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Fluid inclusion studies on fluorite from Chumathang, Ladakh Himalaya

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Abstract

Study indicates low salinity and moderate density for the ore forming fluids responsible for the fluorite. The temperature of homogenisation (120°C to 150°C) in different coloured fluorites indicate that the mineralization is of epithermal type.

Introduction

Fluorite mineralization from Chumathang was first discovered by geologists of the Atomic Minerals Division of the Department of Atomic Energy in 1973 during Puga multipurpose project investigations (Waza *et al* 1977). A preliminary account of the fluid inclusion studies, carried out on the fluorite and quartz from fluorite-bearing pegmatites is presented here (Fig. 1.).

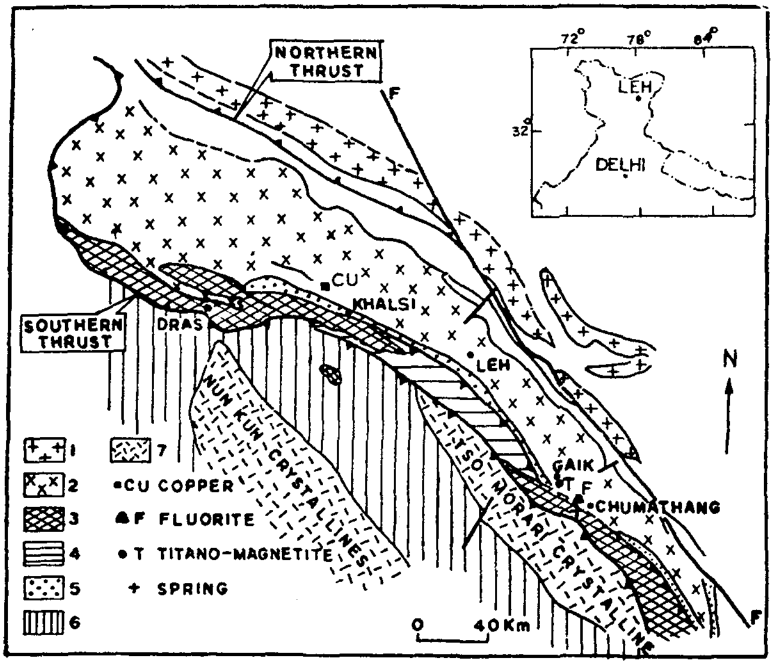

Figure 1. Geological map of the Ladakh Himalaya (after Sharma, 1982). 1–Karakoram Granitoids; 2–Ladakh Granitoids; 3–Indus Volcanics, ophiolitic melange and deep marine sediments; 4–Indus flysch; 5–Indus molasse; 6–Tethyan sediments; 7–Crystallines.

Fluorite Mineralization

Fluorite mineralization in Chumathang is in the form of quartz-fluorite veins cutting across granitoids and shale-sandstone-grit unit of the Indus Flysch. The mineralized veins strike NE-SW with southerly dips (high angle) and are exposed along the southern slope of the ridge to the northwest of the hot springs. These mineralized veins vary from 1 cm to 1 metre in width and fluorite occurs as cubes of white, green and yellow colour in the core while towards the margin it is generally massive. Textural studies indicate that fluorite crystals have replaced the earlier formed quartz and feldspar of the marginal zone of pegmatites. The sequence of crystallization is:

early quartz→white fluorite→green fluorite→yellow fluorite→late quartz.

Fluid Inclusion Studies

Doubly polished plates of transparent crystals of fluorite were used for normal petrographic observations. Cleavage flakes parallel to (110) and (111), devoid of fractures, were used for homogenization studies. Primary, pseudosecondary and secondary inclusions were distinguished. Typical primary inclusions were used for detailed thermometric observations using Leitz heating stage calibrated with melting point standards (Table I).

TABLE I. Data on fluid inclusions of fluorite and quartz from Chumathang.

I *Petrographic Observations:*

Mineral	Colour		Abundance (n/mm^3)	Size (M)	Density (gm/cm^3)
Fluorite	White	P	19	60	
		Ps	57	N.D.	0.8–0.6
		S	5	25	
	Green	P	10	50	
		Ps	67	N.D.	0.9–0.6
		S	2	25	
	Yellow	P	12	50	
		Ps	43	N.D.	0.9–0.75
		S	3	20	

II *Thermometric Observations:*

Mineral		* Homogenization Temp. (0°C)			State of Homogenization
Early quartz			360–380		Liquid
Fluorite		White	Green	Yellow	Liquid
	P	145–149	130–135	124–129	
	Ps	137–140	125–128	120–125	
	S	70–80	70–80	70–80	
Late Quartz			100–106		Liquid

P=Primary, Ps=Pseudo-secondary,

S=Secondary, N.D.=Not determined.

* =Homogenization temperatures are uncorrected for pressure and therefore indicate lower limit of temperature of formation.

The temperature was regulated with auto-transformer and the rate of increase was kept 2°C/Min. to minimise the thermal lag. Primary inclusions show negative crystal shape and are biphase (liquid and gas) in nature.

Conclusions

Studies indicate that fluorine-rich fluid phase concentrated in the core part of the pegmatite and reacted with early formed quartz (360°C-380°C) and feldspars of the border zone. The large size of fluorite crystals and presence of negative crystal shape of primary inclusions indicate slow movement of the ore fluid and post deformation crystallization. Absence of daughter crystals and a biphase nature of inclusions further suggest that salinity of the fluid was below saturation limit. Various coloured fluorites were formed in successive stages with decreasing temperature (150°C to 120°C) and late quartz crystallized in voids during waning phase at a low temperature around 100°C.

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