Supplementary information and figures

Diversity, spatial distribution and evolution of inactive and weakly active seafloor massive sulfide deposits in the TAG hydrothermal field: New discoveries and perspectives

Ewan-Loiz Pelleter*[a], Mélanie Principaud[a], Anne-Sophie Alix[a], Audrey Boissier[a], Sandrine Cheron[a], Florian Besson[a], Vincent Altorffer[a], Charline Guérin[a], Arnaud Gaillot[a], Delphine Pierre[a], Mathieu Rospabé[a], Thomas Giunta[a], Léa Grenet[a], Cecile Cathalot[a], Marie-Anne Cambon[b], Yves Fouquet[a]

[a] *Geo-Ocean, Univ Brest, CNRS, Ifremer, UMR6538, F-29280 Plouzane, France*
[b] *Univ Brest, Ifremer, CNRS, BEEP, F-29280, Plouzané, France*

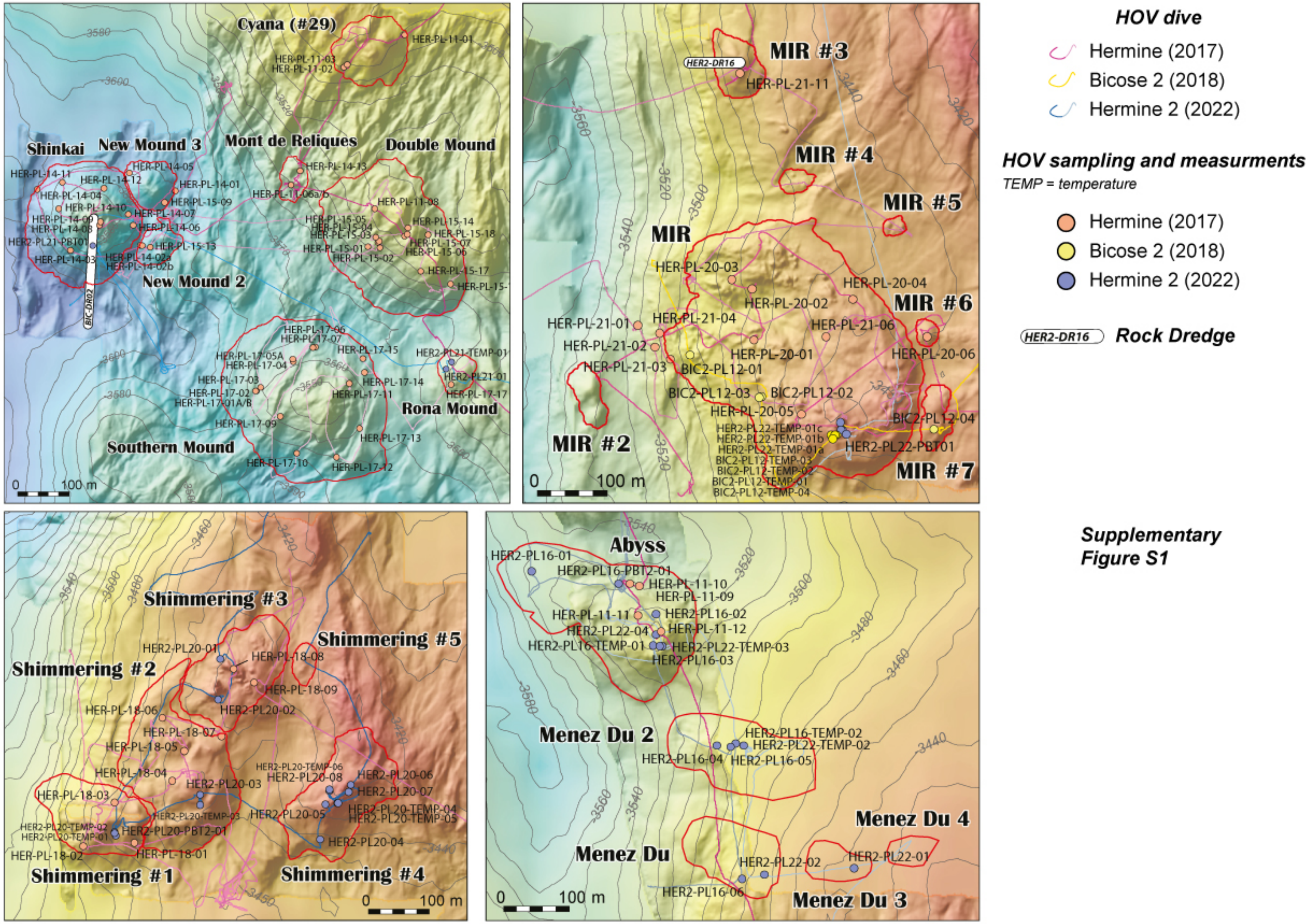
Additional datasets (e.g. raw MBES data, dives video, dives tracks, geographical coordinates of samples) can be found online:

