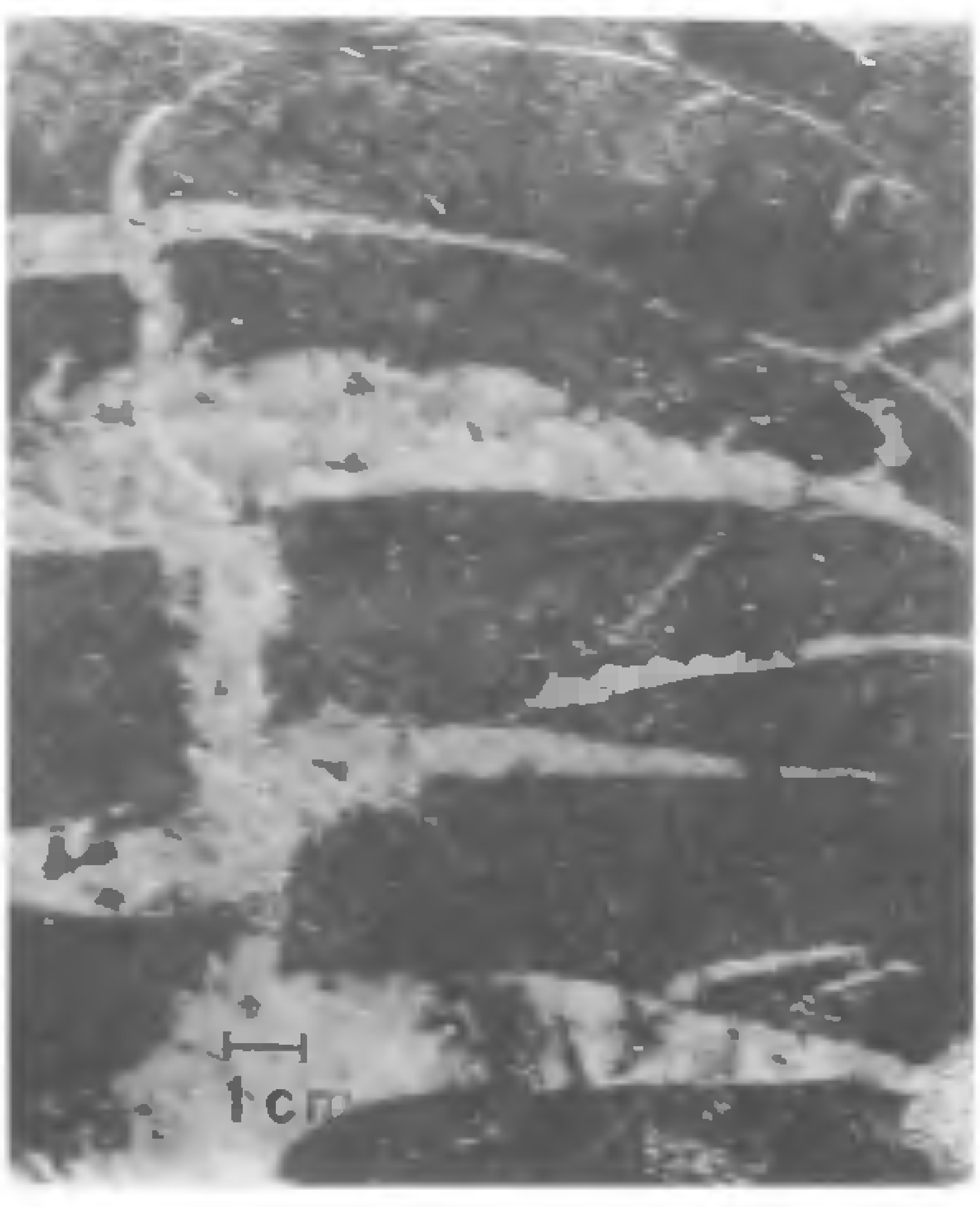

Figure 1. Barite veins showing typical fracture filling and rim type structure cross cutting host Nagthal quartzite in Tons valley.

