MARINE IMPACTS – MECHANISMS OF LATE SYN -/ EARLY POST-IMPACT CRATER INFILL.

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Introduction: Marine impacts are found in sparse numbers on the Earth. Of the 174 impact crater known so far, only 27 are of proven marine origin. This is a relatively small number taking into consideration that about 70 % of the Earth is covered by water, [1],[2]. The poor representation is partly due to attenuation of impact energy by deep water columns, leaving the relatively shallow platforms or continental margins as most promising search areas for impact craters along the sea floor. Preservation of marine impact structures can be limited, as most ocean floors are dynamic features of relatively young age. Furthermore the fast infill and burial by sediments in these environments will mask and protect the structures, and discoveries rely on advanced subsurface information like seismic or drill holes.

Recognition and understanding of the sedimentary successions and the related depositional crater infill processes could be of importance for the recognition of new impact structures. This sedimentological information, in addition, may result in better understanding of crater formation and the possible crater exploitation.

Discussion: In marine craters comparable sedimentary successions have been found deposited on the autochthonous breccias and suevites. The syn- to early post-impact depositional conditions seem to be related in the marine craters studied; developing from avalanches, screes, slides and slumps, through sequences of mass flows before ending with density currents and fine-grained sedimentation from suspension.

Data from several structures have been studied, in this presentation examples from the Chesapeake Bay, [3], Mjølnir, [4], [5] and Gardnos, [6] impact structures will be presented. These craters represent very different conditions e.g. various times of formation and different impact sizes. The Chesapeake Bay Crater is 90 km in diameter and was formed in late Eocene, the 40 km in diameter Mjølnir Crater was formed at the Jurassic/Cretaceous boundary, while the 6 km in diameter Gardnos Crater probably is of Late Precambrian age. In addition to the differences in size and timing, the craters were formed in target areas with highly varying composition; in the Mjølnir case the bolide impacted into about 400 m of water and a sedimentary succession of more that 8 km, while in the Gardnos case Precambrian gneisses just covered with a few tens? of meter of water and some hundred meters of marine claystones and shales were impacted. Target-wise the Chesapeake Bay Crater represents a situation somewhere in-between. These differences can explain some of the thickness and compositional variations in the post-impact successions found, while the overall sedimentary processes active seem to have been comparable in the craters studied.

Conclusion: A common sequence of sedimentary processes has been recognized in the marine impact structures studied. The main successions reflect the shallow marine conditions and sedimentary processes to some extent controlled by the size and age of impact along with water depth and qualities of target lithologies.

Succeeding the fall back impactite sedimentation, tectonic movements related to crater modification and instability of the steep crater walls and central high, result in deposition of very coarse grained breccias. Avalanches, screes, slides and slumps will dominate. Sea water flushing back, resurging into the crater may deposit thick successions within a very short time-span. At this stage slumping, mass- and density flows will be important. Once stabilized and refilled with water, sedimentation processes in the crater may return to close to pre-impact conditions and suspension dominated sedimentation. At least two major differences of depositional significance can be recognized;

1) the new and often steeper topography of the crater basin and
2) the presence of newly generated debris from the impact as an easily available sediment source.

References: [1] Dypvik, H. and Jansa, L. (2003) *Sediment. Geol.*,161, 309-337. [2] Dypvik, H. et al., (2004) *Impact Series, Springer* [3] Gohn, G. et al., in prep. [4] Dypvik, H. et al., (2005) *Sediment. Geol.*,168, 227-247. [5] Dypvik et al. (2006) *Norwegian Journal of Geology*, 84, 143-167. [6] Kalleson et al. (2008), *GSA SPE* 437, in press.