

Supplemental Online Materials

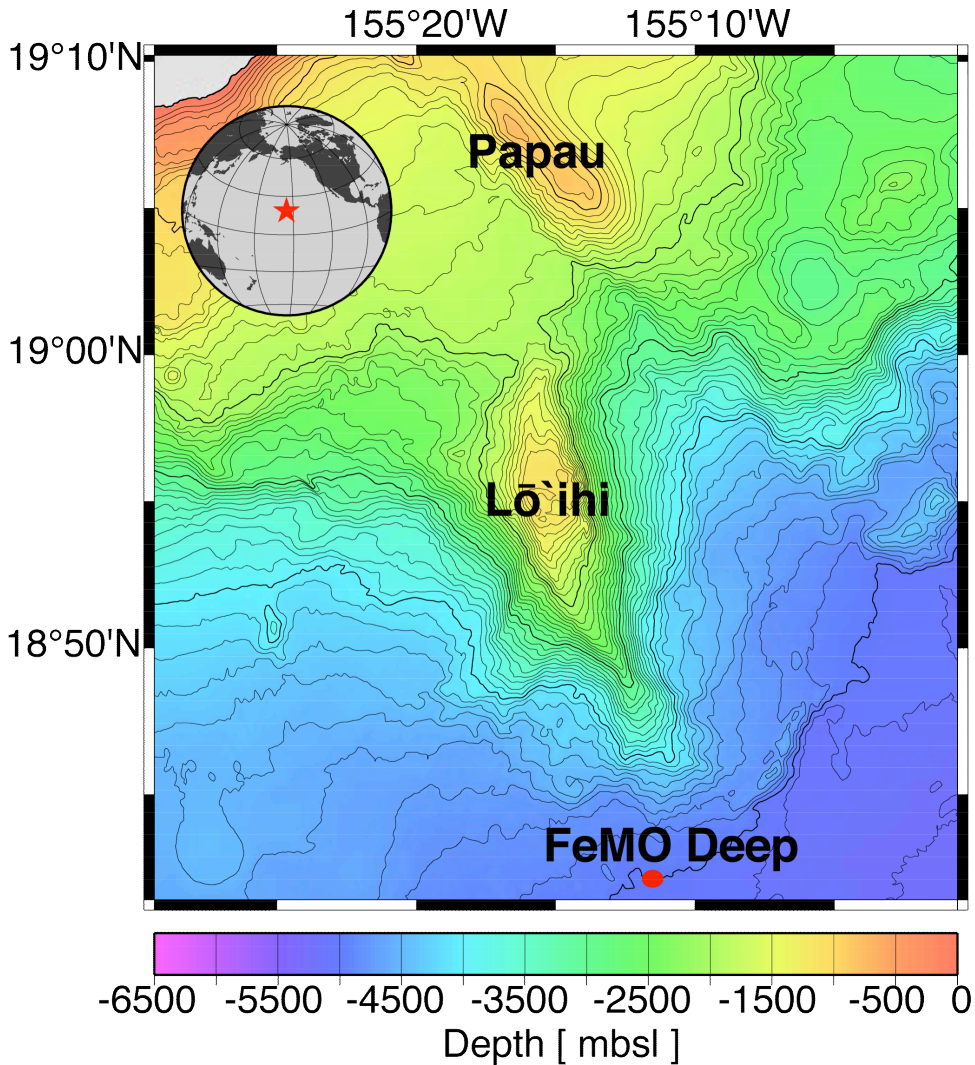


Figure S1. Merged bathymetric map of Lō'ihi and the FeMO deep mat field region, Hawaii-Emperor Seamount Trail, Pacific Ocean. Contour interval 100 m; grid size 180 m; Scale = 0.33 °/cm. Map created at Earthref.org, enduring resources for Earth Science Education – <http://earthref.org/cgi-bin/erda.cgi?n=733>. Three distinct sites were sampled within the FeMO Deep field: `Ula Nui, Mound Field, and Moon Mats.

