SHORT COMMUNICATION

EXTREMELY H_2-RICH FLUID INCLUSIONS IN ECLOGITE FROM DABIE SHAN OROGENIC BELT, EASTERN CHINA

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The eclogites in the Dabie Shan terranes have recorded the physico-chemical properties of crustal materials which underwent the Triassic ultra-high pressure (UHP) metamorphism at mantle depths. Identification of coesite and micro-diamond in different eclogite localities of the region (Okay et al. 1989; Wang et al. 1989; Xu et al. 1992) demonstrates that supracrustal materials can be subducted to mantle depth of at least 120 km. This paper reports extremely rich H_2-bearing fluid inclusions from UHP eclogites from the Dabie Shan orogenic belt.

Fluid inclusions in coesite-bearing eclogites were studied by Yang et al. (1999) in detail. At least five types of fluid inclusions can be identified by microthermometry and Laser Raman Spectroscopy: (1) pure N_2; (2) highly saline brine; (3) CO_2 ($\pm N_2 \pm CH_4$); (4) mixed CO_2-H_2O; (5) low-salinity aqueous inclusions. The high H_2-bearing fluid inclusion is observed in type (3) above, which is a pure gaseous phase. Table 1 gives the chemical compositions of fluid inclusions in eclogite samples from Dabie Shan orogenic belt by Laser Raman Spectrometry (U1000 type from France), from which it becomes apparent that we are dealing with an extremely rich H_2-bearing (48.98%) fluid inclusion.

We also obtained the $\delta^{13}C$ values of CO_2 of the sample derived from step-heating decrepitation approach in different temperature-releasing ranges (Table 2). The two high-temperature ranges of 700-900°C and 900-1100°C give $\delta^{13}C$ values of -6.30‰ and -15.10‰, respectively. The carbon isotopic results show the characteristics of admixture of crustal and mantle fluids (Hoefs, 1987).

Two possible reasons responsible for the origin of the high content of H_2-bearing fluid inclusions are proposed: (1) the interaction of methane (CH_4) with water (H_2O) can produce H_2 at high temperature conditions that prevail in eclogite facies (Baker et al. 1997); (2) H_2 may come from the hydroxyl in nominally anhydrous minerals (e.g., pyroxene, rutile and garnet) in eclogites since hydroxyl ions can occur in the crystal structure of pyroxenes derived from mantle (Martin, 1972).

The present results are of great significance in providing new geochemical insights that have a direct bearing on understanding the crust-mantle interactions during various geodynamic process (like plate subduction, breaking-off and exhumation) in the Dabie Shan orogen.

Table 1. The chemical compositions of fluid inclusions in eclogite samples from Dabie Shan orogenic belt, Eastern China

Sample No.	Location	Gaseous phases				
		CO_2	H_2S	CH_4	O_2	H_2
C11251	Maowu	8.3	12.6	22.0	8.2	48.9

Table 2. Carbon isotopic composition of CO_2 inclusions in eclogites by step-heating technique, Eastern China

Sample No.	390-500° C	CO_2content	500-700°C	CO_2content	700-900°C	CO_2content	900-1100°C	CO_2content	ΣC	
		mmHg		mmHg		mmHg		mmHg	$\delta^{13}C$	ΣCO_2
	$\delta^{13}C$ (‰)		$\delta^{13}C$ (‰)		$\delta^{13}C$ (‰)		$\delta^{13}C$ (‰)		(avg ‰)	(mmHg)
C11251	-10.90	3	-6 70	15	-6.30	11	-15.10	28	-9.75	57

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