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THERMOLUMINESCENCE PROPERTIES OF SHOCKED AND ANNEALED PLAGIOCLASES WITH IMPLICATIONS FOR METEORITES

C.P. Hartmetz and D.W.G. Sears, *Cosmochemistry Group, Dept. of Chem. and Biochem., Univ. of Arkansas, Fayetteville, AR 72701. Open University, Dept. Earth Sciences, Walton Hall, Milton Keynes. MK7 6AA U.K.*

Plagioclase is very sensitive to thermal and shock events, and thermoluminescence (TL) provides a uniquely sensitive and quantitative means of monitoring these events in meteorites. To help clarify how TL relates to the physical state of plagioclase we have previously determined the TL properties of terrestrial oligoclase and bytownite subjected to shock (Hartmetz *et al.*, 1986), and annealing (Hartmetz and Sears, 1987a,b). Here we report on samples which were shock-loaded by the procedures of Ostertag (1983) and then annealed in the manner of Hartmetz *et al.* (1986). TL properties were measured as in Sears and Weeks (1983).

Ordered oligoclase and bytownite have dominant TL peaks at ~ 130°C, but after (i) annealing ≥ 700°C the dominant peak moves to ~ 280°C and (ii) shock ≥ 30 GPa the dominant peak moves to ~ 230° and ~ 180°C, for oligoclase and bytownite respectively. Ordinary chondrites and shergottites have peaks at ~ 130° or ~ 220°C and the peak can be shifted from ~ 130° to ~ 230°C by annealing. The difference in peak temperature between the annealed plagioclase and meteorite data could be attributed to shock (10-20 GPa) in the history of the meteorites, in which case annealing shocked plagioclase should retain the peak at ~ 230°C. However, our new data shows that even heavily shocked terrestrial plagioclases had a dominant peak at ~ 250°C after annealing at 976°C.

We conclude that the defect structure of the extraterrestrial plagioclase differs from that of terrestrial plagioclase, and think that radiation defects may be involved. Radiation defects can be readily produced in feldspars (Lehmann (1984), and peaks at ~ 210°C were produced in annealed Amelia albite after exposure to very high (1 Mrad) gamma doses (Pasternak, 1978).

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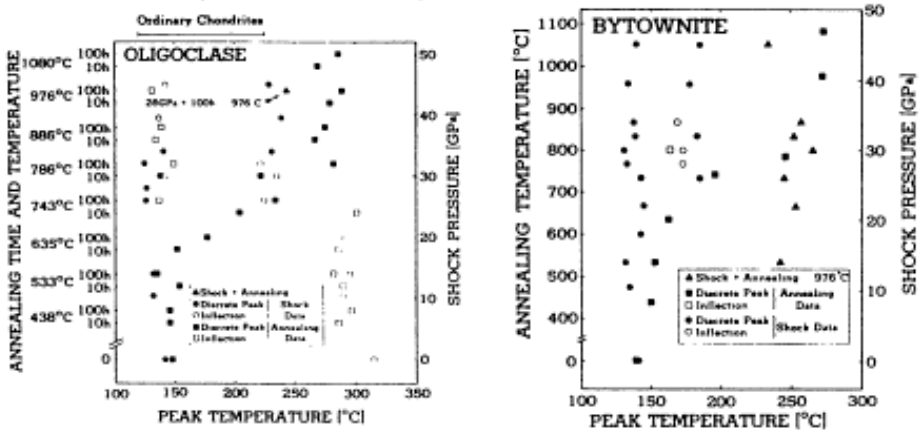

Fig.1 Peak temperatures as a function of annealing (squares), shock-loading (circles), and both (triangles). Bytownite samples were annealed for 100h. Typical 1σ uncertainties are ± 10°C for peak temperatures, < 1-4% for annealing times and temperatures, and 3% for shock pressure.