



Mysterious origins of some catenae on Mercury

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There are only three formally named catenae on Mercury, each of which can be uncontroversially interpreted as a chain of secondary impact craters radial to a major impact site. However, we have documented about 400 features on Mercury that fit the definition of catenae (catena = chain of craters), up to 300 km long and 10-30 km wide. Many of these cannot be related to an impact basin of origin, and moreover there is a strong preference for north-northeast (about 030°) and south-southeast (about 150°) orientation whereas chains of impact secondaries should have random trends (radial to each source).

Some catenae that look like chains of impact craters could result from serial impact by fragments of comets disrupted by tidal forces near perihelion, in which case the non-random orientations across Mercury's surface could reflect a pattern in the orbital inclinations of vulnerable comets.

A few catenae that depart from straightness by diverting round topographic features such as large crater rims are hard to reconcile with an impact origin, and may be volcanic or tectonic features. Additional unusual attributes of 'problem catenae' include: 1) they may have a larger crater (twice the diameter of the rest of the chain) at one end; 2) their edges may lack the degree of scalloping characteristic of coalesced circular craters; 3) they may be unusually shallow.