Figure F1. Base Vent Unconformity (BVU) depth interpreted on 3-D seismic reflection data in the Modgunn Arch area. Expedition 396 hole locations are shown. Seismic data courtesy of TGS. TC = Top Cretaceous reflection.

Figure F2. Depth-converted high-resolution 3-D seismic profile (Bünz et al., 2020, Lebedeva-Ivanova et al., 2021) showing the crater structure at the top of the hydrothermal vent system and borehole locations.

Figure F3. Lithostratigraphic summary, Sites U1567 and U1568. Holes are shown along a 014° bearing (i.e., Hole U1568A to U1567A) and tied along unit boundaries (black horizontal lines).

Figure F4. Lithostratigraphic columns, Holes U1567A–U1567C, U1568A, and U1568B. Preliminary ages are shown with dinocyst zonations (dino zone) (Bujak and Mudge, 1994). Preliminary ages are assigned to Hole U1567C based on lithologic ties because biostratigraphy is lacking for the hole. (Continued on next page.)

Figure F5. Unit transitions, Sites U1567 and U1568. Unit I–II transition is marked by the occurrence of very dark brownish gray clay- to pebble-sized grains rich in manganese and iron. Unit II–III transition is marked by a change from clay rich in sand to well-consolidated clay with silt. Unit III–IV transition is marked by a change from well-consolidated clay to claystone.

Figure F6. Complete section half images, Core 396-U1567C-3H. The lower half of Unit III is shown. A gradational change in color from light yellow to dark green is observed above the Unit III/IV boundary in Hole U1567C, which is placed below this interval (4X-1, 43 cm).

Figure F7. Unit IV and V volcanic ash beds, Holes U1567C, U1568A, and U1568B.

Figure F8. Unit IV, V, and VI smear slides, Holes U1567C and U1568A. A. Diatoms, plant debris, and pyrite framboids in Unit IV. B. Ash bed in Unit IV showing abundant volcanic glass fragments. C. Diatoms accompanied by volcanic glass in Unit V. D. Volcanic glass and diatoms are absent in Unit VI.

Figure F9. Unit V–VI transition, Sites U1567 and U1568. Unit V is marked by parallel lamination, sometimes deformed by coring or structural deformation generating subhorizontal to moderately steep dip angles. Rare glendonite is observed in Unit V in Hole U1567C. Unit VI is marked by dark greenish gray claystone with bioturbation and rare to trace nodules.

Figure F10. Unit V deformation structures, Hole U1568B. Millimeter- and centimeter-scale normal faults offset the volcanic ash layers and claystone. White arrows = relative motion of displacement.

Figure F11. Unit VI deformation structures, Hole U1567A. A, B. Centimeter-scale normal faults. C, D. Series of vertical fractures related to dewatering structures.

Figure F12. Diagnostic diatoms, Site U1567. A. *Trinacria excavata* f. *tetragona*. B. *Trinacria excavata* f. *tetragona*. C. *Solium exculptum* (forma typicum). D. *Solium exculptum* (pentagonal form). E. *Sheshukovia flos*.

Figure F13. Laminated diatomite in the PETM interval, as defined by palynology, demonstrating preservation of subannual (seasonal) diatom accumulation, Hole U1567B. A. *Grunoviella*- and *Hemiaulus*-dominated layers (11X, 38 cm). B. Close up of *Hemiaulus* spp. layer (11X, 33 cm). C. Mixed pelagic diatom layer (11X, 30 cm). D. Pyrite framboid (6 µm) (11X, 56 cm). Smaller framboids are abundant, appearing as bright spots in all images.

Figure F14. Age diagnostic dinocysts, Site U1567. Scale bar = ~25 µm. A. *Membranilarnacia glabra* mid-dorsal view (396-U1567A-5H-CC, 0–5 cm). B. *Alisocysta margarita* dorsal view (17X-CC, 16–21 cm). C. *Apectodinium augustum* (9X-CC, 13–19 cm). D, E. *Spiniferites rhomboideus* (17X-CC, 16–21 cm): (D) dorsal view; (E) mid-dorsal view. F. *Areoligera gippingensis* mid-dorsal view (17X-CC, 16–21 cm). G. *Wetzeliella* cf. *meckelfeldensis* dorsal view (5H-CC, 0–5 cm). H. *Cordosphaeridium inodes* dorsal view (6H-CC, 23–26 cm). I. *Areosphaeridium michoudii* apical view (396-U1567B-3H-CC, 15–20 cm).

Figure F15. *Neogloboquadrina pachyderma* (sin.), Hole U1567A A. *Neogloboquadrina pachyderma* (sin.) encrustation process (3H, 72 cm). Lower portion of the specimen's test shows full encrusting of the chambers, and the upper portion of the test has yet to be encrusted. B. Full encrustation of *Neogloboquadrina pachyderma* (sin.) (3H, 70 cm).

