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Characteristics of hydrocarbon inclusions from oil and gas fields.

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The hydrocarbon inclusions which mainly consist of oil and gas have occurred in the petroleum fields, and have been used for the petroleum exploration as the actual evidence showing the presence of oil and gas like their footprint, and as a material in organic geochemistry. The authors have been examining the occurrence, distribution and microthermometry of hydrocarbon inclusions obtained from oil and gas fields in Japan (Okubo, 1998; Okubo et al, 1999). In addition to them we have attempted to analyze the hydrocarbons in fluid inclusions by using an on-line system developed by JNOC in 2002.

Hydrocarbon inclusions, in general, consist of vapor (gas) and liquid phase like aqueous inclusions. They sometimes consists of solid phase like bitumen or asphaltane. According to the author's experience, water-bearing hydrocarbon inclusions are rare.

Hydrocarbon inclusions can be divided into two types; one is homogenized into liquid phase and another is homogenized into vapor phase while they are heated. They are termed oil-type inclusions and condensate-inclusions respectively.

The homogenization temperature of hydrocarbon inclusions can change after they are trapped in the mineral, if the surrounding temperature is high enough to crack their hydrocarbons thermally (Okubo, 2006). Actually, it has been observed in the oil and gas fields in Japan that the homogenization temperature is far lower than that at the depth, and tends to be lower as the horizon is deeper. These facts should result from the thermal cracking on the hydrocarbons in inclusions.

The distinction between the hydrocarbon inclusions and aqueous inclusions can be made by means of ultraviolet light, because oil emits fluorescence when it is illuminated by ultraviolet light. It is also useful as the non-destructive, reproducible and rapid method to examine the fluorescence spectroscopy of hydrocarbon inclusions.

Meanwhile, the hydrocarbon inclusions without aromatic components do not show fluorescence. These types of hydrocarbon inclusions are often colorless and transparent, and have only single phase at the ordinary temperature, so that they seem empty. In this case, they become two phases while cooled if they are hydrocarbon inclusions.

The volume of hydrocarbon inclusions was so small that the analytical methods were highly restricted. The author tried to develop the method in the JOGMEC project study held from 2004 to 2007. Then the analysis of gas components and its carbon-isotope components in hydrocarbon inclusions has succeeded. In this method, the Laser Micropyrolysis Gas-Chromatograph Mass-spectrometer (LMP-GCMS) developed by JNOC in FY2002 was applied to the analysis of hydrocarbons in fluid inclusions successfully, and its improvement made the analysis more accurate (Hatano et al, 2006). In the usual analysis, only one piece of crystal is used for LMP-GCMS, and about 0.5g of crystal is used for Gas Analysis System. The geochemical data of hydrocarbon-inclusions from some oil and gas fields have been stocked.

References: Hatano et al, 2006; J. Japanese Assoc. Petrol. Techno. 71,366. Okubo, 1998; J. Japanese Assoc. Petrol. Techno. 63,205-215. Okubo et al.,1999: J. Japanese Assoc. Petrol. Techno. 64,330-339. Okubo, 2005: Applied Geochem. 20, 255-260.

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