FIRST RESULTS OF MULTIDISCIPLINARY ANALYSIS OF THE HAUGHTON IMPACT CRATER, DEVON ISLAND, CANADA. V. SEISMIC STUDIES; Hajnal, Z., D. Scott, J. Pohl* and P.B. Robertson**, Dept of Geological Sciences, University of Saskatchewan, Saskatoon, S7N OWO, Canada, *Institut für Allgemeine und Angewandte Geophysik, Theresienstr. 41, D-8000 Munich, FRG, **Earth Physics Branch, Energy, Mines and Resources, Ottawa K1A OY3, Canada.

Haughton has the potential to become a datum for terrestrial ring impact structures in sedimentary rocks. It is young (20±5 m.y.) and therefore well preserved. It is also well exposed because of the lack of masking soils and vegetation in its Arctic setting, so the surface geology has been mapped in detail. There is little subsurface data available for this remote region, however, and the climate and permafrost terrain place limitations on drilling and geophysical surveys that could improve the situation. In the summer of 1984 a high resolution reflection seismic profile was surveyed across the northwestern flank of the impact structure to establish the subsurface extension of roughly circular, surface structural elements (Fig. 1), and to provide a basis for interpretation of earlier gravity and magnetic surveys (1).

The field instrumentation comprised a Texas Instrument, 48 channel DFS V recording system. The seismic array was formed by 48 groups of Mark Products L-28-D, 14Hz detectors. Each group contained 9 geophones distributed linearly in a spacing of 4.20 m resulting in a group interval of 33.53 m. Following a standard split spread shooting arrangement (2) the survey supplied a 12 fold, common mid-point data multiplicity along the 10 km long profile. The energy source was 60 percent Geogel placed in the uppermost 0.30 to 0.9 m of the near-surface active layer. This extremely shallow energy source generated on nearly every recorded shot, strong complex air waves and ground roll patterns. A 6 km reverse refraction profile examined the impact influence on the crystalline basement rocks.

Beyond the coherent noise, the signal processing and analysis is hindered by the rapidly changing near-surface environment. These near-surface influences had more than one distinct source. The sudden, irregular variations in station elevations, as well as the greater than 400 m altitude difference between the highest and lowest point of the profile, made computation of accurate datum correction extremely difficult. Implementation of some smoothing techniques further illustrates the adversity of the problem. Heterogeneity of the surface weathered layer created additional major processing complications. The sandy-clayish soil at the west end of the profile is replaced at irregular intervals by limestone outcrops, unconsolidated rubble, impact breccia and relatively thick lake bed deposits. Having different acoustic velocity characteristics, these different surface layers give rise to different time delays as the seismic signal propagates through them. The correction for these near-surface, induced time arrival irregularities necessitated a very detailed, record to record, weathering analysis program

The individual records were subjected to a two-dimensional f-k filtering (3) and tau-p (4) transformation processes in an attempt to eliminate the coherent noise components. As a consequence of spacial aliasing, the f-k filtering technique was incapable of removing the higher frequency segment of the ground-coupled air waves. However, the transformation operation which collapses all linear events to a point in the tau-p domain, was able to delete all wave components from the signal.

Despite the serious near-surface disturbances, the basic brute stacked seismic section along the western platform segment of the profile indicated nearly continuously correlatable reflection events from several reflecting horizons. Using velocity and geological information from nearby Bathurst Island, a variety of models were computed implementing both the principles of reflectivity (5) and asymptotic ray theory (6) methods in an attempt to relate the seismic events to the projected subsurface geology. It appears that the tops of the Bay Fiord gypsum, Eleanor River limestone and the Cambrian beds are good reflectors. Reflections associated with these interfaces were correlated west of the outer margin of the impact structure. To the east, within the outer ring, the seismic section is badly fragmented by complex patterns. Along the eastern half of the profile, dips of different recognizable reflection segments increase dramatically revealing an uplift structure in the central part of the Haughton complex.

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