THERMAL HISTORY OF THE LEW85300, 85302, 85303 SHOCKED EUCRITES: THERMOLUMINESCENCE OF INDIVIDUAL CLASTS AND MATRIX; J.David Batchelor and Derek W.G.Sears, Cosmochemistry Group, Department of Chemistry and Biochemistry, University of Arkansas, Fayetteville, AR 72701.

Introduction The polymict eucrites LEW85300, 85302, and 85303 are paired, along with LEW88001, and the 85xxx meteorites are the object of a consortium study organized by Roger Hewins. The rock shows petrographic evidence of intense shock (1-4), and the whole-rock thermoluminescence glow curve, and behaviour in laboratory annealing experiments, indicates the rock has been heated to at least 1000^{0}C (5-8). The glow curve shows only a high-temperature peak believed to be linked to disordered feldspar. On the basis of TL sensitivity, LEW85303 has been classified as type-5 (7,8). Radiometric data show that, in addition to the _3.6 Ga heating event common to most HEDs and mesosiderites, the LEW85300 suite has experienced a further heating event <= 0.75 Ga ago (9,10).

According to Kozul and Hewins (2,3), the LEW85300 suite contains both igneous and breccia clasts, and there are both recrystallized and unrecrystallized breccia clasts. A dark glassy matrix encloses all clast types, and this glass forms veins transecting clasts, including a carbonaceous chondrite class. It is unclear whether the glassy matrix formed by intrusion or by in situ melting (4).

Results Fourteen clast and matrix samples were studied; the results are shown in Figure 1. The TL of all samples is dominated by a high temperature peak at 195 +/- 5.7^{o}C. All clast samples, and 3 of the seven matrix samples, show only this peak. Four matrix samples show an additional low temperature shoulder at 130 +/- 5.4^{o}C, believed to be associated with ordered feldspar; however, the dominant peak is still the high-temperature peak.

The TL sensitivities of most of the clasts are higher than those of any other eucritic material except those of two cumulate eucrites, Serra de Mage' and ALH85001. Using our new petrologic type designations for eucrites (7,8), one clast is type-6, three are type-7, and one is type-8. These values are similar to whole-rock value for cumulate eucrites. Our chip of clast 35 was covered with a thin veneer of clear glass on one face. The interior of this clast is type-4, similar to the brighter matrix, while a portion with the glass attached has a value 50% lower. The sensitivities of the matrix samples fall into two distinct clusters. The three samples showing only the high-temperature peak have values equivalent to types-4 and 5, similar to whole-rock values for equilibrated eucrites, while the four samples with low-temperature shoulders have sensitivities equivalent to types-2 and 3, similar to whole-rock values for unequilibrated eucrites.

Discussion As expected, matrix samples have lower TL sensitivities than do clasts, probably due to comminution of the feldspar and formation of glass (8). Four points stand out in this study. 1) All samples, clast and matrix, show intense shock effects. 2) The rock as a whole has high TL sensitivity, higher than those of most equilibrated eucrites. 3) The matrix samples seem to represent two distinct populations, with one set having TL sensitivities more than twice those of the other. 4) The matrix samples with relatively low TL are the only samples to exhibit the low-temperature peak related to ordered feldspar.

It is evident that the entire assemblage has been shock-heated to at least 1000°C. Either this shock event occurred after final assembly of the breccia, or the shock affected a sufficiently large area that the breccia was assembled predominantly from shocked material. If the shock occurred after assembly, cooling must have been sufficiently rapid not to dehydrate the carbonaceous clast, as noted by Hewins (4).

Assembling the breccia from already shocked material presents a possible explanation for the two matrix populations. In this scenario, events would have occurred in the following sequence. 1) A large impact results in a widespread ejecta blanket of shocked material. Autometamorphism within the large blanket may order some feldspar, but this ordered material remains buried. 2) One or more smaller impacts bury some of the shocked material in a smaller blanket, where metamorphism results in partial ordering of the feldspar. 3) A second small impact assembles the final breccia of material from both blankets. Two small impacts are needed, since excavating partially ordered material from the interior of the larger blanket probably would not result in two distinct populations of matrix, and the additional impact working of the partially ordered material accounts for its lower TL sensitivity. The carbonaceous clast, if hydrated, could arrive after the large impact.

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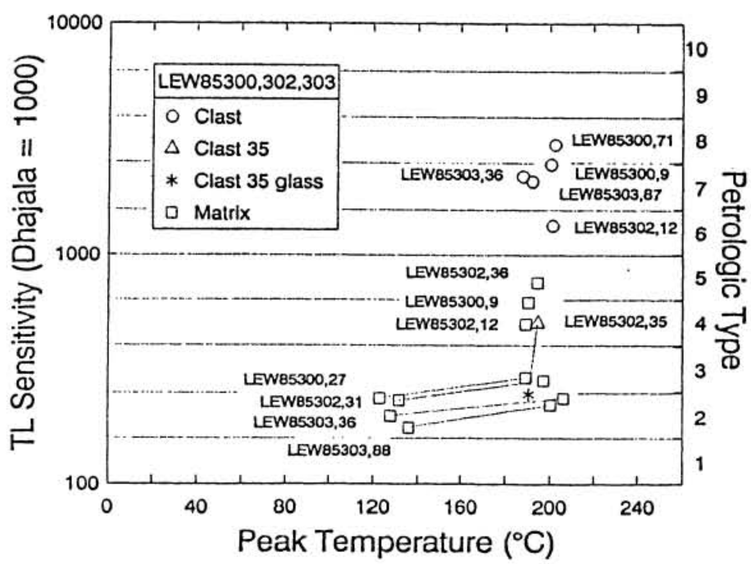

Fig. 1. Petrologic type and TL sensitivity versus TL peak temperature for clasts and matrix from LEW85300-group shocked eucrite. Matrix samples with tie lines have two peaks. Clast 35 splits connected by tie line.