

THE CANADIAN IMPACT RECORD: A UNIQUE RESOURCE FOR ANALOGUE SCIENCE, ENGINEERING, TRAINING, AND OUTREACH ACTIVITIES. G. R. Osinski¹, ¹Institute for Earth and Space Exploration / Dept. Earth Sciences, University of Western Ontario, London, ON, Canada (gosinski@uwo.ca).

Introduction: The collision of asteroids and comets with planetary bodies is one of the most common geological processes in the Solar System [1, 2]. This is evidenced by impact craters being one of the most numerous geological landforms on the majority of the rocky planets, asteroids, and many of the rocky and icy moons of the inner and outer Solar System. It is also becoming increasingly clear that impact events have played an important role in the geological evolution of the planets [3] and, potentially, in the origin and evolution of life [4].

Outcrops within impact craters have been frequent stops during the robotic exploration of Mars by the Spirit, Opportunity, and Curiosity rovers and, most recently, the Perseverance rover successfully landed in Jezero Crater from which the first *in situ* samples from the Red Planet will eventually be returned. With the renewed robotic exploration of the Moon and future return of humans, an understanding of impact cratering processes and products is critical for maximizing the science return of lunar exploration missions.

The impact record on Earth offers the only potential for ground-truthing interpretations made on other planetary bodies and the opportunity for fieldwork, in depth sampling, and deep drilling, makes the terrestrial record of paramount importance for our understanding of the impact cratering process. Impact craters on Earth also offer an important training ground for scientists, engineers, mission managers, and astronauts, in support of future missions.

In this contribution I will provide an overview of the impact cratering record on Earth via the *Impact Earth* initiative and highlight the well-preserved Canadian impact record as a resource for analogue science, engineering, training and outreach.

The Impact Record on Earth: Through an exhaustive analysis of an original Geological Survey of Canada database and the ongoing analysis of the published literature, we list 200 confirmed impact structures in the *Impact Earth* crater database (www.impactearth.com) (Fig. 1).

The Canadian Impact Record: Thirty-one of the world's craters are in Canada, many of which lie in remote and sparsely vegetated regions, making them ideal planetary analogues. Many have received very little scientific study since their discovery leaving room for future science-driven analogue activities. Furthermore, many of the Canadian craters are extremely well preserved and exposed. Notable examples are provided below.

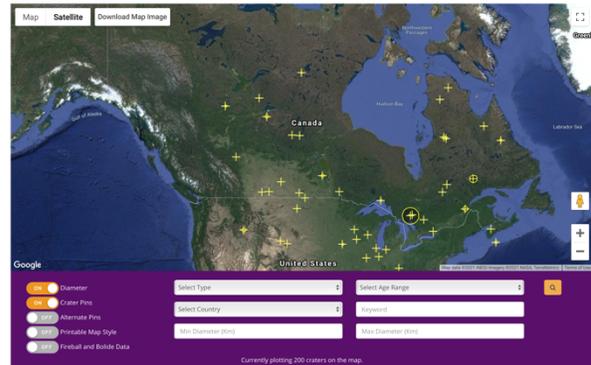


Fig. 1. The interactive landing page for the *Impact Earth* database.

Haughton impact structure. This 23 km-diameter crater lies in a polar desert environment on Devon Island. It is a unique Mars analogue site [5], with well-preserved ejecta and crater-fill deposits, geomorphological attributes such as gullies, and impact-generated hydrothermal deposits considered prime candidates for life on early Earth and Mars.

Mistastin Lake impact structure. The 28 km-diameter Mistastin Lake structure, Labrador, is well exposed impact breccias, melt rocks, shocked materials, and impact ejecta deposits [6]. This crater formed in a target comprising anorthosite, the dominant rock type of the lunar highlands.

West Clearwater Lake impact structure. This 60 km-diameter structure possess significant exposures of impact melt rocks and breccias and hydrothermal alteration that has been understudied to date.

Sudbury impact structure. The 250 km diameter Sudbury structure is one of only two confirmed peak-ring impact structures on Earth – the other, Chicxulub, being buried off the Mexican coast – and the only terrestrial example of a large differentiated impact melt sheet [7].

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