The Late Jurassic Mjølnir Marine Impact Crater

[1]TSIKALAS, F., [1]FALEIDE, J. I., [2]GUDLAUGSSON, S. T., [1]ELDHOLM, O. and [1]DYPVIK, H.
[1]Department of Geology, University of Oslo, P.O. Box 1047 Blindern, N-0316 Oslo, Norway; [2]Now at Orkustofnun, Geoscience Division, Reykjavik, Iceland.

The 40-km-diameter Mjølnir Structure, one of the few well-preserved marine impact craters on Earth, has been extensively studied for the last six years. Its impact origin has been convincingly confirmed by two shallow drillholes that constrain the event to Volgian-Berriasian age (149-141 Ma), and show sedimentological, geochemical, and mineralogical evidence typical of impact craters. Detailed geophysical analysis also provides new, important constraints on meteorite impacts into water-covered areas. In particular, the low-strength sedimentary target and the presence of water have led to increased gravitational collapse and infilling resulting in shallow apparent crater depth. The geophysical anomalies closely correspond to the structural crater expression and to the laterally-varying physical properties induced by impact in a shallow marine sedimentary basin. The estimated magnitude of the Mjølnir impact (~10e21 J) is not large enough to have caused significant mass extinction. It may, however, be associated with considerable short-term regional environmental disturbance, including a large-magnitude earthquake, displacement of significant amount of material from the crater site, and generation of high-amplitude tsunami waves. Furthermore, a 3-7% increase in porosity in combination with observed gas-related seismic-amplitude anomalies, the large volume of impact-deformed strata, and regional geologic considerations suggest that the crater may have hydrocarbon reservoir potential. The structure provides a well-defined and easily accessible laboratory for the study of both impact and post-impact related processes.