Expedition METEOR 114

Kingston – Veracruz - Kingston

4th Weekly Report: 2 – 8 March 2015

During the fourth week of our expedition we focused on scientific work in the southern part of Campeche Bay in water depths of around 1,200-1,900 m. Transit times and night-time hours have been employed to make further measurements of topography and backscatter intensity of the seafloor, as well as continued searching for locations of gas emission. In the northern working, area we mainly find dome-like hills rising above the flat seafloor by several hundred meters. In the southern part, particularly elongated ridge structures dominate – built during millions of years by thick salt layers in the underground, as well as by a special tectonic of salt diapirism when sediments are buried above the salt. These features are very similar to our salt stocks in northern Germany's strata. We find many different examples in the southern Gulf of Mexico, including single salt diapirs, salt banks and walls– their differences are traced in the seafloor's morphology.

From seismic records taken during expedition M67/2 nine years ago in this area, we know that the salt has ascended through the sedimentary strata and quite close to the seafloor in some of the diapir features – in some case it may be exposed at the seafloor. So far, salt glaciers and salt lakes are unknown in the southern Gulf. We have had some excited discussions on board about the fantastic details of our seafloor recordings; much of this is speculative at this point. But this is not the case with our criteria for finding the hydrocarbon seeps. Based on a combination of high backscatter from the seafloor with the detection of flares in the water column, we can forecast with a high rate of accuracy the precise locations of active seeps. For instance we were able to identify new seep locations by means of former survey during the two TV-sled operations (Fig. 1), performed on Monday and Tuesday at deep sea hills 1955 and 2036. The characteristic formations of carbonates, asphalt layers and, most importantly, the occurrence of chemosynthetic communities are reliable indicators of active seepage or seepage in the recent past.

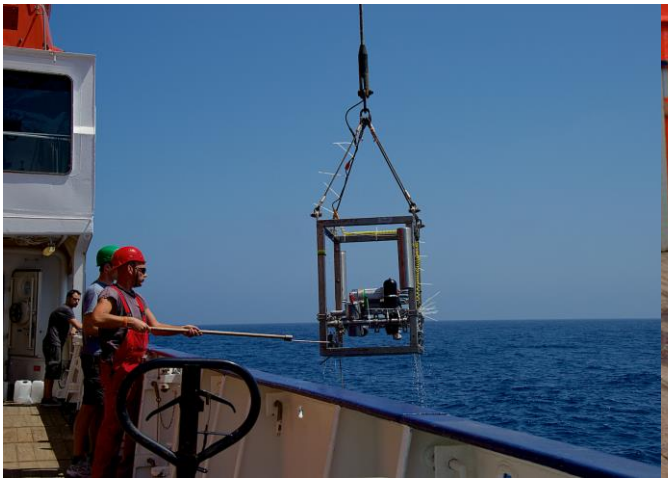

Fig. 1: Deploying the TV-sleds under bright sunshine on Tuesday, 3 March.

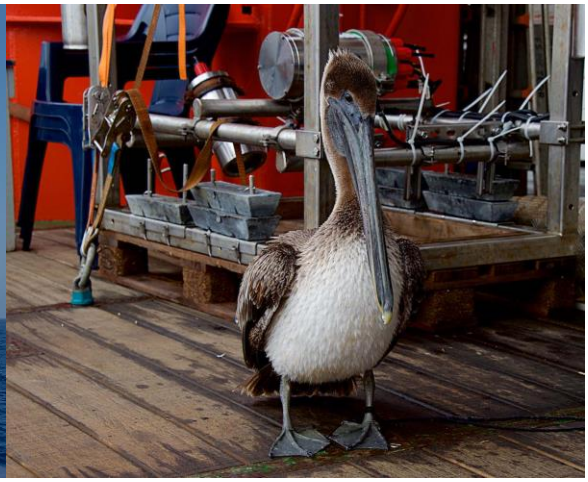

Fig. 2: A pelican takes a rest on our work deck before its next gliding flight.

