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

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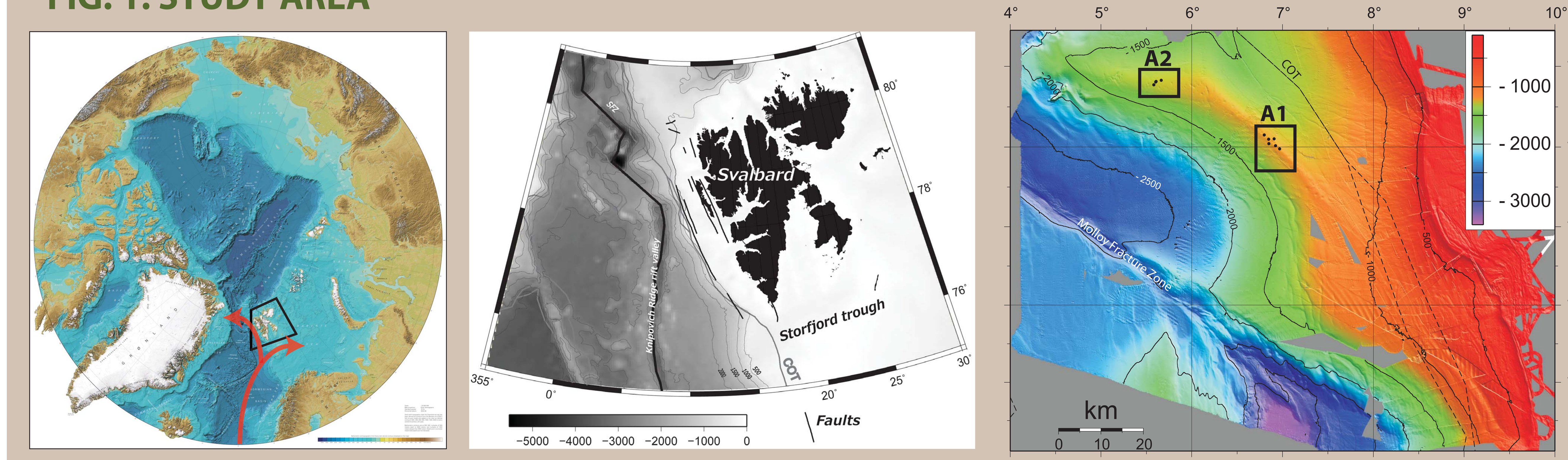
- **MAIN AIM** - Reconstruct past methane release events using $\delta^{13}C$ signal preserved in benthic fauna (esp. benthic foraminifera)
- **MOTIVATION** - Understand the effects of climate and ocean circulation changes in the Arctic region on gas hydrate stability and methane release during glacial/interglacial times
- **FIG. 1** - The study area is the large pockmark-field of the Vestnesa Ridge (~79°N), a sedimentary drift in the Eastern Fram Strait (NW Svalbard).
- **FIG. 2** - We are investigating two pockmarks areas: Area 1 at ~1200 m water depth, where acoustic gas flares have been recently observed. Area 2, NW tip of the ridge, ~1300 m water depth, no longer active.

- **FIG. 3** - In order to compare the two sites, 6 gravity cores from A1 and 4 from A2 have been collected. All cores have been analyzed with a GEOTEK Multi-Sensor Core Logger and the bulk density (D) and magnetic susceptibility (MS) are shown. By comparing the collected data with the MS stack of the W-Svalbard margin (Jessen et al., 2010), we observed that all cores from the "inactive" site have an undisturbed MS signal, like the three cores collected outside the pockmarks in the "active" site (A1). But two cores from A1 pockmarks present nearly constant values of very low MS probably due to gas advection disturbance.

- **FIG. 4** - In order to understand the timing of methane activity, the pockmark cores from both areas will be investigated in terms of planktonic and benthic foraminifera distribution, AMS ^{14}C dating and stable isotope ($\delta^{13}C$) analysis.
The "active" core (JM10-335GC) shows a disturbed MS signal, presence of gas bubbles, H_2S smell, tubeworms at the surface and a level rich in mollusks (bivalves and gastropods) that possibly marks the time when the seep become very active. None of these characteristics have been observed in the core from the inactive site A2 (JM10-330GC).

