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Neutron Diffraction Studies on Gold Crystals from Placer Deposits¹

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The single-crystal nature of large (centimeter scale) gold crystals from placer deposits in Venezuela, Russia and elsewhere had often been questioned. Testing whether those gold crystals are indeed single crystalline has been a challenge because sectioning crystals to expose their interiors is both undesirable and problematic in that cutting or grinding creates significant deformation. Because of the relatively small penetration depth, X-rays will test mainly the surface structure. While in most cases the X-ray diffraction patterns on such crystal are inconsistent with single-crystal patterns, it has been hypothesized that surfaces may be damaged due to cold working as a result of mechanical distortion associated with stream transport. Unlike X-rays, neutrons can penetrate deep into the bulk of a material. Our neutron-diffraction data on selected specimens confirmed the single-crystalline nature of some of the crystals from Venezuela, while the Russian crystals were found to be cast imitations.

¹In collaboration with John Rakovan, Miami University, Ohio.