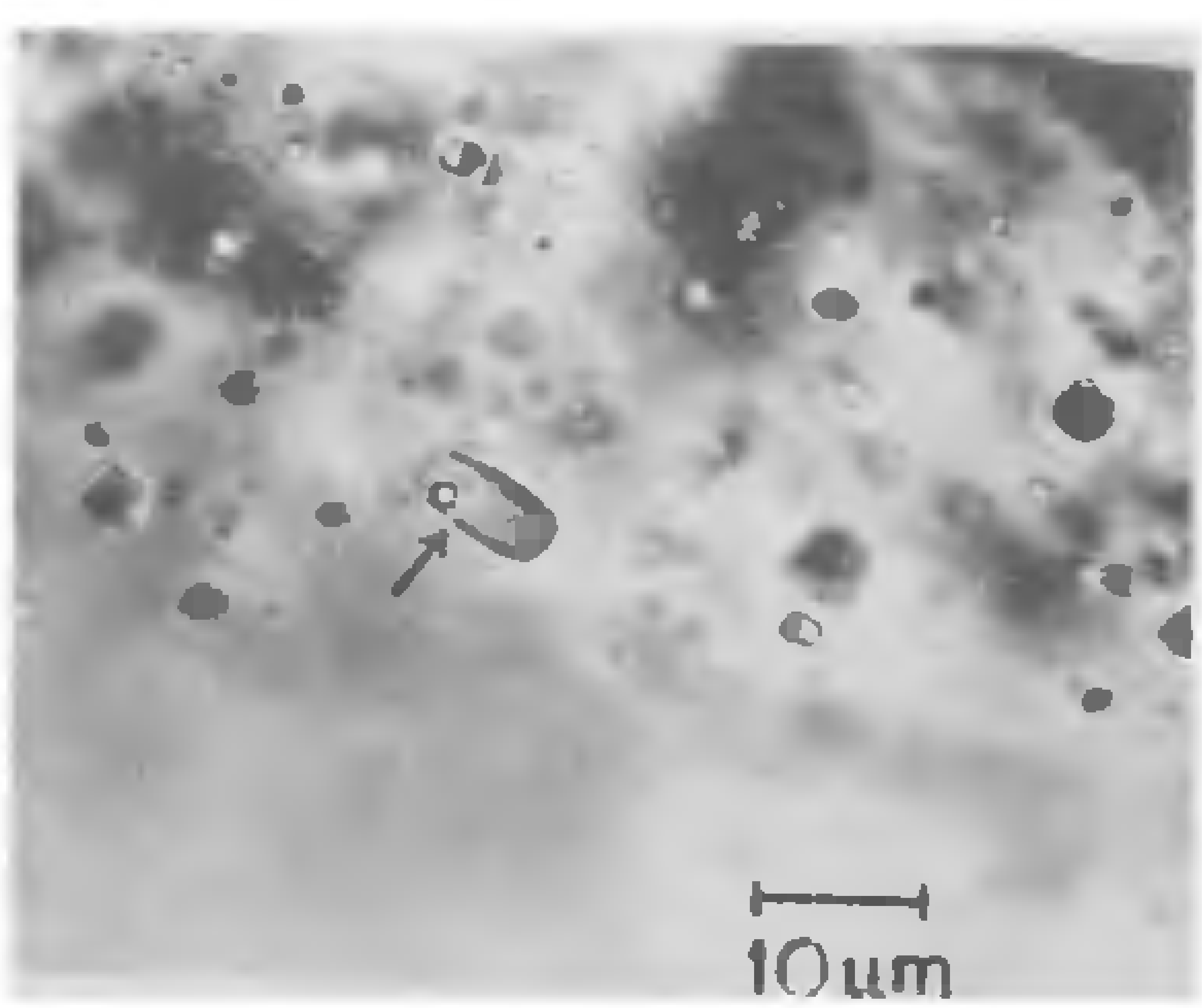

Figure 2. Biphase liquid vapour primary (Type I) inclusion in barite

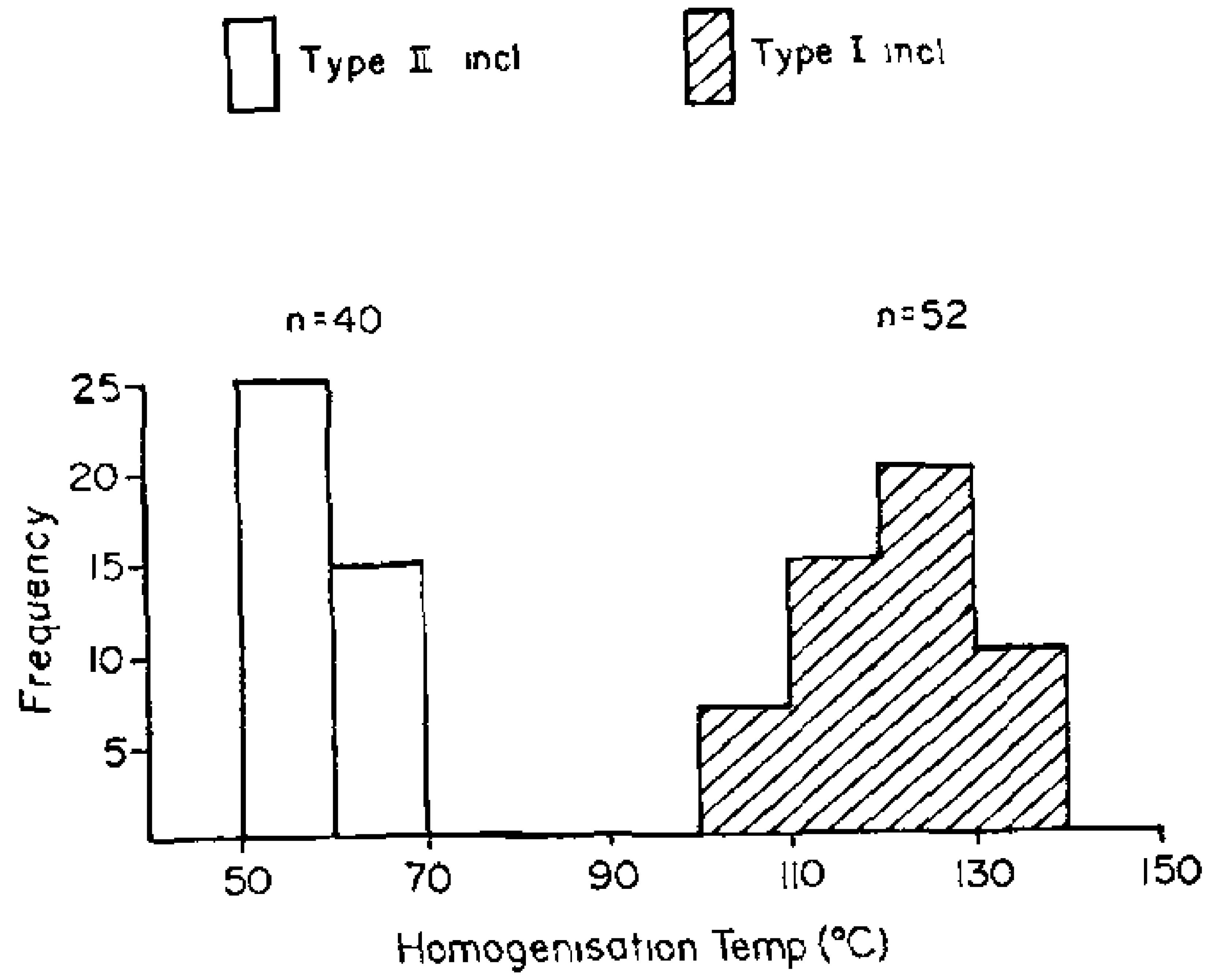

Figure 3. *Histogram showing trend of homogenization in Type I and Type II inclusions.*

cated by their mode of occurrence in the healed fractures and low homogenization temperature range (Figure 3).

The compositional and thermal data of fluid inclusions when compared with those from other genetic types of barite deposits[10] suggest that the present mineralization broadly corresponds to epithermal and stratabound type deposits. The results of this study are consistent with the inclusion data from limestone-hosted epithermal Pb–Zn deposit where barite is associated[11]. The mineralizing fluid, characterized by low temperature ($125 \pm 15°$ C), low salinity and moderate density is also in support of its epithermal nature. A combination of field and petrographic evidences also suggest the epigenetic nature of this mineralization. The wall rock alteration substantiates a low temperature for the hydrothermal fluid. As mineralization is restricted to the Nagthat quartzite horizon, the source of mineralizing fluid appears to be local. This study emphasizes the role of low-temperature epithermal fluids in ore deposition, and classifies the Doon Valley barite mineralization as stratabound epithermal type.

