N94-16325

TERRESTRIAL BITUMEN ANALOGUE OF ORGUEIL ORGANIC MATERIAL DEMOSTRATES HIGH SENSITIVITY TO USUAL HF-HCl TREATMENT.

A.V.Korochantsev and O.V.Nikolaeva; Vernadsky Institute, Russian Academy of Science, 117975 Moscow, Russia.

The relationship between the chemical composition and the interlayer spacing (d002) of organic materials (OMs) is known for various terrestrial OMs (see, for example, [1,2]). We improved this general trend by correlation with corresponding trend of natural solid bitumens (asphaltite-kerite-anthraxolite) up to graphite. Using the improved trend we identified bitumen analogues of carbonaceous chondrite OMs residued after HF-HCl treatment (as proposed in [3,4]). Our laboratory experiment revealed that these analogues and, hence, structure and chemical composition of carbonaceous chondrite OMs are very sensitive to the HF-HCl treatment. So, usual extraction of OM from carbonaceous chondrites may change significantly structural and chemical composition of extracted OM.

BITUMEN ANALOGUES OF CARBONACEOUS CHONDRITE OM RESIDUES. Rietmeijer [5] constructed a diagram of d002 vs. C/(C+H+N+O)(at.) for various natural OMs and received a rough trend which gave him a possibility to determine the bulk chemical composition of a CP IDP [6]. We plotted on the diagram more recent data and correlated with the trend for all natural solid bitumens (asphaltite-kerite-anthraxolite) up to graphite. The H/C ratio for this continuous series is gradually decreasing from asphaltite to graphite. The d002 values of acid residues of carbonaceous chondrites, measured by HRTEM [7], and chemical compositions of these residues [8] allowed to evaluate the validity of the obtained trend as applied to chondrite OMs (Fig.). Orgueil (CI) residues have the prominent d002 value of 3.8A [7] and the C/(C+H+N+O)(at.) ratio of 0.505 [8], which is within the range of C/(C+H+N+O)(at.) ratios (0.45-0.65) given by the trend. Murchison (CM) residues have the prominent d002 value of 3.57A [7] and the C/(C+H+N+O)(at.) ratio of 0.53 [8], i.e. again within our range of C/(C+H+N+O)(at.) ratios (0.50-0.71). Thus the diagram can be used successfully to estimate compositions of OMs in carbonaceous chondrites. For example, Allende (CV) residues show the prominent d002=3.50A [7], and hence, they should have the C/(C+H+N+O)(at.) ratio of about (0.56-0.78). Our plot (Fig.) indicates that CI residues correspond mainly to the kerite field, CM residue lies on the kerite-anthraxolite interface, and CV residues belongs mostly to the anthraxolite field.

SIMULATION OF HF-HCl TREATMENT OF ORGUEIL. However, the HF-HCl residues of carbonaseous chondrites are products of heating and chemical treatment. Therefore the OMs of the residues may not reflect the true composition and structure of meteorite OMs. In order to estimate possible chemical and structural changes of OMs in carbonaseous chondrites after the acid treatment we carried out an experimental study. A sample of kerite [9], which can be inferred above as an analogue of the Orgueil residue, was powdered and mixed with a serpentine powder

in a proportion to obtain 6 wt.% of carbon in the mixture for a rough simulation of the Orgueil composition. The mixture was demineralized by repeated soft HF-HCl treatment. The obtained organic residue was analysed for C, H, N, O, S and studied by X-ray diffraction. Results show that the HF-HCl treatment of the kerite-serpentine mixture led to a considerable change the H/C atomic ratio of the kerite from 0.99 before to 0.62 after treatment and a great change of d002 from 4.0A before to 3.65A after. The direction of the observed shift permits to conclude that the true composition of Orgueil OM, before HF-HCl treatment could be richer in H and less ordered than OM in Orgueil acid residue. In order to define the true chemical composition and structure of OMs in carbonaceous chondrites it is necessary either to introduce some corrections in analyses of acid residues or to study the OMs in situ as it was done by [6] for CP IDP.

CONCLUSIONS: As shown by our laboratory experiment on serpentine+bitumen analogue of Orgueil, the chemical composition and structure of carbonaceous chondrite OM could be subject to significant alteration by HF-HCl treatment.

REFERENCES: [1]Yen T.F. et al. (1961), Anal.Chem., 33, 1587-1594. [2]Korolev Yu.M. (1989), Chemistry of solid fuel., 6, 11-19, (in Rus.). [3]Nikolaeva O.V. (1988), LPSC X1X, Abstr., 862-863. [4]Nikolaeva O.V. (1991), XV1 Gen.Assembly of EGS, Wiesbaden,383-384. [5]Rietmeijer F.J.M. (1991), Carbon, 29, 669-675. [6]Rietmeijer F.J.M. (1992), Geochim.Cosmochim.Acta, vol.56, 1665-1671. [7]Lumpkin G.R. (1986), LPSC XV11, Abstr., 502-503. [8]Hayatsu R. (1977), Geoch.Cosm.Asta, 41, N-9, 1325-1339. [9]Luk'yanova V.T. et al.(1989), New date on minerals, Moscow: Nauka, 83-91 (in Rus.).

Fig. Summary of C/(C+H+N+O)(at.) versus d002(A) for naturally occurring carbonaceous materials