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Dating active vs inactive seep sites in the pockmark-field of the Vestnesa Ridge (NW Svalbard)

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Hydrocarbon seeps including CH4 release are widespread in the Arctic region. Investigation of the natural variability and frequency of CH4 emissions from the seafloor under different climate regimes is essential to understand the role of methane in natural climate change. Our study area is the large pockmark-field of the Vestnesa Ridge (∼79°N), a mounded and elongated sedimentary drift in the Eastern Fram Strait (NW Svalbard). This is a very active site, representing one of the northernmost methane hydrate provinces and the second largest hydrate province off Europe. We are investigating two pockmarks areas:
- Area 1, at the eastern part of the ridge at a water depth of ∼1200 m, is considered the "active" site because acoustic gas flares have been recently observed above large pockmarks;
- Area 2, at the western-northern tip of the ridge at a water depth of ∼1300 m, is referred as the "inactive" site: no gas flares have been observed and the pockmarks appear smoother and more regular in morphology.
In order to compare the two sites and asses the timing of methane activity, six gravity cores from area 1 and four from area 2 have been collected. All cores have been analyzed with a GEOTEK Multi-Sensor Core Logger (MSCL) for bulk density, magnetic susceptibility (MS), P-Wave Velocity and fractional porosity. By comparing the collected data with the MS stack from the Western Svalbard margin (Jessen et al., 2010), we determined the stratigraphic setting of both areas and the preliminary ages of the different cores. All cores from the "inactive" site show an undisturbed magnetic susceptibility signal. Two cores retrieved outside the pockmarks both represent continuous record from the Last Glacial Maximum to the Holocene (the last ca 27,500 cal years BP). Two cores collected from the pockmarks are younger than ca 15,000-20,000 cal year BP, and reveal an expanded Holocene record. From the "active" site, three cores collected from outside the pockmarks show an undisturbed MS signal. The age of the sediment is ca 14,000-27,500 cal years BP. Two cores collected from the pockmarks close to the acoustic gas flare location shows a MS signal that is clearly disturbed by gas advection with almost constant low values. These preliminary results indicate that in the cores of area 2 there is no evidence of active methane seeping, whereas in area 1 there are at least two cores affected by active seeping. To study the timing of when area 2 became inactive and when area 1 became active, the pockmark cores from both areas will be investigated in high-resolution in terms of faunal assemblage, i.e. planktonic and benthic foraminifera distribution, stable isotope (δ13C) in their shells and detailed AMS 14C dating.