THE WYOMING IMPACT CRATER FIELD: SECONDARY CRATERING VS. PRIMARY CRATERING.

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Introduction: ln 2022, an article was published in the GSA Bulletin [1] claiming that a secondary crater field of a major impact structure has been detected for the first time in the state of Wyoming in the United States, as has long been known from the Moon, other planets, and their moons. 31 craters are confirmed by shock effects, and more than 60 are considered possible craters. Here we discuss the article and disapprove of the arguments for a secondary cratering.

The secondary-cratering model [1]: Two findings are highlighted as evidence: the axial directions of elongated craters within four separately occurring clusters of craters. The elongated axis directions span four acute-angled corridors that overlap at a distance of roughly 200 km, where they are thought to mark the presumed primary crater from which projectiles were launched along the corridors to create the secondary craters. The landing of these projectiles after ballistic trajectory are then supposed to have produced the elliptical to ovoid asymmetric shapes of the secondary craters. In the intersection region of the three corridors, there should exist a significant negative gravity anomaly of a hypothesized primary impact crater measuring perhaps 50 km. Third, it is argued that such a large Wyoming strewn field, measuring close to 90 km, could never be attributed to a primary impact according to theoretical modeling and considerations.

Failure of the secondary-cratering model: From the text of the article and the Supplementary Material, we deduce that the argument of asymmetry of the crater axes must be rejected. Of the 31 craters classified and measured as proven, 15 have an eccentricity e = 1, that is, they are circular. With an e ≤ 1.2, 19 of 31, well over half, are also practically round. Of 23 crater measurements in cluster SM, 11 have an e = 1, meaning they are round, and with e ≤ 1.2, 14, more than half, are also practically circular. In the WR and PCR clusters, only 2 and only one crater, respectively, were measured, but trajectory triangle corridors were constructed for the intersection of the assumed primary crater. - The suspected primary crater at the intersection of the above trajectory corridors is based also on a negative free-air gravity anomaly. The use of the free-air anomaly instead of the correct Bouguer anomaly makes the statement about a primary crater there completely worthless. - That the extension of the Wyming strewn field of about 90 km excludes a primary impact formation is based on rather old model calculations and ignores several actually existing larger primary terrestrial crater strewn fields, which the article does not list.

Discussion and conclusion: The elongation of the postulated secondary craters (but only for roughly half) as assumed "signpost" to the primary crater remains without significance, because such an asymmetry can arise in both cases: at the impact of the projectiles of a previously disintegrated asteroid or comet, or at the impact of the ejecta launched from a primary crater. Elongated craters may be also the result of overlapping double craters suggesting only an apparent impact direction. - A secondary crater field logically requires a primary large impact crater. Such a primary crater does not exist so far, neither morphologically nor geologically. The negative gravity free-air anomaly (which is not shown in the article) is a fundamental methodological mistake, because geophysically relevant is the Bouguer anomaly. At the location of the free-air anomalies described in [1] the map of the Bouguer anomalies does not show any special feature suggesting a large impact structure there. It is not clear to us why the Bouguer map was ignored, as it is used in worldwide impact research. - The claim that a crater strewn field as extensive as Wyoming's would not be consistent with a primary impact ignores reality. The claim is supposedly supported by a 20 years old model calculation [2] and by a comparison with the small strewn fields from the densely clustered fields of Morasko, Odessa, Wabar, Henbury, Sikhote Alin, Kaalijärv, and Macha, but is contradicted by the three larger impact strewn fields of Campo del Cielo [3], Bajada del Diablo (very likely) [4, and ref. therein], and Chiemgau [5, and ref. therein; 6], which are best described in the literature but are not mentioned in [1] with a single word. We also miss in [1] the reference to the Carolina Bays probable true secondary crater field of the suspected YDB impact [7]. A comparison of the Wyoming field with the Chiemgau impact field of similar extent but with far more than 100 craters in an elliptical scattering field shows [6] that practically all features of the Wyoming craters described in [1] occur in almost identical formation in the Chiemgau craters. – We conclude that the Wyoming secondary crater field is a fiction and not supported by anything. Nowhere is there any robust evidence for the existence of an associated primary crater.

References: [1] Kenkmann, T. et al. (2022) *GSA Bulletin*, online 11 Feb. 2022. [2] Artemieva, N.A. and Shuvalov, V.V. (2001) *Journal of Geophysical Research: Planets* 106: 3297–3309. [3] Wright, S.P. et al. (2007) LPS XXXVIII Abstract #2017. [4] Orgeira et al. (2017) *Geoscience Frontiers* 8:137-149. [5] Rappenglück, M.A. et al. (2017) *Zeitschrift für Anomalistik* 17: 235-260. [6] Ernstson, K. et al. (2022) *http://www.impact-structures.com/wp-content/uploads/2022/04/Wyming-article-text*.pdf. [7] Sweatman, M.B. (2021) *Earth-Science Reviews* 218: 103677.