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An assessment of the rare metal potential of the granitoids of Siwana, Jalor, Jhunjhunu and Tosham, North Western Peninsular India

Ramanathan Baskar*[†] and Rajni Sharma

*Wadia Institute of Himalayan Geology, 33 General Mahadeo Singh Road, Dehra Dun 248 001, India
Centre of Advanced Study in Geology, Panjab University, Chandigarh 160 014, India

The rare metal contents of the plutons of Siwana, Jalor, Jhunjhunu and Tosham have been assessed. The peraluminous Tosham and Jhunjhunu granites are of high mineral potential, the peralkaline Siwana granites are also of high mineral potential whereas the metaluminous to peraluminous Jalor granites are of low mineral potential. According to the extant petrological, mineralogical and geochemical criteria, the Siwana granites are classified as rare metal granitoid of 'agpaitic' type, the Tosham and Jhunjhunu granites as 'plumasitic' type and the Jalor granites as 'calcic' type.

[†]For correspondence

METALLOGENETICALLY specialized felsic plutonic rocks are those having a spatial and genetic association with ore deposits of rare elements such as Be, Cs, F, Li, Mo, Nb, Rb, Ta and W. They are distinguished from ordinary felsic plutonic rocks by a number of gelogic, petrographic and chemical pecularities, the most obvious being the commonly enhanced contents of Be, F, Li, Mo, Nb, Pb, Rb, rare-earth elements (REE), Sn, Ta, Th, U, W, Y, Zn, and / or Zr[1]. It may be emphasized here that these criteria cannot be used individually to characterize