THERMOLUMINESCENCE AND THE ORIGIN OF THE DARK MATRIX OF FAYETTEVILLE AND SIMILAR METEORITES

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Gas-rich regolith breccias consist of light clasts in a dark matrix (Seuss *et al.*, 1964). The clasts have all the properties associated with normal chondrites, but the matrix is highly enriched in solar gases, volatile elements and charged-particle tracks, and contains occasional clasts of CM chondrite (Suess *et al.*, 1964; Bart and Lipschutz, 1979; Wilkening, 1976). The origin of the dark matrix is uncertain and two theories have been much discussed: (A) The matrix is a new kind of primitive material similar to type 3 ordinary chondrites (Suess *et al.*, 1964; Bart and Lipschutz, 1979); (B) that it is comminuted and shocked clast material which has been "contaminated" with solar gases and in-falling meteorites (Fredriksson and Keil, 1963; Chou *et al.*, 1981). Type 3 ordinary chondrites have thermoluminescence (TL) sensitivities 10^{-5} to 10^{-3} times those of types 5-6, the more primitive (i.e. less metamorphosed) having the lower values, while heavily shocked chondrites have TL sensitivities 0.1-0.01 times unshocked chondrites. Theories A and B therefore make opposite predictions concerning the relationship between TL sensitivity and regolith maturity; theory A predicts that TL sensitivity will increase, and theory B predicts that it will decrease, with increasing regolith maturity. In the present work we report TL sensitivity data for five gas-rich chondrites of widely differing regolith maturities: Fayetteville, Leighton, Weston, Cangas de Onis and St. Mesmin.

The non-magnetic portions of 0.2-0.5 g samples were ground (100 mesh), $5+/-1$ mg aliquants placed in a Cu pan and the TL measured as in Sears and Weeks (1983). The TL sensitivity of the dark material, normalized to that of the light clasts, is compared with ^{4}He contents in Figure 1; we use ^{4}He contents as a measure of regolith maturity. In all meteorites studied the dark matrix had a lower TL sensitivity than the light clasts, and the TL sensitivity of the dark matrix decreases steadily with increasing ^{4}He content; the TL sensitivity of the Plainview matrix being 70% that of the clasts, while for Fayetteville the matrix TL sensitivity was 35% that of the clasts. Our data are therefore consistent with the dark matrix being comminuted clast material, and that the abundance of solar gases and volatiles is due to the implantation of solar wind, the in-fall of chondritic material and, possibly, outgassing of the interior of the parent body during metamorphism.

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