Olympic Dam (OD) is a supergiant Cu-U-Au-Ag ore deposit (~9 x 10^9 t) hosted by a breccia complex within Mesoproterozoic granite in South Australia. It is widely considered to have a magmatic-hydrothermal origin and to have formed in an active mafic maar-diatreme setting. The dominant facies in the breccia complex is unstratified hematite-rich breccia that consists of granite clasts and has gradational relationships with intact granite. This breccia formed subsurface through a combination of tectonic and hydrothermal fragmentation processes. Mafic dykes that intrude the breccia are locally fragmented because (1) they intruded unlithified breccia and formed peperite, and/or (2) they intruded faults that were reactivated. A very thick (>350 m) succession of well-bedded, below-wave base sedimentary facies occurs in the breccia complex. The succession includes planar laminated mudstone, graded sandstone and poorly sorted conglomerate that have felsic volcanic, mafic volcanic, and granitoid provenance. None of the facies in this succession are typical of the deposits from phreatomagmatic or hydrothermal eruptions. Instead, the succession records the presence of a sedimentary basin beneath and partly within which the breccia complex and the ore body were formed. We also challenge the genetic interpretations that underpin the ~1590 Ma age of mineralisation. This is the U-Pb age of zircons in (1) clasts in breccias interpreted to be felsic peperitic dykes cutting the ore, and (2) “ash-fall tuff” thought to have been deposited within a crater above a diatreme that cross-cuts the ore. We propose that this date relates to the pre-breccia protolith rather than ore formation.