SILVERPIT STRUCTURE, NORTH SEA: SEARCH FOR PETROGRAPHIC AND GEOCHEMICAL EVIDENCE FOR AN IMPACT ORIGIN.

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Stewart and Allen [1] described a 20-km-diameter concentric multiring structure, named „Silverpit“, ca. 130 km E of the coast of England, centered at 1° 51’ E and 54° 14’ N. The structure, in Cretaceous chalk and Jurassic shales, is at a present-day depth of 300 to 1500 m below the sea bed. Mapping from detailed 3D seismic reflection data allowed obtaining a detailed structural image of the feature. Multiple rings, similar in appearance to impact craters on Jupiter’s moon Europa, are present, and have diameters of ca. 4 to 20 km. The structure also has a small central uplift about 1 km in diameter. The disrupted zone is covered by Tertiary chalk, which constrains the age of the feature between 60 and 65 Ma [1]. Based on the structural interpretation, an impact origin for Silverpit was assumed by [1]. Unfortunately, none of the customary petrographic or geochemical indicators supporting such a proposal were available at the time. Recently, Underhill [2] challenged the impact hypothesis, suggesting that the feature rather formed by salt withdrawal at depth, and that the evidence for a central peak is not unequivocal. He also noted that Silverpit is located on a Tertiary fold axis, a feature interpreted by [3] as possibly being caused by the impact. We studied drill cutting samples from two boreholes for the possible presence of petrographic and geochemical evidence for shock metamorphism or a meteoritic component. We studied 56 polished thin sections made from 42 samples of drill cuttings in three grain sizes (sand, coarse sand, and pebble = 0.5 - 1 cm) from two boreholes located 3 km (well 43/25-1) and 7.5 km (well 43/24-1) from the center of the Silverpit structure. Samples were from the interval between 425 and 836 m depth. A number of lithologies (limestone, fossiliferous limestone, chert, silt- and mudstone, various granitoid- and meta-gneiss-derived lithic and mineral clasts) were sampled by these holes. Thousands of quartz grains, and hundreds of lithic granitic and feldspar particles were scrutinized for shock metamorphic effects, without a single positive recording. Deformation is generally restricted to undulatory extinction in some grains of/with felsic minerals and minor bending and kinking of biotite and muscovite. It is possible that samples from well 43/25-1 contain some partially altered volcanic fragments, but this is still subject of further investigation. In addition, we analyzed most of the same samples also for trace element composition, mainly trying to find enrichments of siderophile elements, in an attempt to detect the presence of a possible meteoritic component. These analyses are still in progress. No unequivocal indication pro or contra an impact origin has been found yet.

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References: [1] Stewart S.A. and Allen P.J. (2002) Nature 418, 520-523. [2] Underhill J.R. (2004) Nature doi 10.1038/nature02476. [3] Stewart S.A. and Allen P.J. (2004) Nature doi 10.1038/nature02480.