Figure F16. Age diagnostic dinocysts, Hole U1568A. Scale bar = ~25 µm. A. *Cerodinium wardenense* (13X-CC, 26–31 cm). B. *Apectodinium augustum* (13X-CC, 26–31 cm). C, D. *Thalassiphora delicata* (17X-CC, 34–39 cm): (C) high focus; (D) low focus. E. *Glaphyrocysta ordinata* (25X-CC, 18–23 cm). F. *Deflandrea oebisfeldensis* (13X-CC, 26–31 cm). G. *Hystrichosphaeridium tubiferum* (13X-CC, 26–31 cm).

Figure F17. Planktonic and benthic (?) foraminifers, Hole U1568A. A, B. *Neogloboquadrina pachyderma* (sin.) (1H-CC, 7–9 cm): (A) umbilical view; (B) umbilical view with growth (?). C. Sediment-covered *Pulsiphonina? prima* (24X-CC, 17–19 cm).

Figure F18. Overview of microfossil occurrences and abundances, Holes U1567A and U1568A. Ages are inferred from microfossils and identified dinocyst (DC) zonations following Bujak and Mudge (1994). PAL = paleontology. – – = no entry, B = barren, T = trace, R = rare, F = few, C = common, A = abundant, VA = very abundant, D = dominant. * = Hole U1568B.

Figure F19. Magnetic inclination measured on the SRM, Holes U1567A–U1567C, U1568A, and U1568B. Respective lithostratigraphic units and position of discrete samples are shown.

Figure F20. Absolute magnetic intensity (in A/m) measured on the SRM, Holes U1567A–U1567C, U1568A, and U1568B. Magnetic intensity varies across three orders of magnitude. Orange frames = intervals where the magnetic intensity is too low for reliable magnetic polarity to be interpreted.

Figure F21. Magnetic inclination vs. magnetic intensity measured on the SRM, Holes U1567A–U1567C, U1568A, and U1568B. The inclinations are predominantly normal and steep over long periods of time. This bias toward normal polarity could be explained by a contribution of drilling-induced magnetization, particularly in weakly magnetized sediments. Red line = current geomagnetic field (~77°) for this area.

Figure F22. Top left: stereonet of paleomagnetic directions from AF demagnetization of natural remanent magnetization (NRM), Sample 396-U1567A-1H-3, 93–95 cm. Top center: magnetization intensity as a function of applied field in AF demagnetization experiments. Top right: orthographic projection of demagnetization experiment. Bottom left: stereonet of paleomagnetic directions from AF demagnetization of NRM, Sample 19X-2, 92–94 cm. Bottom center: magnetization intensity as a function of applied field in AF demagnetization experiments. Bottom right: orthographic projection of demagnetization experiment.

Figure F23. Interstitial water alkalinity, pH, chloride, bromide, ammonium, and phosphate, Holes U1567A–U1567C. Stratigraphic log is from the reference site (Hole U1567A).

Figure F24. Interstitial water alkalinity, pH, chloride, bromide, ammonium, and phosphate, Holes U1568A and U1568B. Stratigraphic log is from the vent site (Hole U1568A).

Figure F25. Interstitial water content of alkali and alkali earth metals (Li, Na, K, Mg, Ca, Sr, and Ba), Holes U1567A–U1567C. Stratigraphic log is from the reference site (Hole U1567A).

Figure F26. Interstitial water content of B, Si, Sulfur, Mn, and Fe, U1567A–U1567C. Stratigraphic log is from the reference site (Hole U1567A).

Figure F27. Interstitial water content of alkali and alkali earth metals (Li, Na, K, Mg, Ca, Sr, and Ba), Holes U1568A and U1568B. Stratigraphic log is from the vent site (Hole U1568A).

Figure F28. Interstitial water content of B, Si, Sulfur, Mn, and Fe, Holes U1568A and U1568B. Stratigraphic log is from the vent site (Hole U1568A).

Figure F29. NGR-derived K, U, and Th content, Holes U1567A–U1567C. The stratigraphic log is from the reference site (Hole U1567A).

Figure F30. NGR-derived K, U, and Th content, Holes U1568A and U1568B. The stratigraphic log is from the vent site (Hole U1568A).

Figure F31. Carbonate, nitrogen, sulfur, and total organic carbon contents from solid squeeze cake samples, Holes U1567A–U1567C. The stratigraphic log is from the reference site (Hole U1567A).

Figure F32. Carbonate, nitrogen, sulfur, and total organic carbon contents from solid squeeze cake samples, Holes U1568A and U1568B. The stratigraphic log is from the vent site (Hole U1568A).

Figure F33. Cross-hole comparison of total nitrogen contents of solid squeeze cake samples overlain on interpreted lithologies, Sites U1567 and U1568. Sites are ordered from left to right in terms of relative proximity to the hydrothermal vent complex. Background colors match lithology column colors on previous figures.