FIG. 1: STUDY AREA



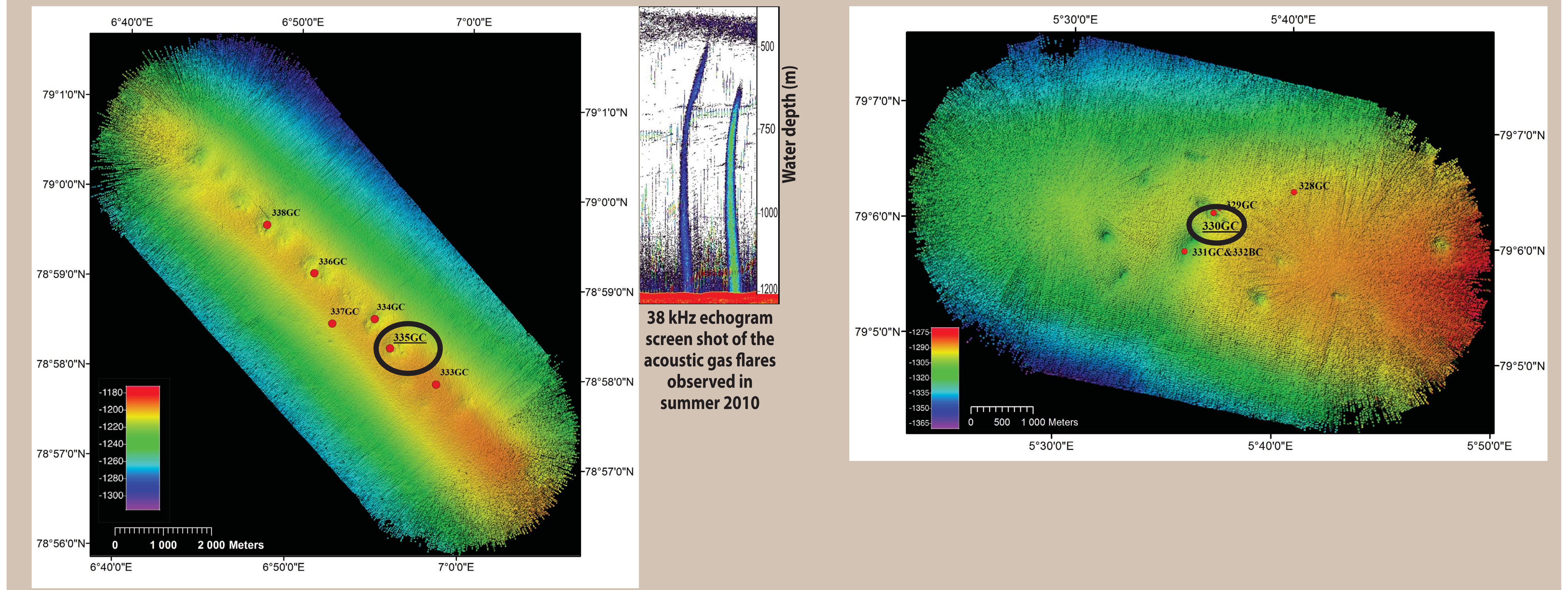
Bathymetric maps (IBCAO, Jakobsson et al., 2008) of the Arctic and of the eastern Fram Strait and the W-Svalbard margin.

