CHROMITE-PLAGIOCLASE ASSEMBLAGES AS SHOCK INDICATORS IN ORDINARY CHONDRITES. Alan E. Rubin, Institute of Geophysics and Planetary Physics, University of California, Los Angeles, CA 90095-1567, USA, aerubin@ucla.edu.

Most crystals of chromite in unshocked equilibrated ordinary chondrites (OC) are irregular, rounded or quasi-equant grains surrounded by mafic silicates (with or without adjacent minor plagioclase) or coarse grains adjacent to or enclosed within metallic Fe-Ni and/or troilite.

Another type of chromite occurs as 0.2-20-µm-size euhedral, subhedral, anhedral and/or rounded grains surrounded by 10-300-µm-size patches of plagioclase or glass of plagioclase composition. Such chromite-plagioclase assemblages occur in OC impact-melt breccias (e.g., Ramsdorf, Portales Valley, Rose City, Smyer), regolith breccias (e.g., Zag), fragmental breccias (e.g., L5 Farmington, LL6 Trebbin), and rocks that have been moderately to strongly shocked (e.g., L6 Kyushu, S5; an L6 portion of Gold Basin, S4; L6 Jartai, S4; L6 La Criolla, S4; L6 NWA 108, S4; L5 QUE99145, S5).

There are reports in the literature of chromite within maskelynite in L6 Paranaiba, S6, and chromium-rich spinel intergrown with plagioclase in an unusual inclusion in L6 Los Martinez.

Because chromite-plagioclase associations occur in many shocked chondrites, it seems likely that the impedance mismatch between chromite and plagioclase is sufficiently large to cause substantial shock reverberations at the grain boundaries between these phases. This would result in localized melting of relatively large fractions of chromite. The occurrence of chromite-plagioclase assemblages in some weakly shocked OC (e.g., H6 Butsura, S3; H6 Lunan, S3; H6 Wuan, S3; H6 Zhovtnevyi, S3) may indicate that the assemblage forms at shock pressures below those necessary to cause olivine to develop mosaic extinction (i.e., <50 GPa).

Chromite-plagioclase assemblages also occur in H6 Kernouvé, S1 and LL6 MIL99301, S1; these chondrites appear to have been shocked and then annealed sufficiently to have healed olivine crystal lattices. It seems possible that the few very weakly shocked OC that contain chromite-plagioclase assemblages (e.g., H5 NWA 141, S2; H6 Xingyang, S2) also experienced post-shock annealing.

A variety of chromite that is not adjacent to plagioclase occurs as equant 1-µm-size blebs and/or 0.5-µm-thick needles within 5-300-µm-long veinlets. However, in some OC, many of the chromite veinlets are located near chromite-plagioclase assemblages. Because the high (incongruent) melting temperature of chromite (~1635°C) would lead to extensive melting of adjacent silicate, it seems likely that chromite needles and blebs crystallized from a lower-temperature chromitic and feldspathic shock melt that subsequently disappeared (either by evaporation or melt withdrawal into nearby pockets of molten chromite-plagioclase).

Probably related to the chromite-plagioclase assemblages are chromite-bearing chondrules with cryptocrystalline, granular, radial, barred and porphyritic textures in equilibrated OC. These “chondrules,” which consist mainly of olivine, plagioclase-normative mesostasis and chromite, may have formed from chromite-plagioclase melts during impact events.

The compositions of the phases in the chromite-plagioclase assemblages tend to differ from those of unmelted grains elsewhere in the host meteorites. Assemblage chromite grains that are completely surrounded by plagioclase tend to contain significantly more Al₂O₃ and MgO and less TiO₂ than unmelted matrix chromite grains. Plagioclase in these assemblages tends to contain more Cr₂O₃ than coarse crystalline plagioclase grains in the host.