BICOSE (2014): https://doi.org/10.17600/14000100

HERMINE (2017): https://doi.org/10.17600/17000200

HERMINE2 (2022): https://doi.org/10.17600/18001851

Supplementary Figure S1. Location of mineralized rocks sampled during HOV dives and dredge operations. Temperature measurements are also positioned.



Supplementary method: difference between interpolation methods used to define reference surface

We assume that volume calculations using a reference volume instead of considering a flat surface at single depth is more accurate. However, we observed that interpolation methods could provide different reference surfaces leading to major difference in volume calculation in peculiar settings. Here, reference surfaces were generated using two interpolation methods of the ArcGIS spatial analyst toolbox: (i) inverse distance weighted (IDW) interpolation and (ii) “topo to raster” (TR) interpolation tool. IDW interpolation was used to compare our results with those of Graber et al (2020) or when only lower resolution DTM (i.e. 20m) was available. TR tool is based on ANUDEM program (see Hutchinson et al., 2011) and was initially developed for the creation of hydrologically correct digital terrain models. This method has the advantage of preserving the surface continuity of global interpolation methods such as kriging.

We tested IDW and TR tool and observed that when initial topography was complex and far from a flat surface IDW could provide an incorrect reference surface. Figure S2 presents the results of the two different interpolation methods (IDW and TR) applied on MIR mound. Three cross-sections (2 inside the SMS mound and 1 outside) provide (1) the real topography (blue lines), (2) topography generated using IDW (orange lines) and (3) topography generated using TR tool (green lines). A compilation of topographies generated compared to initial topography outside the mound is shown for comparison. We observed that IDW interpolation generates an unrealistic sigmoid topography (orange lines) whereas TR tool create a more accurate topography (green lines) that fits well the initial topography further north (blue line).

