of perovskite seems to be required. It is hoped that further chemical and isotopic analyses by electron and ion microprobe will provide more clues about the origin of OSCAR.

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THE METAMORPHIC HISTORY OF ORDINARY CHONDRITES ACCORDING TO CATHODOLUMINESCENCE

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Thermoluminescence (TL) has proved of great value in deciphering relative metamorphic intensities experienced by type 3 ordinary chondrites, showing a 10**3-fold range (Sears *et al.*, 1980). There are also systematic changes in the TL peak temperature and TL peak width which are related to phase changes in the TL phosphor and therefore have thermometry and cooling rate possibilities (Sears *et al.*, 1984). However, for reasons that are unclear the trends break-down for meteorites of type < 3.4. In order to better understand these effects we have examined the cathodoluminescence (CL) of a suite of type 3 ordinary chondrites. Since the TL and CL processes are strongly related, this enables petrologic examination of the species probably producing the TL.

Photomosaics (> 1 sq. cm. area) of the CL of Semarkona (3.0), Bishunpur (3.1) and Chainpur (3.4) were prepared. In Chainpur, the major source of CL appeared to be the mesostasis of several large chondrules. Olivine and pyroxene grains showed little CL, if any, and the matrix contains numerous isolated blue grains. A few blue/red isolated olivines of the sort described by Steele *et al.* (1985) were observed. In Bishunpur, the mesostasis showed CL ranging from bright yellow to blue and the mafic silicates had red CL with a variety of intensities. The matrix consisted of numerous small blue and red grains. In Semarkona, the matrix was distinctly different to the others, being a uniform, intense red. The chondrules had yellow to blue CL and were generally dimmer than in the Bishunpur and Chainpur.

The importance of chondrule mesostasis in the CL of Chainpur is consistent with earlier suggestions that the cause of the metamorphism-related increase in TL in type 3 chondrites is the formation of feldspar by devitrification of chondrule mesostasis (Sears *et al.*, 1984; Lofgren *et al.*, 1985). We suggest that the loss of red CL, first from the matrix and then from the olivine/pyroxene grains in chondrules, reflects the disappearance of pure Mg end-members as homogenization of silicate composition occurs in response to metamorphism (Dodd *et al.*, 1967; Geake *et al.*, 1972). The appearance of blue CL, in the matrix and mesostasis, we attribute mainly to the formation of submicron feldspar grains (Geake *et al.*, 1971). It seems that CL properties are comparable to TL in their responsiveness to metamorphism, in some respects more so, particularly at the lowest grades. The matrix seems most responsive to metamorphism, followed by chondrule mesostasis and finally the large olivine and pyroxene grains in chondrules. In fact, metamorphic changes in CL seem to occur at much lower levels of metamorphism than are required to homogenize silicate compositions. These studies confirm that Semarkona has experienced lower levels of metamorphism than Bishunpur, and that Chainpur has experienced greater metamorphic alteration than the other two.

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