NON-CLASSIC IMPACT STRUCTURES IN THE EPICENTER AREA OF THE 1908 TUNGUSKA CATASTROPHE

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Introduction: John's rock is an exotic boulder associated with the fresh impact in the epicenter area of the 1908 Tunguska catastrophe [1,2]. John's rock landing velocity is estimated to exceed 547 m/s [1,2]; surface of several splinters shows fusion crust-like coating. There is a consistency in geometry of the Tunguska projectile trajectory, locations of John's rock fragments, cleaved pebbles, and directions of impact groves produced by the large fragments. John's rock locates on quaternary deposits at the top of the Stoykovich Mountain [3]. This rock significantly differs from the indigenous rocks as previously discussed in detail [2,3].

Non-classic impact structures: Reconstruction studies show that John's rock did not produce a typical impact crater. Instead, it formed the massive (>50 m^3) canal and further the groove in hydric permafrost (Fig. 1). Pattern of permafrost destruction suggests recent high-speed entry and lateral ricochet of John's rock with further deceleration and breakage. The ricochet was caused by bouncing of the boulder from the dense geological deposits.

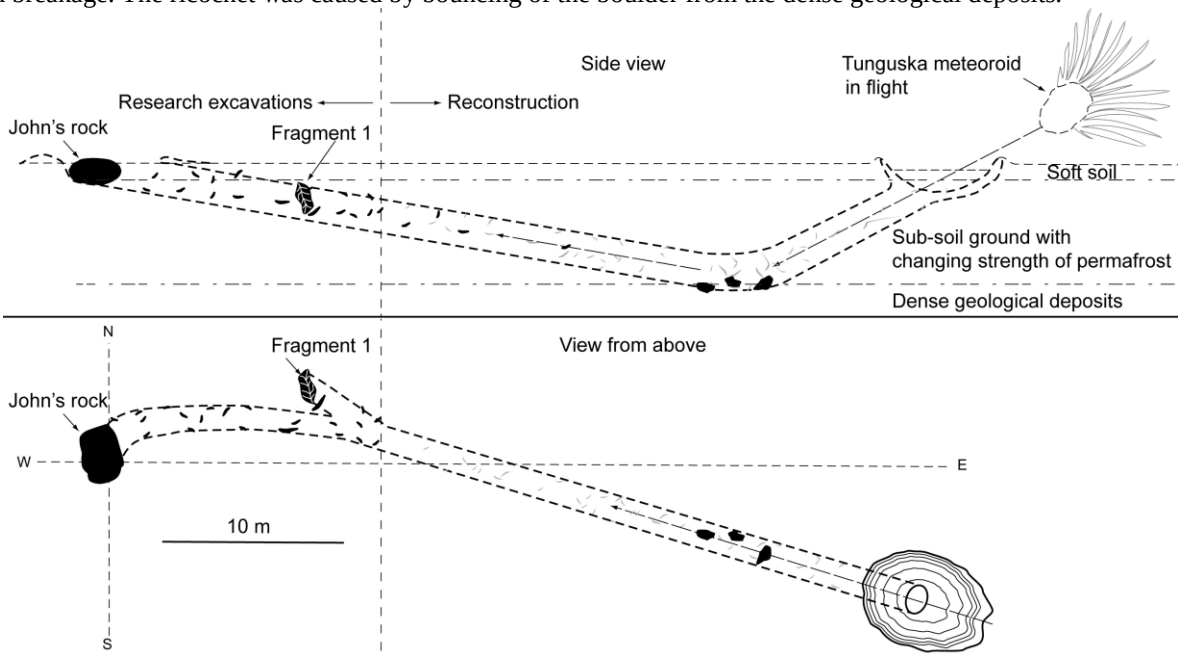

Fig. 1. Side and top views of the high-speed entry, ricochet, and breakage of John's rock.

Discussion: The fall of the Tunguska projectile fragments caused the formation of non-classic impact structures such as the funnels, grooves, and the pipe-like disturbances in the boggy ground [4]. Comparative analysis of aerial photographs taken in 1938, 1949, and 1999 allowed to distinguish the particular hydric surface patterns with rapidly changing morphology which helped to identify non-classic impact formations associated with the 1908 Tunguska catastrophe. The absence of classic impact crater in Tunguska is similar to several other cases when large meteorites fell on hydric soils and sands producing the atypical impact formations. Indeed, among thousands of fragments of the 1947 Sikhote-Alin meteorite, several large fragments fell on frozen hydric soil forming up to 8-m long canals with merely small entry holes [5]. Similarly, the largest fragment of the Chelyabinsk meteorite, a ~570 kg rock, did not form a significant impact crater at 20 m deep bottom of Lake Chebarkul [6,7].

Conclusion: Non-classic impact structures associated with the 1908 Tunguska event require comprehensive interdisciplinary field explorations.

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