

PALEOENVIRONMENTAL CHARTS FOR TERRESTRIAL IMPACT STRUCTURES - A SIMPLE TOOL TO TEST IMPACT AGES AND MARINE/CONTINENTAL IMPACT CONDITIONS.

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Introduction and Background: Most of the ~175 impact structures currently known on Earth are still insufficiently dated [1-2]. At buried or deeply eroded impact structures that lack material suitable for isotopic dating, stratigraphic methods provide the only constraints for the timing of crater formation; in many cases, only the maximum age (the actual age of the shocked target rock) is given in the literature and in terrestrial impact crater listings [3]. In addition to isotopic and stratigraphic dating, paleogeographic considerations may help to test and refine poor and/or equivocal impact ages as recently done for Puchezh-Katunki (Russia) and Obolon (Ukraine) [4].

Paleogeographic studies are, furthermore, an essential tool to discriminate between impact structures that formed in continental or marine environments. Only a small number (~25) of marine terrestrial impact structures have been reported so far [5]. Structural and sedimentological investigations (e.g., the recognition of submarine resurge breccia deposits) helped to reveal some additional marine impact structures, such as Obolon (Ukraine) [6]. However, further efforts need to focus on the recognition of marine impact structures on Earth.

Data: Combining recent paleogeographic maps of North America (provided by Ron Blakey, Northern Arizona University [7]) with impact ages available in the literature [3; 8-14], we present a preliminary set of paleoenvironmental charts for some selected North American impact structures (USA: Ames, Oklahoma; Avak, Alaska; Crooked Creek, Missouri; Newporte, North Dakota; Sierra Madera, Texas; Upheaval Dome, Utah; Wells Creek, Tennessee; Canada: Carswell, Saskatchewan; Charlevoix, Québec; Pilot, Northwest Territories; Steen River, Alberta; Fig. 1).

Interpretation and Results: In accordance with [7], given that both the paleogeographic maps and impact ages can include uncertainties, the paleoenvironmental charts suggest that Newporte (~500 Ma [8]) and Steen River (91 ± 7 Ma [9]) formed under marine conditions and that Ames (>470 Ma [10]), Avak (~93-88 Ma [11]), Charlevoix (~450-480 Ma [12]), and Carswell (115 ± 10 Ma [13]) are probably marine impact structures. The Pilot (445 ± 2 Ma [13]) event was obviously a continental impact scenario, as most likely was the Wells Creek (200 ± 100 Ma [14]) impact. Charts exhibit transitions in environmental conditions for Crooked Creek (320 ± 80 Ma [14]),

Upheaval Dome (<170 Ma [3]), and Sierra Madera (<100 Ma [14]). New field studies and the detection of structural and sedimentological features diagnostic for marine or continental impact, respectively, might strongly narrow the age windows for these structures.

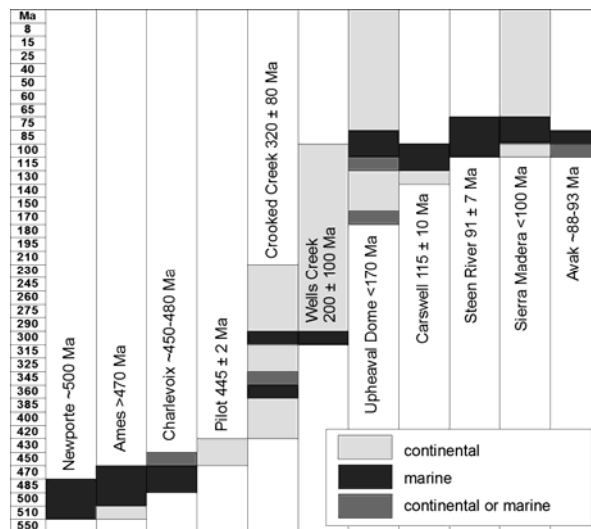


Fig.1: Paleoenvironmental charts for 11 selected North American impact structures (according to [7]).

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