Expedition METEOR 114

Kingston - Veracruz

2. Weekly report: 16. – 22. Feb. 2015

This report summarizes activities conducted during the short leg 1 of M 114 focusing on mapping hydrocarbon seeps in the Bay of Campeche, southern Gulf of Mexico. We have successfully accomplished most of the planned scientific activities despite the fact that we experienced strong winds and water currents. We started the expedition knowing where to expect natural hydrocarbon seepage based on sea surface oil slicks imaged by synthetic aperture radar (SAR) satellite images that were analyzed prior to the cruise. This information, combined with the ensemble of modern hydroacoustic mapping techniques available during this leg, allowed us to locate and map hydrocarbon seeps at the seafloor reliably.

Upon arrival in the working area on **Sunday, 15 Feb. 2015**, a CTD was conducted to obtain sound velocity profiles needed for optimal performance of the ship-mounted hydroacoustic equipment. Water samples collected during this hydrocast also shed light on the methane concentration and aerobic turnover rates at a site not influenced by hydrocarbon seepage.

On **Monday, 16 Feb. 2015**, we found hydroacoustic evidence for hydrocarbon emissions in the water column by crossing of the first knoll in the main working area (Knoll 2201), using the multibeam echosounder EM 122. In contrast to 'grounded flares' that originate at the seafloor, these 'mid-water flares' occur hundreds of meters above seabottom (Fig. 1 left). While the former is commonly attributed to gas bubbles rising from the seafloor through the water column, we hypothesize that the latter is a result of oil-coated bubbles or oil drops.

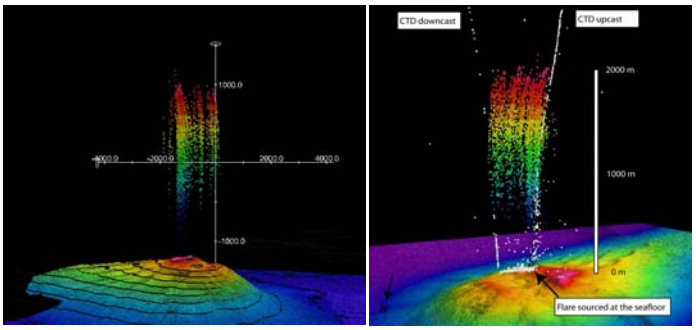

Figure 1: Perspective view of 'mid-water' flares as imaged by multibeam EM 122 at Chapopote Knoll (left) and the track of CTD cast 4 as measured by the POSIDONIA subpositioning system (right).

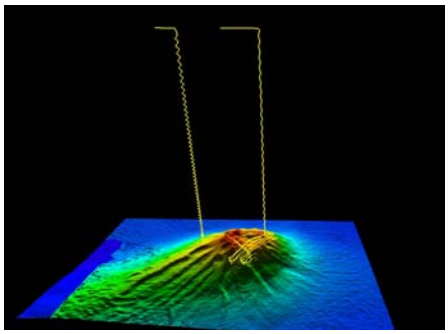

Figure 2: Perspective view of the dive track of AUV SEAL 5000m dive 67 at Chapopote Knoll reaching the greatest depth at 3090 m water depth.

At Chapopote Knoll an AUV SEAL 5000m deployment was planned, but subsequently canceled due to unfavorable sea state. A hydrocast revealed elevated methane concentrations only close to the seafloor at the seep site.

As the sea state remained unchanged during the day, preventing the deployment of the AUV, the deep-towed sidescan sonar DTS-1 was deployed (Fig. 3). For this towed system, a new 8000-m long coaxial cable was specifically installed on the winch prior to the cruise. The extent of seep-influenced seafloor areas was mapped at the summit of three knolls with the DTS until the morning of **Tuesday, 17 Feb. 2015**. Subsequently, the AUV (Dive 67) was deployed at a favorable sea state. However, due to strong water currents, a first attempt to

reach the seafloor was abandoned by the vehicle and it rose to the seasurface. After some modification in the mission plan that was radio transmitted to the vehicle while at the sea surface, the AUV conducted the deepest dive so far to 3090 m water depth (Fig. 2). During this dive the bathymetry, backscatter and flare distribution was mapped along four profiles in the area of the main asphalt fields at Chapopote Knoll. Due to increasing wind speeds of Bft 6-7, everyone involved was relieved upon the safe recovery of the vehicle.

The high wind speeds, in combination with strong water currents perpendicular to it, presented challenges to the CTD deployment that were overcome by allowing the ship to slowly drift with the CTD through the flares (Fig. 1 right). Due to the strong wind, the planned DTS deployment was delayed to the morning of **Wednesday, 18 Feb. 2015**. Unfortunately, an electrical short circuit required the recovery of the system just upon deployment at very rough sea state; again, everyone involved was relieved after safe recovery. As an alternative scientific program, multibeam mapping and CTD casts were conducted. The wind speed decreased and so the DTS was deployed **Thursday, 19 Feb. 2015**, but electrical problems with the umbilical again caused a delay of four hours. The subsequent successful deployment lasted until noon **Saturday, 21 Feb. 2015**. During that time the mapping previously conducted during DTS-1 was extended and, in addition, the summit area of an additional knoll was mapped. At all four knolls the seafloor revealed evidence for extensive hydrocarbon seepage indicating that this process is ubiquitous in the region. A hydrocast station ended that day and allowed us to celebrate the retirement of Master Michael Schneider. After about 28 years at sea and five years as master of the R/V METEOR, Michael will disembark in Veracruz. As said in one of the speeches during the celebration, we will remember him as “a competent seafarer, an excellent captain, and a strong personality”. We all wish him health and happiness in this new phase in life, and perhaps - who knows- we will meet again.

Figure 3: Configuration of the deep-towed sidescan sonar DTS-1 prior to deployment. The towfish is connected via umbilical to the 750 kg depressor weight.

Figure 4: Group photo of the scientific team on the occasion of the farewell celebration of Master Michael Schneider. As we sail in Mexican waters, the come-together and performances were conducted accordingly.

On **Sunday, 22 Feb. 2015**, oil slicks were spotted at the sea surface above Knoll 2223. The multibeam echosounder shows flares rising several thousands of meters from the seafloor to near the sea surface, a discovery that we will be included in the next weekly report, after the port call in Veracruz 26 to 28 February 2015.

Best wishes in the name of all participants,
Heiko Sahling R/V METEOR Sunday, 22 Feb 2015

For further information concerning the cruise please refer to: **www.marum.de**