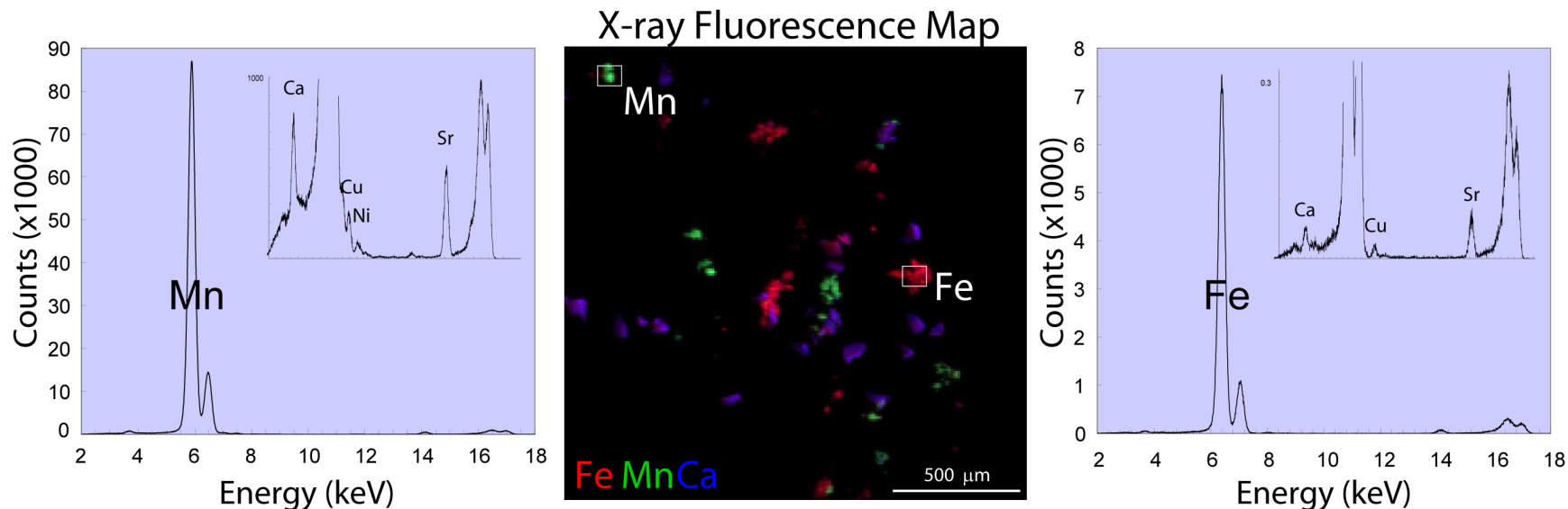


Figure S2. A red-green-blue X-ray fluorescence map shows the elemental distribution of Fe, Mn, and Ca in the particles retrieved from the Ula Nui mat (center panel). The red, Fe-rich particles are Fe oxides, the green, Mn-rich particles are Mn oxides, and the purple particles are Ca- and Fe-rich basalt chips. XRF spectra (left and right panels) were collected from a Mn-rich particle (labeled “Mn”) and a Fe-rich particle (labeled “Fe”). For each XRF spectrum, the inset displays a close-up of the low-counts peaks in the spectra. The Mn-rich particle also contains Ca, Cu, Ni, and Sr. The Fe-rich particle contains a similar set of trace elements.

