

Matt Wilson, Australia: Structural Insights on Elliptical Crater Formation

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The vast majority of impact craters are circular. Only if the impact angle is lower than 10-15° from the horizontal, elongated impact craters form. The crater forming process that produces elliptical shapes is still poorly understood. Here we document the structural inventory of Matt Wilson crater in Northern Territory, Australia, the first elliptical crater on Earth that contains a central uplift and provides insights to the mechanisms of crater formation at a critical angle of ~10-15°.

We confirm the impact origin of the Matt Wilson structure as already proposed by Sweet et al. (2005), based on the presence of possible PDFs and proven PFs in quartz grains, the occurrences of monomict and polymict breccias in the inner part of the dome, as well as the structural inventory that indicates a convergent inward flow. The pre-impact target structure consisted of Mesoproterozoic, flat-lying, tectonically undisturbed sediments, thus giving an excellent control of structural deformation caused during the cratering event.

This structural inventory consists of an outer, elliptical ring monocline and syncline with a NE-SW-trending long axis. Further inwards, radially oriented fold axes, ramp thrusts and transpression ridges dominate the NE and SW sectors of the crater. The inner central uplift consists of imbricate thrust faults of deeper lying, uplifted strata that show a preferred direction of movement of top to the SW, which coincides with the orientation of the long axis of the ring ellipse. We interpret the preferred stacking of thrust sheets both in the central uplift and preferential deformation in the surrounding ring syncline as an uprange to downrange transport of rock. This motion is most likely caused by remnant momentum transferred from the impacting projectile coming from the NE to the target and interferes with the characteristic inward material flow during crater collapse and central uplift formation.

Matt Wilson is unique in that the preferred stacking of the central uplift, which has also been observed in other terrestrial craters, is additionally aligned with the long axis of the ring ellipse, giving two independent indicators for the axis along which the impactor was travelling.

Sweet I, Haines P, Mitchell K (2000) Matt Wilson structure: Record of an impact event of possible Early Mesoproterozoic age, Northern Territory. *Austral Jour Earth Sci* 52: 675-688

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