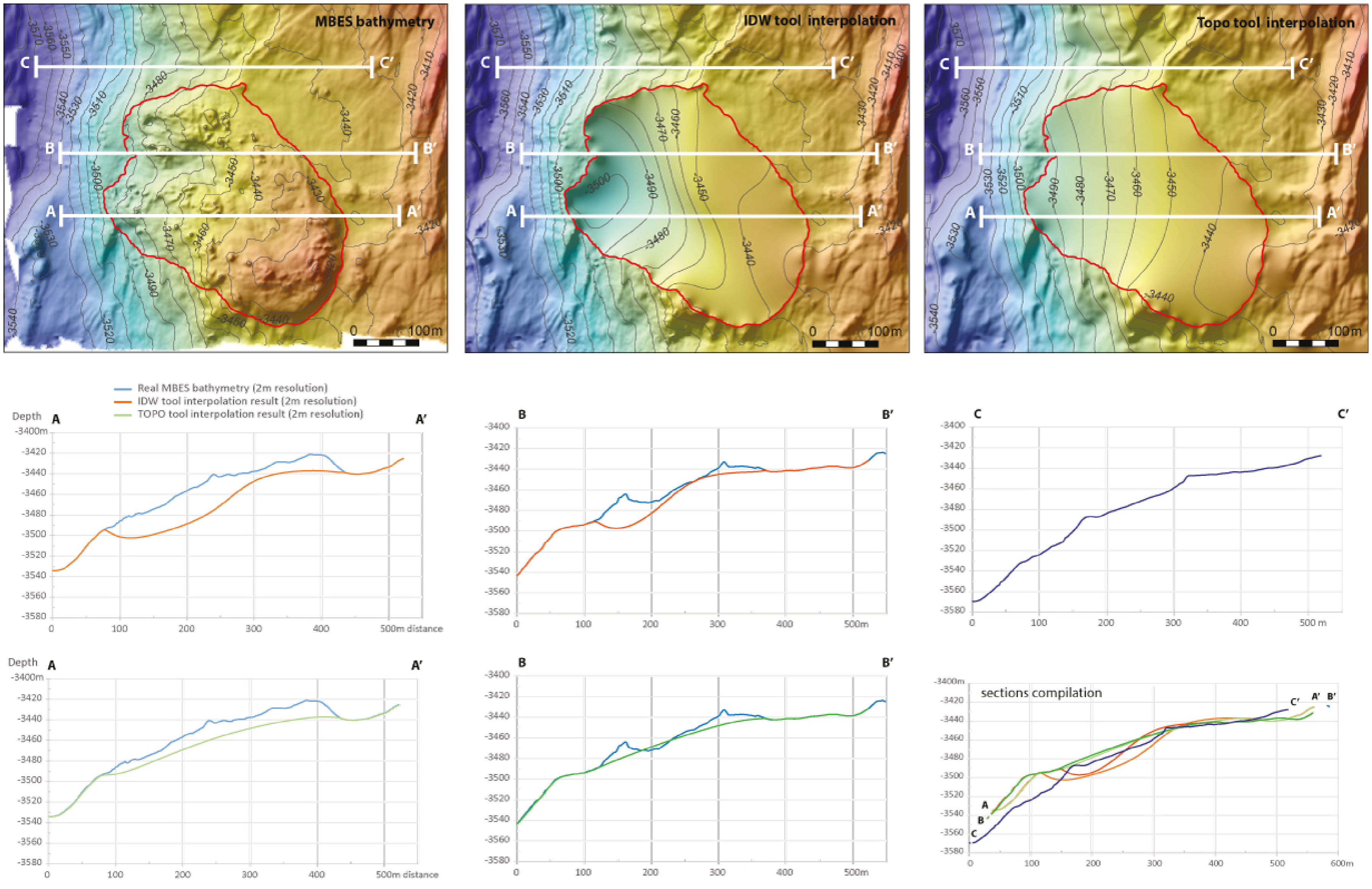
Using reference surface generated with IDW method will led to an overestimation of the deposit volume for the western part. Using reference surface generated with TR tool assumes that the western part of MIR mound is relatively thin which is in good accordance with HOV dive observations.

Hence, we assume that TR tool can be more accurate than IDW when initial topography is complex and far from a flat surface.

Supplementary Figure S1. Left: original bathymetric map of MIR mound; middle map: Reference topography generated inside MIR mound using IDW; right: Reference topography generated using “Topo-to-raster” tool. IDW interpolation generates an unrealistic deep depression to the west.

