Organic compounds in H5 meteorite: Spectroscopic investigation of Dergaon H5 Chondrite

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On March 2,2001, at 16:40 local time (GMT+5:30hrs), four fragments of a meteorite fell near Dergaon town (Lat.16^0 41' N, long. 93^0 52'E, Assam, India. Based on the petrography and chemical composition of the stony iron Dergaon meteorite has been classified as H5 chondrite. But from the chemical composition, the previous workers reported that the meteorite is an unusual H chondrite. In this present work we analysed the sample with the help of FTIR and Diffused Reflection Spectroscopy and found the SiO4 tetra-hedron at 800-1100cm^{-1} and aliphatic functional CH_2 and CH_3 groups in the spectral region around 2800-3000cm^{-1}. In 2800 – 3000 cm^{-1} region (3.4 μm region), the hydrated and anhydrous interstellar dust particles attribute CH_3 and CH_2 stretching vibrations of aliphatic hydrocarbons which is similar to the spectra found from the meteorite in this frequency region. The silicate grain in the interstellar medium and meteorites consist predominantly of olivine [(Mg,Fe) SiO_4] or of non-crystalline silicates of intermediate compositions associated with organic matter. The organic matter can extract the poly atomic carbon based molecules by crushing the MgO and (Mg,Fe)SiO_4 crystals. Generally four peaks are observed in this region. The symmetric CH_2 stretching vibration at 2850 cm^{-1}, symmetric CH_3 stretching vibration at 2865 cm^{-1}, asymmetric CH_2 stretching vibration at 2922 cm^{-1} and asymmetric CH_3 stretching vibration found at 2958 cm^{-1}. The spectral features in the mid infrared region were found to be identical to that of the interstellar dust gain particles. Most of the strong IR absorption bands are due to olivine. Few weak absorption bands observed in the Dergaon meteorite are due to organic compounds present in the meteorite, the features observed in other H-chondrites by Lawless *et al*. (1972).

Reference:

Lawless, J. G., Folsome, C. E., and Kvenvolden, K. A. (1972) Organic matter in meteorites. *Scientific American* **226**, 38-46

Experimental study on gas emission using fault rock core penetrating Atotsugawa fault, central Japan

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Crustal gas-anomalies with earthquakes have been observed around active faults. However few experimnetal studis have been done for this problem. Therefore fundamental processes are largely unknown. In order to examine the processes, grinding experiments were carried out under wet condition using two types of rocks taken from drilled core penetrating Atotsugawa fault: (1) Weakly Pulverized and Altered Rock (WPAR) and (2) Fault Gouge.

Result of the experiments show that positive relationships between surface area (ΔS) and amount of gas (n) (Fig.1). For hydrogen, the relationships can be expressed as: $n \propto \Delta S$, which is in good agreement with those reported by *Kameda et al.,* (2003). For methane, the relationships can be expressed as: $n = A(1 - EXP[-k\Delta S])$. The equation corresponds to solution: $dn/d\Delta s = k(A-n)$. A will be max amount of methane contained in a sample and k shows degree of evolution of gas when samples are crushed. This diferencial equation indictes that methane gas contained in the rock sample were released by fracturing and release ratio($dn/d\Delta s$) is proportional to (A - n), which means the amount of methane gas remains in the rocks.

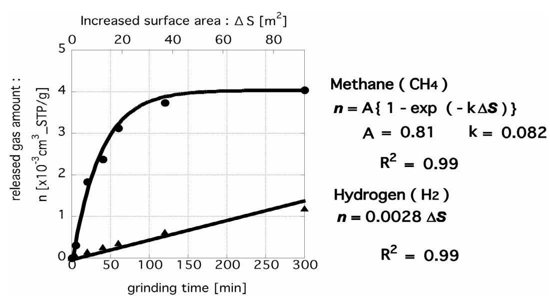

Figure 1. Amount of released gases (methane and hydrogen) during wet grinding experiment.

Microstructural observation of thin sections clarified that fluid inclusions are abundant in quartz or calcite in granitic rocks, metasediments, and less in calcarious rock, which released methane gas by grinding. On the contrary, no fluid inclusion is observed in the minerals of andesite that did not released methane gas by grinding.

Combining experiment results and microstructural observations, we concled that methane gases were included in fluid inclusion and released by fracturung minerals.

References

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