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Melt structures in comets

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Since the three comets imaged at close quarters (comets Wild-2, Borrelly and Tempel-1) differ strongly in terrain types and overall topography, their history if not their origins were different. We see evidence of the three types of melting postulated for bodies containing substantial fractions of frozen H_2O: a) early central melting due to radionuclides, b) impact melts resulting from hypervelocity meteorites or cometesimals, and c) subcrustal melting due to solar heating of the dark (carbonaceous) outer surface. Though Tempel-1 currently has a similar orbit to the other two comets with q $\sim$ 1.5 AU, its refrozen lakes imply that its dynamical history included a period of earth-crossing (q $<$ 0.9 AU). The central plateau within crater remnants are consistent with crust-covered ice being more stable to sublimation-driven erosion than uncompacted nucleus material. Wild-2's lumpy nucleus with broad flat-bottomed 'craters' could indicate a remnant interior shell and partially recrystallised region resulting from central melting.