On Wednesday and Thursday we were able to document new discoveries at the seafloor during the first dives of this expedition (No. 351 and 352) and successfully collected samples (Fig. 3). The first sunny days on board we were accompanied by a pelican (Fig. 2) which was quite disabled in moving because of a fishing line tangled around its left foot. The

courageous intervention of ship's crew and scientists released the animal from its entanglement and after a few hours it continued its flight.

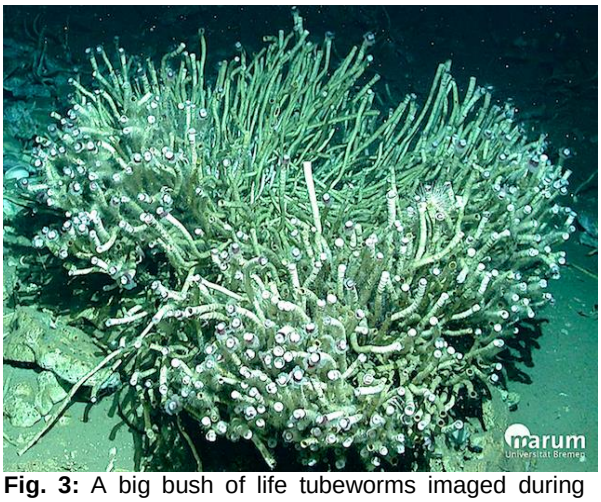

Fig. 3: A big bush of life tubeworms imaged during ROV-Dive 352 at an active cold seep.

Fig 4: Coarse-grained gypsum crystals in the gravity corer (GeoB19321) correlating with high backscatter intensities on the seafloor of Knoll 2009.

Our ROV-team was debilitated by some cases of flu at the beginning of the week, but the middle of the week they could perform a complete dive again. The dive area was a ridge which had been classified as "Knoll 1955", as per usual definition of deep sea knolls here in southern Gulf according to the highest point of the elevated structure at 19 degrees and 55 minutes of geographic latitude. We had very good results from the dives so that we from now on will call this structure UNAM-Ridge in order to point out the peculiarity of this ridge. UNAM is the abbreviation for „Universidad Nacional Autónoma de México, the university of our Mexican cooperating partners in Mexico City.

On Thursday we had to finish our dive prematurely at 4 p.m. in order to take shelter from some bad weather which had been forecast by our weather technicians on board during the past three days. The weather front approached from north, and the skies turned dark very fast. Within half an hour the wind turned from east to northwest, and its speed increased from 10 to more than 40 knots, with squalls up to 58 knots. Because the waves also increased from 1m to 5m in the western part of Campeche Bay, we relocated our work program to the eastern sector. However, there also the waves were up to 3-4m height on Friday. Therefore, we had to stop our equipment deployments devices. On Sunday after the swell had decreased a bit, we were only able to complete two survey profiles with the TV-sled at the seafloor. We examined areas of high backscatter from the seafloor – namely at the flank of a knoll showing significant morphologic sign of slope slumping and strange glacier-like flow structures. These visual inspections of the seafloor were quite unspectacular. However, the subsequent gravity core in an area with much higher acoustic backscatter intensities revealed an unexpected bull's eye: At a depth of 1m in the sediment a layer of crystalline gypsum stopped the 6m long gravity core penetration (Fig. 4). The big gypsum crystals we recovered from the end of the core not only explain the high backscatter signals from the seafloor, but also show the proximity to the salt stock, and its contact with sea water explains why those gypsum crystals stayed behind.

At the end of the fourth expedition week all participants are healthy,
Best regards on behalf of all cruise participants,

Gerhard Bohrmann R/V METEOR, Sunday 8 March 2015

To the Logbook of the cruise (in German):
http://www.marum.de/Logbuch_METEOR_114-2.html