Evidence in Oman for Mantle Excavating Hypervelocity Impact at the Cenomanian-Turonian Boundary?

Peter OLDS*

College of Alameda, Alameda, CA 94501, USA

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Abstract: Speculation that elliptical to circular segments of surface exposed lithospheric mantle belts might mark rims of large terrestrial impact basins suggests that the ophiolite rimmed Sulu Sea, Loyalty and Yucatan basins may have resulted from middle Miocene, late Eocene and K-Pg boundary mantle excavating hypervelocity impacts on Earth (Olds, 2019). The Semail ophiolite suggests such a circular rim segment with a ~250 km radius of curvature implying an originally ~500 km diameter impact basin before subsequent deformation/destruction at plate boundaries. Presently the Arabian plate is being actively consumed at the Makran subduction zone (Penney et al., 2017) which evidently will result in subduction of the Gulf of Oman and suturing of the adjacent Semail ophiolite in the near geological future. For large impact basins on the rocky planets, O'Keefe and Ahrens (1993) estimate maximum excavation depth to be roughly 5% of final crater diameter. In this case maximum ejecta source depths of ~25 km are implied, a number roughly comparable with observed thicknesses of crust plus mantle sections for the Semail ophiolite (Aldega et al., 2017) and depths of burial due to over-thrusting (obduction) implied by the exhumed metamorphic sole (Cowan et al., 2014). Hacker et al. (1996) and Roberts et al. (2016) place peak metamorphism timing of the Semail metamorphic sole within uncertainty of the C-T Boundary at 94 Ma. Study of possible correlation of peak obduction timing with end-Cenomanian global extinction plus anoxic events (Wan et al., 2003) and C-T boundary impact ejecta plus tsunami deposits (Monteiro et al., 2001) may be warranted.

Key words: ophiolite obduction, hypervelocity impact, Cenomanian-Turonian boundary, impact basin, lithospheric mantle

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About the author and corresponding author

Peter Olds, male, teaches at College of Alameda in California, USA. He received is masters in geology from Princeton University in 1985. He is interested in the geophysical and geochemical effects of large hypervelocity impacts on Earth and collaborates with researchers at Stanford University and UC Berkeley in this area. Email: peter.chem1a@gmail.com; phone 00 1 510 283-8256

* Corresponding author. E-mail: peter.chem1a@gmail.com