**DRILLING THE LATE JURASSIC MJØLNIR IMPACT CRATER IN THE BARENTS SEA.**

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**Introduction:** The Mjølnir impact structure is a 40 km in diameter crater, localized on the Bjarmeland Platfrom in the Barents Sea below 350 m of water and 50 to 150 m of post-impact sediments. The impact happened close to the Jurassic/Cretaceous boundary (about 142 million years ago), in a time when a wide, shallow (300- 400m deep) epicontinental sea covered the area [1,2,3]. The Mjølnir crater is presently situated between Bear Island and the mainland Norway. It is one of few, large marine impact structures on the Earth and one of the very few were crater and proximal ejecta can be correlated [4].

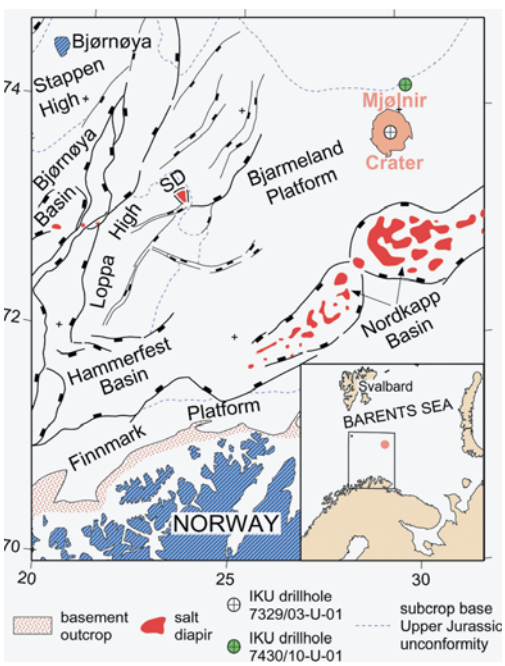


**Figure 1.** The location of the Mjølnir Impact structure in the Barents Sea is shown on the Bjarmeland Platform between the mainland Norway and Svalbard. The two shallow drillholes (7329/03-U-01 and 7430/10-U-01) close to the structure is marked. The area close to the Norwegian coastline (e.g. Hammerfest Basin, Loppa High) has for about 30 years been opened for the search for oil and gas.

**Background:** During the last 30 years the Barents Sea and the Mjølnir structure area have been well mapped geophysically. One shallow core (7329/03-U-01)(121 m) drilled inside the crater and a few shallow drillholes in its neighborhood (a few tens to hundreds of kilometers away) provide a fairly good overview of the main phases of the impact event. Moreover, interesting results have been achieved in combination with numerical simulations [5,6].

Impacts, particularly in marine environments, can significantly affect Earth's geological and biological evolution. However, detailed knowledge of the marine impact cratering process is still limited [4]. Among the 176 terrestrial craters, Mjølnir and its well preserved proximal ejecta deposits are unique; as these ejecta deposits always remained under water in calm conditions, consequently their preservation is most likely excellent.

The Barents Sea has been opened for petroleum exploration south of the Bjarmeland Platform. In the Hammerfest Basin and Loppa High, in particular, the petroleum industry has been active drilling more than 80 wells during the last 30 years. One field is in production (Snøhvit) and one recognized as commercial (Goliat). The petroleum industry has some additional interest in the suggested shallow coring program related to the Mjølnir impact structure; possibly getting more information on the source rocks of the area, better stratigraphical information and recognition of possible new reservoir formations. The development of the Mjølnir research program is consequently carried out in full cooperation with the Norwegian Authorities (Norwegian Petroleum Direcotrate) and the active petroleum industry in the area.

**The coring program:** One of Mjølnir's great scientific advantages is the clear correlation between the crater and the proximal ejecta, accessible by shallow drilling (<300 meters). Consequently, Mjølnir is an ideal target for scientific drilling to document ejecta generation and distribution, and the relationship between a midsize marine impact event and biotic evolution. Moreover, Mjølnir's ejecta may serve as a stratigraphic marker to correlate Boreal and Tethyan faunal provinces near the Jurassic/Cretaceous boundary; a problem that has puzzled stratigraphers for years. Impact- induced tsunami generation, and ignition of or-

ganics and subsequent soot distribution, provide further research opportunities.

