Expedition METEOR 114

Kingston – Veracruz - Kingston

7th and last Weekly Report: 23 – 28 March 2015

On Sunday 22 March the last of our 14 dives on METEOR cruise 114 brought us again to asphalt volcano 2201 whose asphalt formation showed the highest variety of forms (Fig. 1), diversity and dimension. In total, with five ROV dives, three TV-sled profiles and seven gravity cores, we spent the most station time of all knolls at this asphalt volcano. This focus was motivated by the fantastic micro-bathymetry map, showing curious hill and depression structures, that was recorded during the first leg of the cruise by MARUM-AUV SEAL5000. Thanks to our dives and TV-sled operations we now understand better the features seen in that map. It was also possible to delineate many of the surface features. By means of this map, we can estimate realistic asphalt quantities for the first time. Beneath wide-spread surfaces of smooth asphalt, which correspond to past emissions of heavy oil, many small-scale oil emissions can be observed. Over time, the accumulated emissions combine to cover the seafloor like stacks of pancakes (Fig. 1). Bright bacterial mats accumulating on the fresh asphalt are constantly grazed by deep-sea shrimp, crabs and sea cucumbers, but seem regularly to recover for to be just as constantly renewed by fresh growth over a long time. Bacterial mats which existed nine years ago at Chapopote can still be found at the exact same locations. They show that the release of volatile asphalt components is a very slow process during the process of ageing.

Because of the many scientific results from Knoll 2201, we decided to also name this structure. After a voting among the scientists, the name “Mictlan Asphalt Volcano” was chosen. *Mictlan* is the Aztec word for underworld, a region with unknown animals and fabulous creatures—very fitting considering the strange asphalt structures (Fig. 1) found on this deep-sea hill.

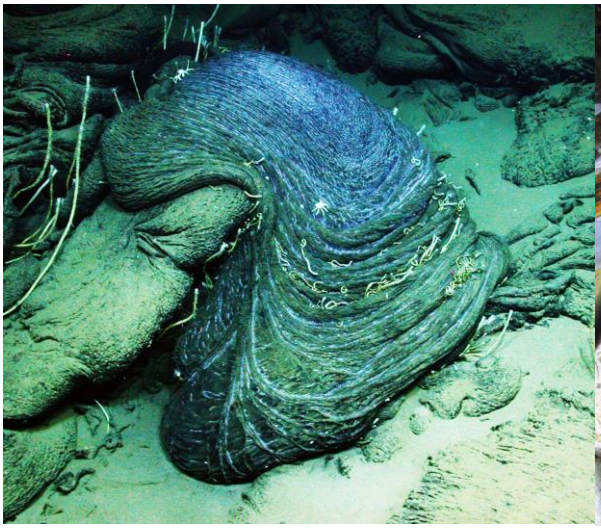

Fig. 1: Fresh asphalt emission with bright microbial film flowing over sediment covered asphalt seafloor in 3,140m water depth.

Fig 2: *Bathymodiolus*-mussel nest with shrimp and tube worms worms on carbonate rock in 3,100m water depth.

Saturday night, 21 to 22 March, METEOR had departed Campeche Bay for additional sampling (Fig. 3). We sailed 100 nautical miles northwards into the central basin of the Gulf with water depths around 3,750 m where the well-known Sigsbee Knolls rise above the absolutely flat deep-sea plain as individual hills. On Monday, 23 March, we performed a TV-sled profile at Challenger Knoll. This deep-sea hill became well-known because it was a drill site during the first cruise of the famous deep-sea drill ship GLOMAR CHALLENGER in 1968. At the time, the formation of knolls by salt diapirism had not yet been confirmed; when they had drilled into the salt stock at 140m sediment depth the cores came up soaked with

oil. The oil occurrence was spectacular at that time because it was the first discovery in such a great water depth. Furthermore, they realized for the first time the high risk of drilling into such a cap rock—which might have been hazardous if it had higher gas pressures. The then newly-inaugurated Deep Sea Drilling Program was controversial right at its beginning.

After we had detected acoustic gas emissions in the water column at the western side of Challenger Knoll, the TV-sled confirmed the existence of seeps. A gravity core at the knoll flank showed a 3-fold increase of salt content in the pore water. This is a clear sign of salt-rich waters ascending from the salt stock to the sediments – in this case the salt is probably in only a few meters under the sediment surface. Further observations took us to the eastern edge of our working area by Tuesday, 24 March at 09:50 a.m. There we concluded the collection work of this cruise.

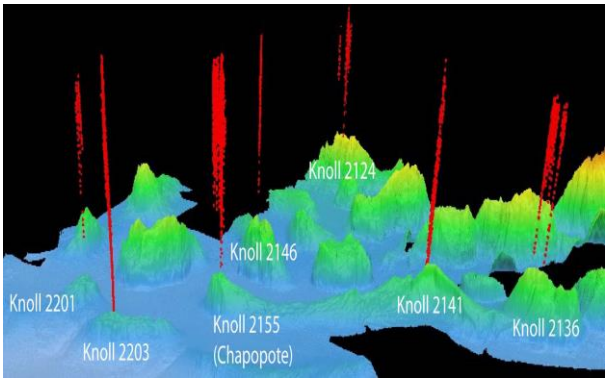

Fig. 3: Knoll seascape of northern Campeche Bay in 3,000 m water depth mapped with gas emission traces above the deep-sea hills.

Fig. 4: Participants of the 2nd leg of METEOR cruise M114 to the southern Gulf of Mexico.

Since then, we have been on a four-days-transit to Kingston, Jamaica, where we are scheduled to reach port on Saturday, 28 March at 08:00 a.m. This transit leaves enough time to prepare the expedition results for the cruise report and to carefully pack our samples for transport back to Germany. In the port, four leased containers will be filled with our expedition goods and will be sent from Kingston back home to Bremen, together with the five containers from METEOR. Most of the scientists will depart on 29 March and arrive in Germany on 30 March after over-night flights.

And so at last, the fieldwork phase of cruise M114 will reach its conclusion on the upcoming weekend. As measured by the numerous scientific results, new findings, and invaluable samples, this cruise was very successful. This success came despite some challenges in the early stages due illness and administrative problems in Mexico. We would like to thank Captain Rainer Hammacher and his expert crew for their outstanding support of our research. Special thanks also to the ROV-Team who had performed 14 dives at 5 asphalt volcanoes with ROV QUEST 4000 m. We thank the many other people whose contributions also helped to make this cruise possible: Control Station German Research Vessels in Hamburg, shipping company Reederei Briese, German Foreign Ministry in Belin, German Embassy in Mexico City, Honorary Consul in Veracruz, Mrs. Erika Rempening, the MARUM logistics group and administrators, as well as our Mexican and US colleagues. We are extremely satisfied with this cruise and thank everyone involved in making it such a great success.

On behalf of the cruise participants I am,
Sincerely,
Gerhard Bohrmann

Further info on the cruise: http://www.marum.de/Logbuch_METEOR_114-2.html

R/V METEOR, Friday, 27 March 2015