EVIDENCE FOR MID-CENOZOIC(?) LOW-ANGLE MULTIPLE IMPACTS IN SOUTH AUSTRALIA.

P. W. Haines[1], A. M. Therriault[2], and S. P. Kelley[3], [1]School of Earth Sciences, University of Tasmania, GPO Box 252-79 Hobart, Tasmania 7001, Australia (e-mail: Peter.Haines@unitas.edu.au), [2]Natural Resources Canada, 601 Booth Street, Ottawa, Ontario K1A 0E9, Canada (e-mail: ATherria@NRCan.gc.ca), [3]Department of Earth Sciences, Open University, Milton Keynes MK7 6AA, United Kingdom.

Introduction: A series of aligned (axes actually radiate slightly) elongate valleys, basins and breccia zones lie within a 035°-trending corridor at least 230 km long and about 30 km wide across southern South Australia. The corridor cuts obliquely across structural, stratigraphic and geophysical trends, with individual elements apparently superimposed on an older landscape. Preliminary data indicates that at least some of these features are of impact origin.

Shock metamorphism: Shock metamorphism including single and multiple sets of planar deformation features (PDFs) and grain mosaicism in quartz is present at two structures, Flaxman (34° 37'S, 139° 04'E) and Crawford (34° 43'S, 139° 02'E). In some samples deformed plagioclase has been partially converted to maskelynite. Target rocks are Neoproterozoic to early Paleozoic metasediments and minor felsic intrusives. Quartz PDF orientation with respect to the c-axis in more than 50 grains from Flaxman (Fig. 1) have a distribution corresponding to that at known impact sites with mixed sedimentary and crystalline target rocks[1]. Macroscopically the rocks are highly fractured and thin pseudotachylyte veins are present at most sites where shock metamorphism has been identified. Shatter cleavage and poorly developed shatter cones have been tentatively identified at Flaxman and in nearby hills of allochthonous breccia (remnants of proximal ejecta?).

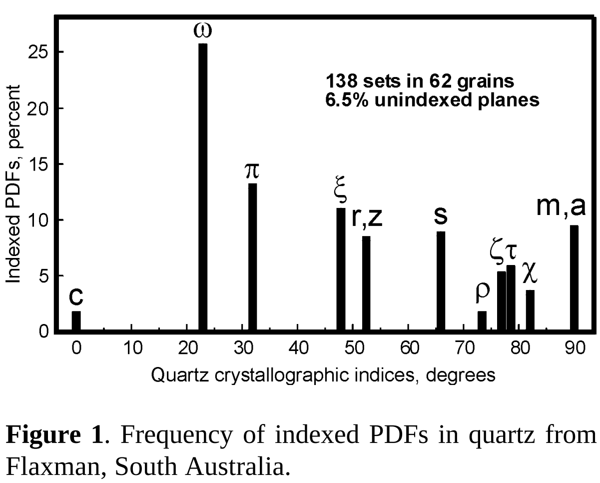

Figure 1. Frequency of indexed PDFs in quartz from Flaxman, South Australia.

Morphology and size: The original shape of Flaxman is hard to define due to degradation of any original rim. The feature consists mainly of an elongate zone of deformation (~10x1 km). Crawford is shaped like a pointed teardrop (~8.5x3.5 km). Relief between the central basin and the average eastern rim is about 80 m. The Barossa Valley (34° 30'S, 139° 00'E), centered 25 km north of Crawford, is of similar morphology and orientation but significantly larger (25x8 km). As yet, definitive evidence of shock metamorphism is lacking, but circumstantial evidence suggests a similar impact origin including what appears to be proximal ejecta in radial grooves around its northern end.

Trajectory and angle: The elongate shapes, as exemplified by Crawford, imply very low-angle impact (~0-5°). Various observations, consistent between different structures, suggest a trajectory towards the NNE. Multiple impacts may be the result of atmospheric break-up, but considering the low-angle trajectory, there is also the possibility of down-range ricochet impacts as inferred for the smaller Rio Cuarto crater field in Argentina[2]. The relationship of Flaxman to Crawford may be of this type.

Age: Impact timing is not well constrained at Flaxman or Crawford. Attempted Ar-Ar dating suggests that pseudotachylyte veins have not been isotopically reset from the early Paleozoic metamorphic age of the target rocks. If the Barossa Valley is a related impact site, better constraints are then available, as its fluvio-lacustrine fill has a probable maximum palynological age of Early Oligocene[3], suggesting that the valley probably formed during the Late Eocene-Early Oligocene. Where 'the corridor' crosses the coast of Gulf St Vincent, Cenozoic marine strata contain a good candidate of a major tsunami deposit (Chinaman Gully Formation). This unit is of terminal Eocene or Eocene-Oligocene boundary age[3]. However, any connection to the interpreted multiple impact event remains speculative.

References:

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