Figure F34. Physical properties summary, Hole U1567A. Filtered point data is presented alongside interpolated traces for selected data with a running average of 50 cm and a maximum interpolation gap of 50 cm applied (denoted “r” in headers). cps = counts per second, WR = WRMSL, G. = SHMG.

Figure F35. Physical properties summary, Hole U1567B. Filtered point data is presented alongside interpolated traces for selected data with a running average of 50 cm and a maximum interpolation gap of 50 cm applied (denoted “r” in headers). cps = counts per second, WR = WRMSL, G. = SHMG.

Figure F36. Physical properties summary, Hole U1567C. Filtered point data is presented alongside interpolated traces for selected data with a running average of 50 cm and a maximum interpolation gap of 50 cm applied (denoted “r” in headers). cps = counts per second, WR = WRMSL, G. = SHMG.

Figure F37. Physical properties summary, Hole U1568A. Filtered point data is presented alongside interpolated traces for selected data with a running average of 50 cm and a maximum interpolation gap of 50 cm applied (denoted “r” in headers). cps = counts per second, WR = WRMSL, G. = SHMG.

Figure F38. Physical properties summary, Hole U1568B. Filtered point data is presented alongside interpolated traces for selected data with a running average of 50 cm and a maximum interpolation gap of 50 cm applied (denoted “r” in headers). cps = counts per second, WR = WRMSL.

Figure F39. Physical properties data plotted to scale, Sites U1567 and U1568. Red lines = lithostratigraphic unit boundaries (see Lithostratigraphy), blue line = modified Unit III/IV boundary based on a major MS transition. Filtered point data is presented alongside interpolated traces for selected data with a running average of 50 cm and a maximum interpolation gap of 50 cm applied (denoted “r” in headers). cps = counts per second, WR = WRMSL.

Figure F40. MS and gamma flattened on the modified petrophysical-based Unit III/IV boundary, Sites U1567 and U1568. An identical linear MS scale is used for each well and highlights the gradual reduction in MS from Hole U1568A through U1567A. Filtered point data is presented alongside interpolated traces for selected data with a running average of 50 cm and a maximum interpolation gap of 50 cm applied (denoted “r” in headers). cps = counts per second, WR = WRMSL.

Figure F41. MS and gamma flattened on the modified Unit III/IV boundary, Sites U1567 and U1568. An identical linear MS scale is used for each well and highlights the gradual reduction in MS with depth in Unit IV prior to an abrupt reduction at the Unit IV/V boundary. Spikes in MS often link to ash layers. Filtered point data is presented alongside interpolated traces for selected data with a running average of 50 cm and a maximum interpolation gap of 50 cm applied (denoted “r” in headers). cps = counts per second, WR = WRMSL.

Figure F42. Summary of wireline log traces for the main open-hole logged interval, Hole U1567A. LCAL = caliper, HSGR = total spectral gamma ray, RLA = resistivity, RT_HRLT = true resistivity, V_S = *S*-wave velocity.

Figure F43. Wireline GR and MS compared to core-based physical properties, Hole U1567A. Wireline data is plotted on the WMSF depth scale, whereas core-based data is plotted on the CSF-A depth scale; the depths are not matched. r = 50 cm running average. cps = counts per second, MSP = point MS, WR = WRMSL, LCAL = caliper, HSGR = total spectral gamma ray, IU = uncalibrated instrument units.

Figure F44. Wireline bulk density, PEF, sonic *P*-wave, and calculated AI compared to core-based physical properties, Hole U1567A. Wireline data is plotted on the WMSF depth scale, whereas core-based data is plotted on the CSF-A depth scale; the depths are not matched. r = 50 cm running average. WR = WRMSL, LCAL = caliper.

Figure F45. Summary wireline log traces for the main open-hole logged interval of Hole U1568A. LCAL = caliper, HSGR = total spectral gamma ray, RLA = resistivity, RT_HRLT = true resistivity, V_S = *S*-wave velocity, IU = uncalibrated instrument units.

Figure F46. Wireline GR and MS compared to core-based physical properties, Hole U1568A. Wireline data is plotted on the WMSF depth scale, whereas core-based data is plotted on the CSF-A depth scale; the depths are not matched. r = 50 cm running average. cps = counts per second, MSP = point MS, WR = WRMSL, LCAL = caliper, HSGR = total spectral gamma ray, IU = uncalibrated instrument units.

Figure F47. Wireline bulk density, PEF, sonic *P*-wave, and calculated AI compared to core-based physical properties, Hole U1568A. Wireline data is plotted on the WMSF depth scale, whereas core-based data is plotted on the CSF-A depth scale; the depths are not matched. r = 50 cm running average. WR = WRMSL, LCAL = caliper.