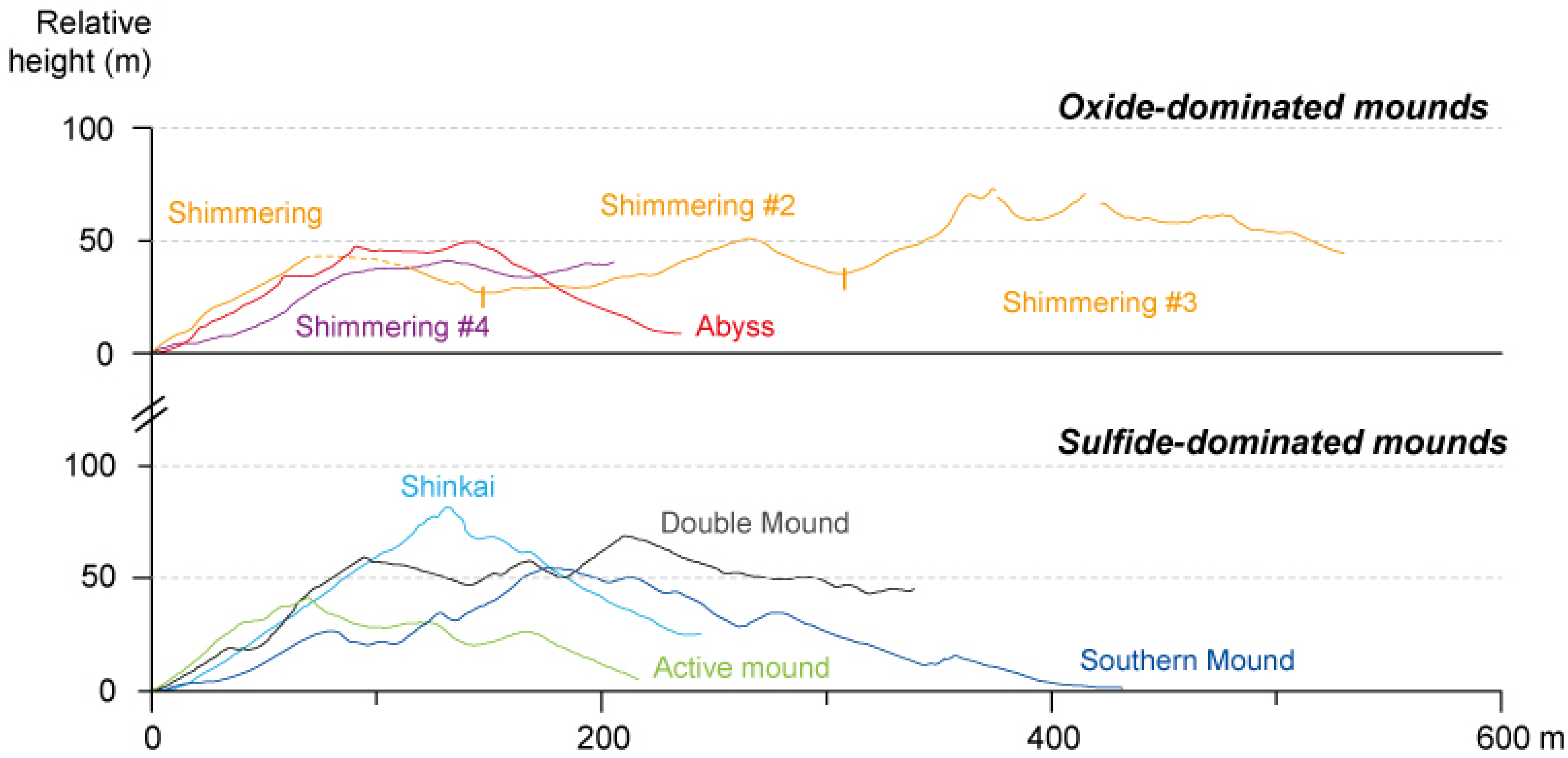
Cross sections are drawn to compare the different topographies (original, interpolated).

Hutchinson, M.F., Xu, T. and Stein, J.A. 2011. Recent Progress in the ANUDEM Elevation Gridding Procedure. In: Geomorphometry 2011, edited by T. Hengel, I.S. Evans, J.P. Wilson and M. Gould, pp. 19–22. Redlands, California, USA.



Supplementary Fig. S2

Supplementary Figure S3. Comparison between large SMS mounds with oxide-dominated rocks at surface (Shimmering, Shimmering #2, #3, #4 and Abyss) and large SMS mounds with sulfide-dominated rocks at surface (Shinkai, Double Mound, Southern Mound, Active mound). “Oxide-dominated mounds” show relatively flat surface, moderate to low slopes and height generally lower than 50 m. “Sulfide-dominated mounds” show conical to subconical shapes, moderate to high slopes and height usually greater than 50 m.



Supplementary Fig. S3