GEOPHYSICS

Occurrences of Sinoite, Si_2N_2O, in Meteorites

THE recent discovery of the new mineral sinoite, Si_2N_2O, in the Jajh deh Kot Lalu enstatite chondrite[1-3] prompted a systematic search for this compound in the other fourteen enstatite chondrites at present known to exist in the world's meteorite collections (Abee, Adhi-Kot, Atlanta, Bethune, Blithfield, Daniel's Kuil, Hvittis, Indarch, Khairpur, Kota-Kota, Pillistfer, St. Marks, Saint-Sauveur, Ufana). Of these fourteen enstatite chondrites, three were found to contain sinoite. These three are the Hvittis, Ufana and Pillistfer stones. The appearance of the mineral in these meteorites is very similar to its appearance in the Jajh deh Kot Lalu enstatite chondrite. In reflected light, the crystals are distinctly lighter than the surrounding enstatite and are up to about 200μ in length (Fig. 1). Under electron bombardment in the electron microprobe, sinoite is easily recognized by its bright greenish luminescence. In each meteorite, ten different grains of the mineral were analysed qualitatively (Fig. 2) and quantitatively for silicon, nitrogen and oxygen by means of electron microprobe techniques using methods previously described[2]. The quantitative analyses were carried out using sinoite from Jajh deh Kot Lalu as a reference standard. The results of these analyses are summarized in Table 1. The chemical identity of the compound in the four meteorites is apparent.

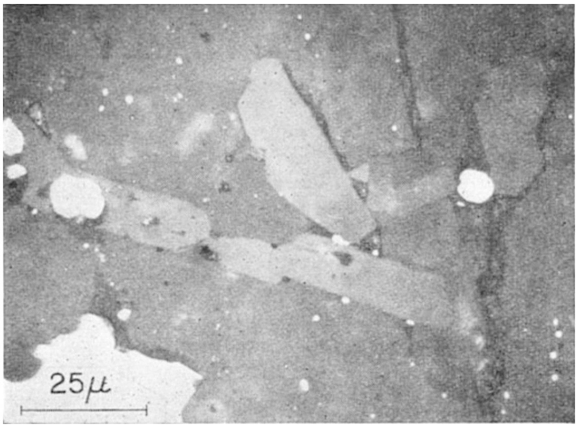

Fig. 1. Several crystals of sinoite (centre, light grey) from the Pillistfer enstatite chondrite. Grey main mass is enstatite, white is metallic nickel-iron. Reflected light

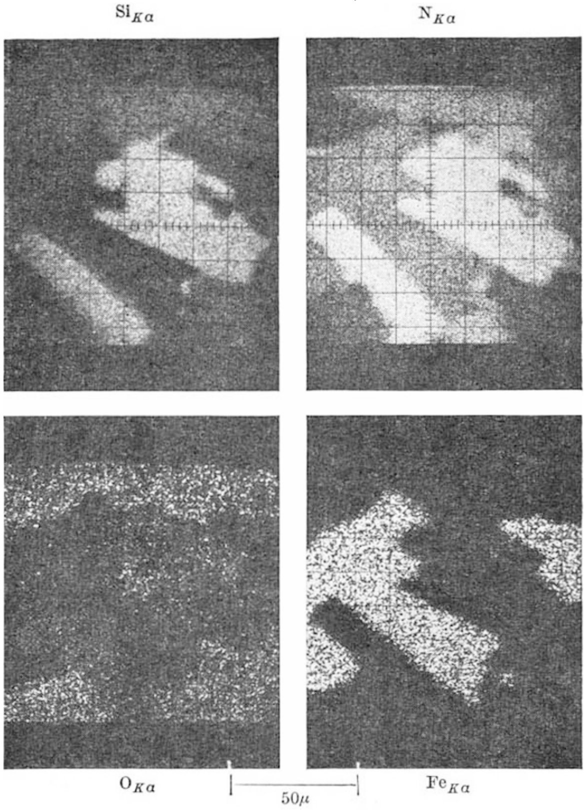

Fig. 2. Electron beam scanning pictures of sinoite, Si_2N_2O. These pictures are obtained by scanning a microscopically selected area of the sample with the electron beam and recording the characteristic X-rays from the spectrometers on an oscilloscope screen. Sinoite has high silicon and nitrogen and moderate oxygen contents. O-rich areas are enstatite ($MgSiO_3$); Fe-rich areas are metallic nickel-iron. The apparent $NK\alpha$ intensities on enstatite and nickel-iron are due to high background values at this wave-length

Table 1. COMPOSITION OF SINOITE, Si_2N_2O, FROM THE HVITTIS, PILLISTFER, UFANA AND JAJH DEH KOT LALU ENSTATITE CHONDRITES (Weight per cent)

Element	Hvittis	Pillistfer	Ufana	Jajh deh Kot Lalu
Silicon	56·7	56·8	57·1	56·6
Nitrogen	31·7	31·4	31·9	31·5
Oxygen	13·0	13·0	—	13·1
Total	101·4	101·2	—	101·2

At our request, Dr. B. Mason kindly investigated thin sections of the Hvittis and Pillistfer meteorites available at the American Museum of Natural History, New York. Dr. Mason found the optical properties of the mineral in Hvittis and Pillistfer to be identical with those of sinoite previously described from Jajh deh Kot Lalu[2]. Dr. Mason also pointed out that Lacroix[4] described the optical properties of an unknown compound found in 1905 in the Hvittis and Pillistfer stones. Lacroix, however, was unable to identify the mineral. From Lacroix's description of the optical properties, it appears that this compound and sinoite are identical.

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Attenuation of Teleseismic Body Waves

AT the Royal Society discussion on "Recent Advances in the Technique of Seismic Recording and Analysis" (January 28–29, 1965), de Noyer directed attention to the difficulty of observing short-period (about 1-sec period) shear waves at angular distances in the range $25° < \Delta < 100°$. The following analysis suggests a possible reason.

Consider a solid possessing a complex rigidity modulus μ but real bulk modulus k and density ρ. Such a material exhibits absorption of both compressional, P, waves and shear, S, waves, and we denote the corresponding specific attenuation factors[1] by Q_P and Q_S and the corresponding wave velocities by α and β, respectively. Then the P and S parameters are related by the Poisson's ratio, σ, of the material, by the following equations:

$$\alpha^2 (1-2\sigma) = 2\beta^2 (1-\sigma) \qquad (1)$$

$$(Q_S/Q_P) = (4/3)(\beta/\alpha)^2 = (2/3)(1-2\sigma)/(1-\sigma) \qquad (2)$$

In the Earth, both α and β are functions of the radius, and their ratio is not constant, that is, σ is also a function