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The Submarine 4-km diameter Corossol Crater, Eastern Canada: Evidence for an impact origin

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The newly-discovered Corossol Crater lies in the northwestern Gulf of St. Lawrence (Eastern Canada; 50°3'N, 66°23'W) and was found in 40-185 metres of water using high-resolution multibeam sonar. It is a 4 km in diameter complex circular structure with a central uplift and concentric rings. Glacial resurfacing indicates that it predates the last phase of glaciation in this area. Dredging on the central uplift recovered many angular clasts of hard grey limestone, which forms the bedrock in much of this area. One 4 cm clast of limestone breccia is somewhat different from the other blocks and has characteristics that suggest that it is an impact breccia. The block comprises fragments of calcite limestone up to 2 mm long. In many parts of the block these fragments have thin black rims. At the edges of the block these rims are brown, presumably reflecting aqueous alteration. Mineral grains in the rims are too small to characterize, but the fact that the ensemble can be oxidized suggests that it contains sulfides. In places the block is cut by veins of fine-grained calcite with euhedral dolomite crystals. The most unusual component is rare droplets up to 2 mm long, commonly fragmented. The droplets comprise a glassy matrix with a composition very close to fluorapatite and opaque crystals that have a composition close to pyrite. A few droplets have up to 5% vesicles. Fluorapatite requires fusion temperatures of about 1600 C, which cannot be achieved at the surface of the Earth by endogenous processes. A single fragmented quartz crystal with planar features was found close to one droplet. Universal stage measurements of the orientation of the planar features give an angle of 42 degrees which is close to that of {10-13} planes. This is the most common set of deformation planes produced during shock metamorphism of quartz. Unfortunately no other grains were found with similar planes. The glassy droplets and shocked quartz together suggest that the clast was produced by an impact, and hence that it is very likely that the Corossol Crater in which the clast was found is an astrobleme. The absolute age of this structure is unknown, but its geological setting indicates that it was formed long after the Mid-Ordovician and possibly before regional pre-Quaternary sea-level lowstand. We are now attempting to obtain a U-Th helium age for the droplets which will date the impact event.