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CHEMICAL AND PHYSICAL STUDIES OF TYPE 3 CHONDRITES-III. CHONDRULES FROM THE DHAJALA H3.8 CHONDRITE

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Fifty-eight chondrules were separated from the Dhajala H3.8 chondrite and their thermoluminescence properties were measured. Chips from 30 of the chondrules were examined petrographically and with electron-microprobe techniques, and the bulk compositions of 30 chondrules were determined by the fused bead technique. Porphyritic chondrules, especially five which have particularly high contents of mesostasis, tend to have higher TL than non-porphyritic chondrules. Significant correlations between log (mass-normalized TL) and the CaO, Al₂O₃ and MnO content of the bulk samples, and between the CaO, Al₂O₃, SiO₂ and normative anorthite content of the chondrule glass, indicate an association between TL and the abundance and composition of mesostasis. Unequilibrated chondrules (i.e. those whose olivine is compositionally heterogeneous and high in Ca) have low mass-normalized TL, whereas equilibrated chondrules have a wide range of mass-normalized TL, depending on their chemical and petrographic properties.

We suggest that the TL level in a given chondrule is governed by its bulk composition which largely determined the abundance and composition of constituent glass) and by metamorphism (which devitrified the glass in those chondrules with high Ca glass to produce the TL phosphor). We also suggest that one reason why certain chondrules in type 3 ordinary chondrites are unequilibrated, while others are equilibrated is that their mesostasis resists the devitrification which is required to allow the diffusive communication between chondrule grains and matrix which enables equilibration.