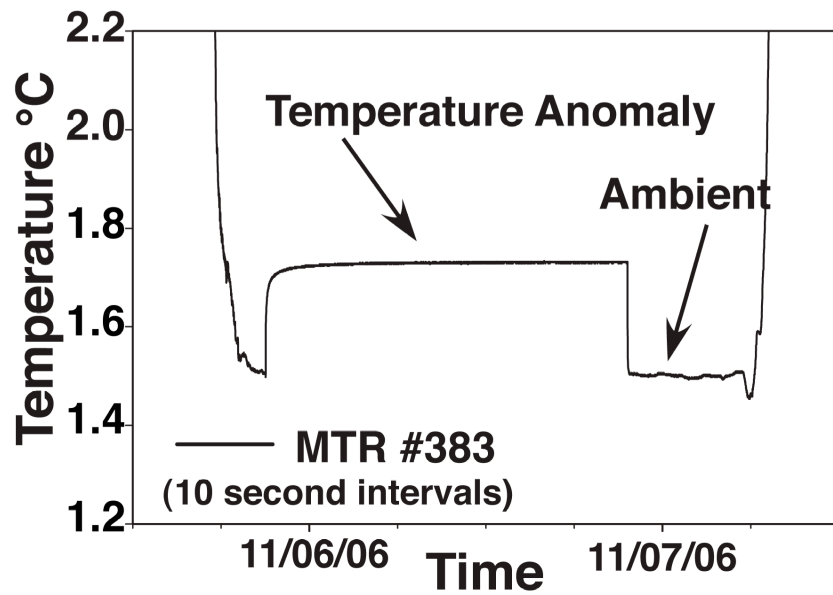
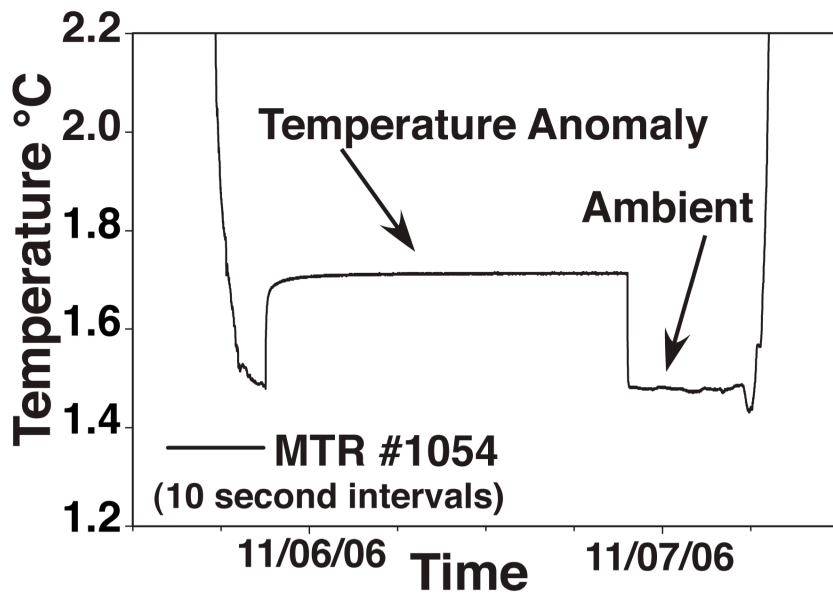


Figure S3. Temperature data for `Ula Nui. Continuous temperature loggers (MTR's) were completely submerged in the `Ula Nui mats for ~24 hours. Following collection, several hours of bottom time for other sample collection took place prior to recovery of the ROV Jason.

