COMPARISON OF MID-SIZE COMPLEX TERRESTRIAL IMPACT STRUCTURES. G. R. Osinski[1], and R. A. F. Grieve[1,2], [1]Dept. Earth Sciences/Physics and Astronomy, University of Western Ontario, London, ON N6A 5B7, Canada (gosinski@uwo.ca), [2]Earth Sciences Sector, NRCan, Ottawa, ON K1A 0E4, Canada.

Introduction: Despite the ubiquitous nature of impact craters in the solar system, some important second-order aspects of the processes and products of their formation remain incompletely understood. One such aspect are the parameters and processes controlling the final morphology and morphometry of impact craters For this reason, the systematic study of mid-size impact structures was one of the three main recommendations for future research resulting from the first Bridging the Gap conference in 2003 [1] and provides the motivation for this study. This builds upon an initial comparative study of the Haughton, Ries, and Mistastin that focused on impact melt products [2]. We expand this study here to include other craters (Table 1) and different aspects of these craters.

Discussion: We focus here on 3 main aspects of terrestrial impact craters.

Diameter. A fundamental question to be asked at the outset is what exactly the various listed diameters for these craters actually represent. Do they represent the *rim* (or final crater) *diameter* or *apparent crater* diameter (see discussion in [3])? It has been suggested for Haughton that the commonly quoted diameter of 23 km is actually the apparent diameter and a robust estimate of 16 km has been suggested for the rim diameter [4]. At the more eroded craters (Mistastin and Rochechouart), the listed diameter is clearly an apparent diameter. It is not so clear, however, for Ries and Boltysh – which both retain much or their original morphology – what the listed diameter represents.

Impactites. One of the most notable differences between these various craters is in their allochthonous impactites. Early suggestions that impacts into sedimentary targets do not produce impact melt-bearing lithologies have now largely been superceded by the realization that the volumes of melt produced within craters formed within different target lithologies are similar [2, 5]. It is apparent, however, that even in craters developed purely in crystalline targets, there are substantial differences in the characteristics of the allochthonous crater-fill materials. At Mistastin, a large coherent melt sheet was generated but impact melt-bearing breccias ("suevites") also underlie the melt sheet and intrude into the crater floor [6]. At Boltysh, suevites underlie and overlie the melt sheet [7]; whereas, at Rochechouart, it appears that no coherent clast-poor melt sheet is preserved (or formed?) but rather a series of more heterogeneous melt-bearing breccias. This begs the question of why, given the seemingly similar target lithologies?

Central uplift. There are also notable differences in the surface expressions of the central uplifts at these structures. Rochechouart and Mistastin are too eroded to make any definitive affirmations regarding their original uplift morphology. Boltysh possesses a central peak that is emergent through the crater-fill deposits [7]; whereas at Haughton, uplifted lithologies (with a diameter of 12 km) were buried under allochthonous crater-fill impactites such that an emergent uplift would not have been visible in the pristine crater [4]; erosion has since exposed a small part of the uplift. Like Haughton, the Ries structure also lacks a central emergent topographic peak. Instead, an "inner ring" of uplifted basement material is present [8]. Some workers suggest this is equivalent to the central uplift, while others suggest it represents part of the collapsed transient cavity rim. These different hypotheses have very different implications for interpreting cratering processes. We note that the diameter of the central uplift at Haughton and the "inner ring" at Ries are both ~12 km, which potentially suggests a common origin.

Concluding remarks: It is most credible to reason that target strength (e.g., sedimentary versus crystalline) played a role in the noted morphological differences and the presence of volatiles played a role in impactite differences. While this may be the case, it is not clear how these different parameters resulted in achieving these differences and further compartive studies are required and encouraged.

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Table 1. Initial craters investigated for this study and their important attributes*.

Crater	Age (Ma)	D (km)	Target
Boltysh	65	24	C
Haughton	39	23	S
Mistastin	36	28	C
Ries	14.3	24	M
Rochechouart	214	24	C

* Abbreviations: D = Diameter as listed in the Earth Impact Database [9]. C = crystalline. S = sedimentary. M = mixed crystalline–sedimentary target.