

CATHODOLUMINESCENCE OF SHOCKED QUARTZ AT THE CRETACEOUS-TERTIARY BOUNDARY; Michael R. Owen¹ and Mark H. Anders²;
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Empirical studies have documented an association between rock type and the cathodoluminescence color of constituent quartz grains. Quartz from extrusive igneous sources luminesces uniform pale blue (1-4). Quartz from intrusive igneous and high-grade metamorphic rocks generally luminesces darker purple-blue, whereas quartz recrystallized under low-grade metamorphic conditions luminesces reddish-brown (5-15). Quartz grains in most sandstones luminesce a heterogeneous mixture of these colors because the grains were derived from a variety of ultimate source rocks. If shocked quartz found at the K/T boundary is volcanic in origin, its cathodoluminescence should be predominantly pale blue. Alternatively, quartz grains derived from bolide impact upon, and ejection of, mixed igneous, metamorphic, and sedimentary rocks should luminesce a variety of colors.

We examined grain mounts of sand collected at the K/T boundary horizon from the Clear Creek North site in the Raton Basin, Colorado (16). Shocked quartz luminesced a variety of colors and very few grains luminesced the pale blue color that is typical of volcanic quartz.

Of 1,000 grains counted, 13.7% displayed one or more sets of continuous, planar, parallel shock-deformation lamellae in flat-stage projection. Of these, approximately 40% were polycrystalline grains in which shock lamellae directions were controlled by the differing crystallographic orientations of subcrystals. Approximately 50% of the shocked grains showed more than one set of shock lamellae in flat-stage projection; up to 5 distinct cross-cutting sets were visible in some grains. The remaining (non-shocked) grains consisted of microcrystalline quartz and chalcedony (46.3%) and polycrystalline + monocrystalline quartz (40.0%).

In CL, 54% of the shocked quartz grains luminesced reddish-brown and the remainder luminesced a variety of blue hues ranging from very dark blue to pale blue. Less than 5% of the blue-luminescing shocked grains (ca. 3 % of all shocked grains) luminesced the pale blue color that is typical of volcanic quartz. In addition, three grains displayed a medium blue-luminescing core surrounded by a dark brown-luminescing rim. These grains represent originally intrusive igneous (or perhaps high-grade metamorphic) quartz with authigenic quartz overgrowth, identical to common quartz sandstone with quartz cement. No correlation was apparent between CL color and the number of shock lamellae or their orientations.

We conclude that the shocked quartz was derived from a petrologically diverse source region *without* substantial volcanic contribution. Most shocked grains apparently were derived from low-grade metamorphic rocks, with a slightly smaller contribution from high-grade metamorphic and intrusive igneous rocks. Rare quartz grains with brown-luminescing rims reflect a minor addition from detrital sedimentary sources. The apparent relative abundances of intrusive (and rare extrusive) igneous, metamorphic, and sedimentary ultimate source rocks suggested by CL colors of shock-deformed quartz at the K/T boundary is consistent with a crustal/supracrustal origin for the grains.

CL OF SHOCKED K/T QUARTZ
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