Swath bathymetry map of the Vestnesa Ridge with locations of study areas

FIG. 2: THE VESTNESA RIDGE POCKMARK FIELD

A1: Active site

A2: Inactive site



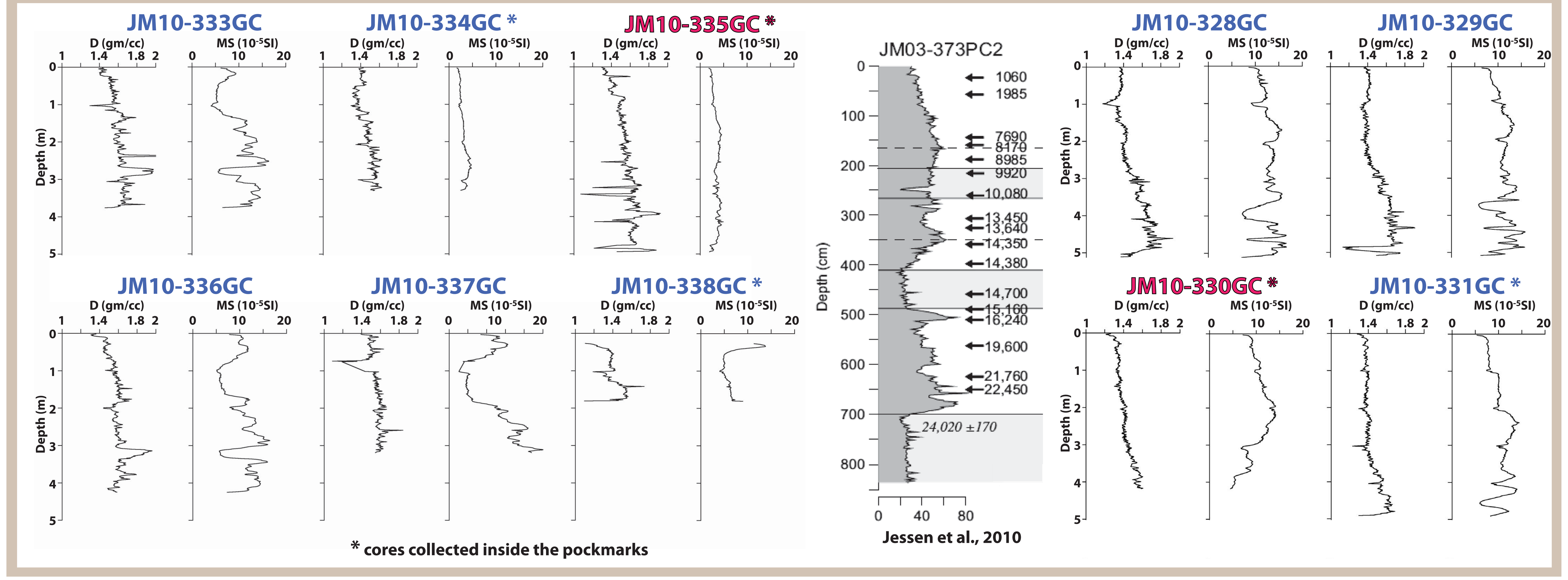
38 kHz echogram screen shot of the acoustic gas flares observed in summer 2010

FIG. 3: COLLECTED SEDIMENT CORES - Magnetic Susceptibility (MS) and Density (D)