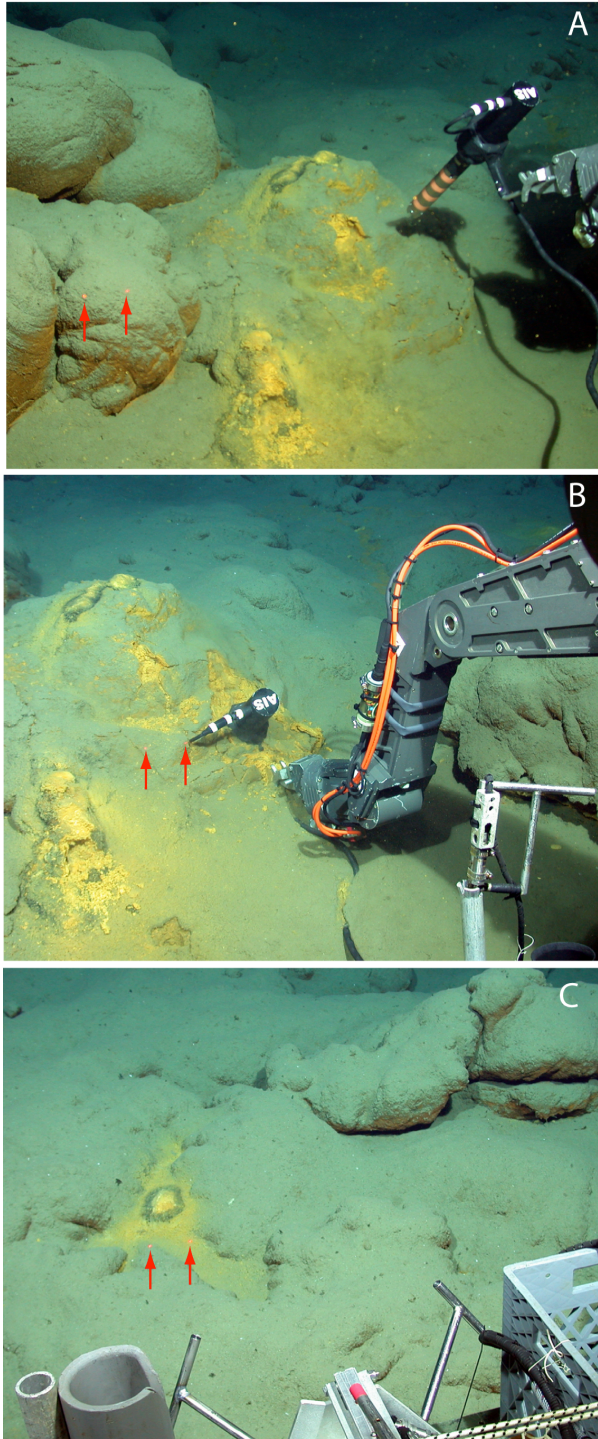


Figure S4. Mound Field images. A & B: Electrochemical profiling into a mound of Fe-oxyhydroxides that is adjacent to pillow basalts. Note black Mn oxides at the top of mound. C: “proto-mound” between basalt pillows with cylindrical structure that could be an orifice. Arrows emphasize laser spots that indicate 10 cm scale.

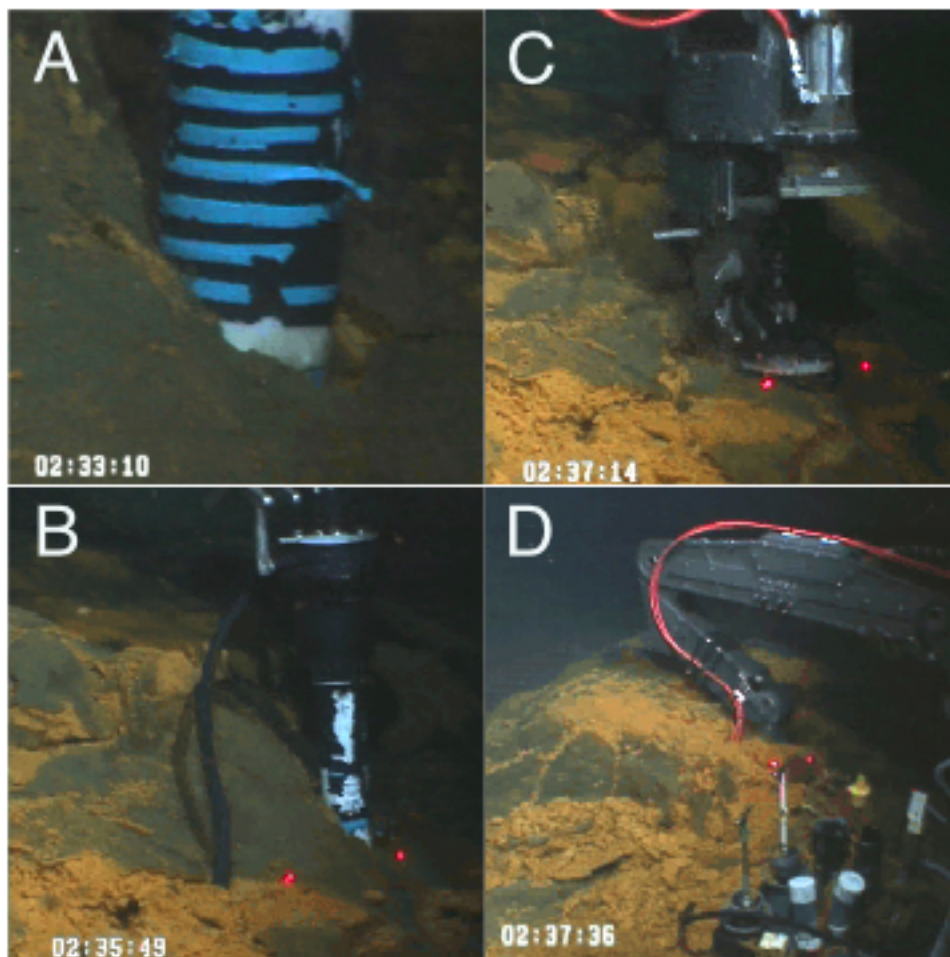


Figure S5. Mat Chemistry. A-D still images from the ROV *Jason II* showing consecutive profile measurements into `Ula Nui (see Movie S1 for complete time series of measurements and sampling of this mat). Laser dots are 10 cm apart.