The drilling proposal suggests drilling of five to six, up to 300-meter deep core holes around the Mjølnir structure to map and understand ejecta formation and distribution, coupled with in-situ disturbance of sediments due to seismic and shock waves, or erosion by displaced water near the crater. Analysis of the cored material should be accompanied by more sophisticated simulation models of the formation and deposition of ejecta in a marine environment.

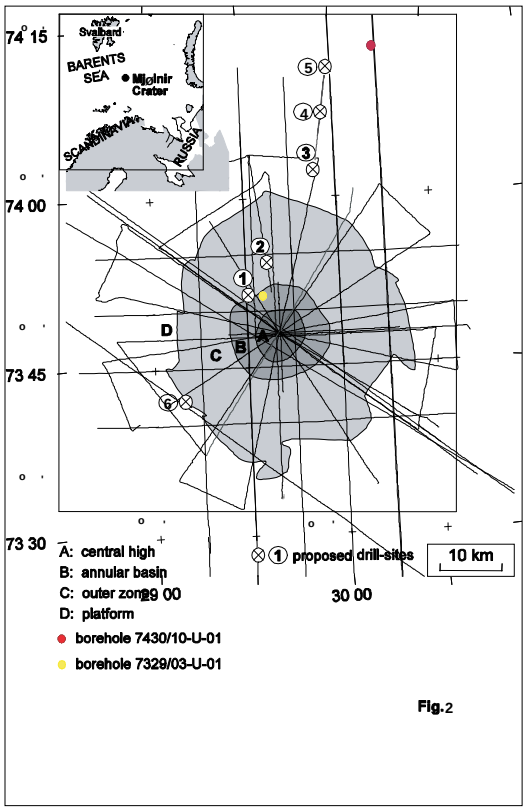


**Figure 2.** The outline of the Mjølnir structure and the seismic lines across the structure is shown along with the suggested 6 new drill holes of the present proposal. The old shallow drillholes (7329/03-U-01 and 7430/10-U-01) are marked red and yellow respectively.

The coring will be executed in 2011. Finacially support has been applied for; possible sources include, the integrated Ocean Drilling Program (IODP) og International Continental Scientific Drilling Program (ICDP), Norwegian Research Council (NRC) and the petroleum industry active in the area.

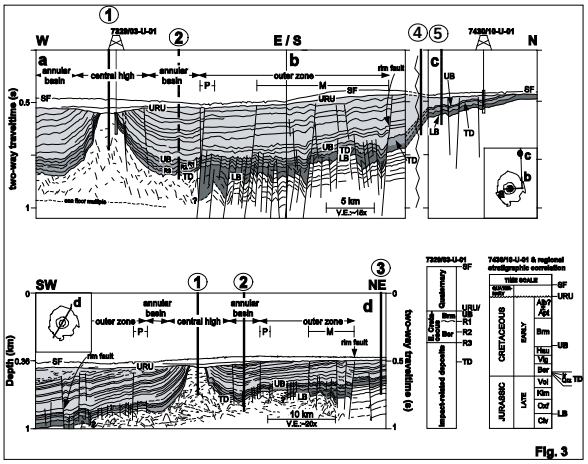


**Figure 3.** The suggested locations (see Firgure 2) marked on the relevant seismic lines crossing the Mjølnir structure.

**Refrerences:** [1] Dypvik H., Gudlaugsson S.T., Tsikalas F, Attrep M.Jr., Ferrell R.E.Jr, Krinsley D.H., Mørk A., Faleide J.-I., and Nagy J.,(1996) *Geology* 24, 779 – 782. [2] Gudlaugsson S.T.(1993).*Geology*, 21, 291-294. [3] Tsikalas F., Gudlaugsson S.T. and Faleide J.-I. (1998). *Journal of Geophysical Research*, 103: 30,469 – 30,483. [4] Dypvik H. and Jansa, L. (2003). *Sedimentary Geology*, 161, 309 – 337. [5]Shuvalov V., Dypvik H. and Tsikalas F. (2002) *Journal of Geophy ical Research*, 107, E7, 10.1029: 1-1 to 1-13. [6] Sh valov V. and Dypvik H. (2004).*Metoritics and Planeta Sciences* 39(3), 467 – 478.