A1- 6 cores from the active site

W-Svalbard MS reference core

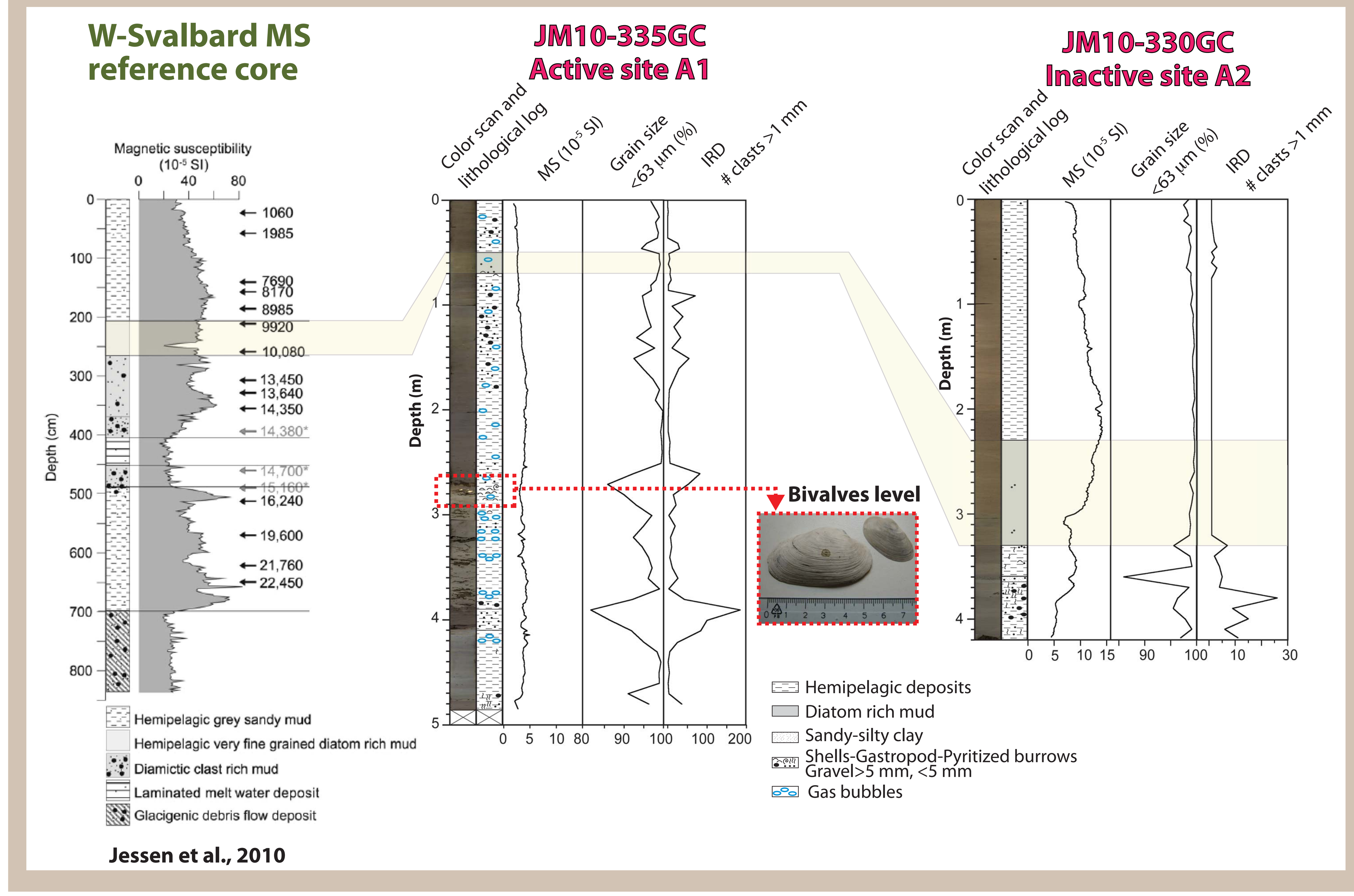
A2- 4 cores from the inactive site



* cores collected inside the pockmarks

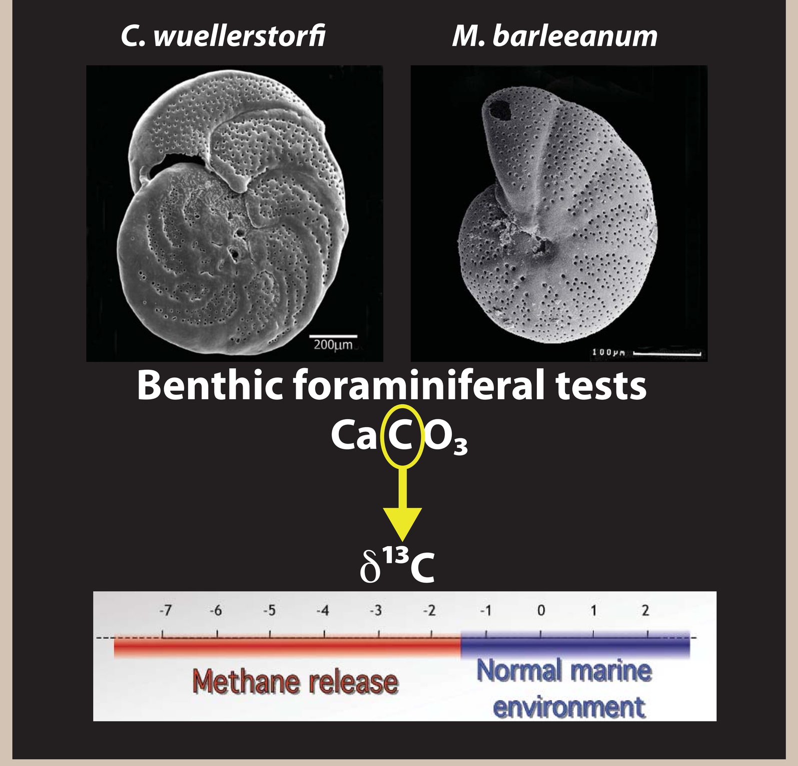
Jessen et al., 2010

FIG. 4: ACTIVE VS. INACTIVE SEEP SITES



Jessen et al., 2010

Reconstruct past methane release events using $\delta^{13}C$ signal



PRELIMINARY RESULTS:
Preliminary correlation of lithology and MS with the reference core (Jessen et al., 2010) indicates that:
- JM10-330GC ("inactive site") is probably younger than 15,000 cal years BP, suggesting that Area 2 stopped its activity at least since that time.
- The vents may become active in JM10-335GC (A2) at the beginning or during the deglaciation (after 25,000 cal years BP), like in the Mid-Norwegian Margin (Plaza-Faverola et al., in press.)