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NOACHIAN AND HESPERIAN MODIFICATION OF THE ORIGINAL CHRYSE IMPACT BASIN TOPOGRAPHY:

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Introduction

We propose a new center (35.5°W, 32.5° N) and ring assigment for the original Chryse impact basin based on photogeologic mapping and re-examination of the published geology. Noachian features in the Chryse Planitia area are the best indicators of the ***original*** ancient multiringed impact structure. While other workers have centered the Chryse impact on the topographic low associated with Hesperian volcanic and fluvial deposits, we suggest that the center of the original Noachian-age excavation cavity was located 800 km farther NE and the basin topography was significantly modified over time.

Evidence for Modification of the Topographic Low

Previous workers [1,2,3] proposed a center for the Chryse impact at 45-46.5°W, 22-24°N. This center generally coincides with the locus of Hesperian outflow channel drainage and with the present day topographic low. However, there are two channels which do not drain toward the Hesperian low, Ares Vallis and Kasei Valles.

Ares Vallis exhibits a sudden direction change within Chryse Planitia. The southern portion of the channel and its associated flow features trend toward the present day topographic low. However, where Ares Vallis debouches into the Chryse Basin the direction is N to NE (not NW). Teardrop shaped bars associated with this part of the channel indicate flow was toward the north-northeast away from the (present-day) Chryse topographic low and more toward the lowlying portions of Acidalia Planitia. Additional flow features are also present between 30°N and 40°N in Chryse Planitia, which suggest flow to the NNE, away from the present Chryse Basin low and toward Acidalia.

Kasei is the widest channel debouching into the Chryse Basin. Where it approaches the basin, channel orientation is E-W, trending N of the topographic low. The bars within Kasei are asymmetric and indicative of flow to the SE, toward the present-day topographic low. Kasei Valles is the only channel in the region where channel orientation and fluvial features contrast, suggesting that the channel structure and flow direction has been controlled by separate factors.

New Center and Ring Assigments

Because Hesperian-age features such as the outflow channels suggest different locations for the topographic low of the Chryse Basin, we considered only the distribution of Noachian-age structures in attempting to locate the original impact basin. From photogeologic mapping and the distribution of Noachian-only units, we propose the original Chryse impact basin is centered at 35.5°W, and 32.5°N (Fig. 1), significantly N and E of previously published centers (Fig. 1,). Four rings (diameters 1850, 2650, 3200, 3950 km) were identified.

Previous studies and this study all have at least one ring that intersects Noachian basement (*Nb*)massifs and Noachian Hilly units (*Nplh*) in the SW region of the impact basin, and a second ring that includes the *Nplh* and Noachian plateau sequence cratered unit in Xanthe Terra (Fig. 1). However, restriction to oldest structures yeilds rings fitting the entire Chryse Basin, not just the southern portions. For example, our 1850 km ring follows the contact between Noachian and Amazonian material in NE Chryse, and the contact between Noachian and Hesperian units in NW Chryse. Previous studies did not explain the arcuate Noachian-Amazonian contact in E Chryse.

Conclusion

The original center of the impact basin (35.5°W, 32.5°N), indicated by Noachian age features, is significantly north and east of the low marked by Hesperian-age flow features (45-46.5°W, 22-24°N). The early (Noachian) geologic history of the Chryse Planitia region was

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probabably strongly influenced by two major impacts. The second impact, centered farther N in Acidalia [1,4], overlapped and destroyed the northern portion of the Chryse impact rings and uplifted the central region of the Chryse impact basin. We suggest at least two Acidalia rings may pass through the central portion of the Chryse impact basin. The central topographic depression shifted S and W between the Late Noachian and Hesperian, due in part to the effects of topographic barriers associated with the Acidalia Basin rings [1,4] which restricted volcanic and sedimentary deposits derived from the south to the southern half of the original Chryse Basin. Ponding in this region led to subsidence, shifting the topographic low and controlling the later Hesperian deposition, which became centered on 45-46.5°W, 22-24°N.

References: [1] Schultz, R.A. and Frey, H. V., JGR., 95(B9): 14,175-14,189; 1990. [2] Schultz, P.H. et al., JGR, 87(B12): 9803-9820; 1982. [3] Pike, R. J. and Spudis, P.D., Earth, Moon & Planets 39: 129-194; 1987. [4] Craddock, R. A., et al.., LPSC., XXIV: 335-336; 1993.

Figure 1. Simplified Geologic Map of the Chryse Planitia Region, Mars showing the center and ring assignments for the Chryse Basin multiringed impact structure (a) [2], (b) [3], (c) [1], (d) Stockman and Frey (this study). **Key to Geologic Units**: NPL- Noachian plains units (*Npl_1, Npld, Nple, Npl_2*); NB -Noachian basement material (*Nplh, Nb, Nm, HNu*) HV- Hesperian volcanic plains units; HCH-Hesperian channel deposits and chaotic terrain; AP- Amazonian plains units.