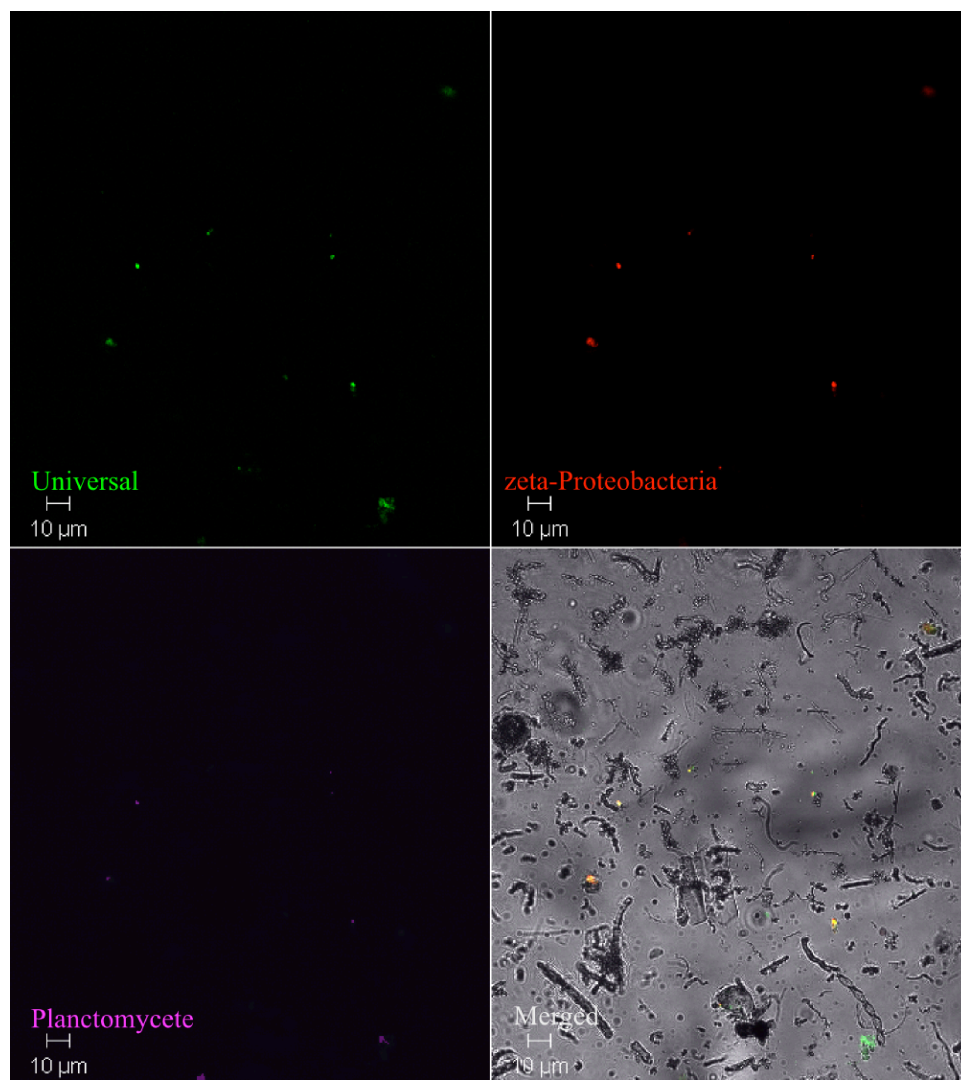


Figure S6. Fluorescent in situ hybridization images of 'Ula nui mat materials. A: hybridization with a Bacterial group-specific probe (Univ-1390). B: same field of view as A, showing cells that hybridize with a *Zetaproteobacteria*-specific probe (Zeta-672). C: 'Ula nui-specific *Planctomycetes* probe hybridization (Plancto-313) for same field of view. D: Merged fluorescent and unfiltered image showing hybridized cells with Fe-oxyhydroxide and Mn-oxide material.