Preparation for characterisation of natural gas hydrate reservoirs by high energy synchrotron radiation

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Natural Gas Hydrate reservoirs in the Gulf of Mexico and in the Black Sea have been characterised by Synchrotron radiation at the new materials beam line HARWI II.

Eight natural samples were investigated in September 2006. Although at that time, only phase fractions could be measured, the results strongly indicate that further attention needs to be paid on those samples. Unfortunately, the instrumentation at the HARWI II did not allow moving detector measurements, otherwise already at that time crystal sizes and grain shapes would have been measured [1][2][3]. Grain Size information are an important tool in characterising gas hydrate reservoirs. Thus determining the age of naturally occurring gas hydrates should be feasible by statistically sufficient grain size investigations. Dating gas hydrates is not possible by any other mean and is of great importance for geosciences. Appropriate grain size or shape identification is difficult and often impossible to obtain by using light or electron microscopy.

Recent synchrotron measurements at HARWI II in September 2006 revealed samples both from the Black Sea and the Gulf of Mexico feature structure I (and structure II?) gas hydrate and ice 1h [4][5]. These interesting findings suggest a more complex environment at the sites of sampling than previously anticipated. Our results as well as gas analysis and electron microscopy of the samples are important news for the scientific community. However, the observations need further investigation.

Also, judging from the relative peak intensities in the diffraction diagram (fig. 1) one could assume that the gas hydrate crystals might be textured, which is an issue well worth for further investigation. The two-dimensional diffraction image (fig. 2) shows, however, that the texture plays only a very small role. Apparently the large grain sizes dominate the diffraction diagram.
Moreover, gas hydrate crystals have been observed with crystal sizes ranging from 300 µm to 600 µm in natural samples [6]. However, these investigation were merely a test of applying the Moving area detector method [1][2] on gas hydrate samples, even though samples from different geological sites were investigated.

References