Figure F1. Detailed site and hole location images for Sites (A) M0075 and (B) M0068 overlain onto DSL120 sonar imagery (from Blackman et al., 2002) in two different swath orientations and the newly acquired 50 m resolution multibeam bathymetry.

Figure F2. High-resolution multibeam bathymetry showing drilling locations. Contour interval = 20 m. A. Holes M0075A and M0075B. B. Holes M0068A and M0068B and an oblique fault (dashed line; tick marks on hanging wall [f]) cutting the striated detachment fault surface.

Figure F3. Lithologic summary for eastern holes, Expedition 357.

Figure F4. A. Metadolerite cutting an amphibole-chlorite schist (357-M0075B-3R-1, 100–102 cm; cross-polarized light [XPL]). An internal intrusive contact in the dolerite is cut by small faults that are localized undeformed chlorite (Chl) veins. B. Close-up of an undeformed chilled margin of the dolerite dike cutting schistose tremolite. Coarser parts of the dike show plagioclase laths with clinopyroxene altered to amphibole.

Figure F5. A. Chilled margin of metadolerite in hand sample (357-M0075B-3R-1, 100–106 cm). Dashed line = chilled margin confirmed by microscopic observation. B. Thin section of chlorite vein (3R-1, 100–102 cm; plane-polarized light [PPL]).

Figure F6. Background alteration of dolerite to chlorite cut by a quartz vein with a chlorite-rich alteration halo (357-M0075B-2R-1, 64–66 cm). Toward the alteration halo, thin veins change composition from iron-oxyhydroxide dominated to chlorite dominated.

Figure F7. Structural interpretation and units found within the fault zone (357-M0075B-3R-1, 75–132 cm).

Figure F8. Alteration, Hole M0068B. Alteration intensity: 0 = fresh (<2%), 1 = slight (2%–20%), 2 = moderate (21%–40%), 3 = high (41%–80%), 4 = very high (81%–95%), 5 = total (>96%). Distribution of alteration types: 1 = pervasive, 2 = localized, 3 = patchy.

Figure F9. Talc replacement of mesh texture and alteration of pyroxene (357-M0068B-2R-1, 78–85 cm).

Figure F10. Serpentinized dunite (357-M0068B-4R-1, 50–53 cm). A, B. Scan of thin section (PPL). C, D. Orthopyroxene (Opx) vein cutting olivine (Ol) grain (XPL). Position is shown by white squares in A and B.

Figure F11. Ribbon-shaped mesh texture wrapping around poorly serpentinized olivine (Ol) domains in a serpentinized (Serp) harzburgite (357-M0068B-4R-1, 18–22 cm). Mgt = magnetite.

Figure F12. Split core line scan image and annotated sketch (357-M0068B-2R-1) showing gabbro intrusion (0–44 cm) with adjacent talc-chlorite-amphibole metasomatism (44–75 cm) that has a gradational boundary with serpentinized harzburgite (75–92 cm).

Figure F13. Replacement of pyroxene by amphibole and chlorite (357-M0068B-2R-1, 31–36.5 cm).

Figure F14. Series of sigmoidal to irregular isolated talc veins that form a subparallel network (357-M0068B-4R-1, 78–88 cm).

Figure F15. Relative abundance of mineral phases identified by bulk powder XRD analysis, Sites M0075 and M0068. Colors correspond to mineral phases merged as groups (see **Core description** in the Expedition 357 methods chapter for mineral group definitions [Früh-Green et al., 2017b]). Numbers are semiquantitative abundances determined from fits to XRD peak patterns. Trace phases are subject to large uncertainties. * = poor data quality.

Figure F16. Cemented breccia in contact with serpentinized peridotite both at its base and along a schistose deformation zone (357-M0068A-1R-1, 50–74 cm).

Figure F17. A. Fault breccia comprising foliated fault schist clasts (357-M0068B-8R-1, 15–20 cm; PPL). Breccia is cut by a later quartz-chlorite vein (lower left corner). B. Well-developed schistose fabric in one tremolite-rich clast hosted in the breccia (XPL). C. Large tremolite grain in another clast broken up into a thin zone of cataclasis (XPL).

Figure F18. A. Olivine with tight and well-oriented microfractures and incipient recrystallization (357-M0068B-4R-1, 18–22 cm; XPL). Note curved cleavage in orthopyroxene porphyroclasts. These microstructures are characteristic of those formed during semibrittle deformation at Site M0068. B. Aligned and partially recrystallized amphibole overprinted by talc (1R-1, 34–35 cm; XPL). Amphiboles have prismatic or euhedral shapes and are preferentially aligned, defining a foliation. Undeformed talc has grown from former serpentine clasts toward the amphibole-rich zone.

Figure F19. Comparison of Ni concentrations vs. Mg# of Atlantis Massif mafic and ultramafic rocks from Expedition 357 with those recovered at Site U1309 during Integrated Ocean Drilling Program Expedition 304/305 (Godard et al., 2009).

Figure F20. Chondrite-normalized REE plot, Sites M0068 and M0075. Values for CI chondrite from McDonough and Sun, 1995.

Figure F21. PM–normalized extended trace element plot, Sites M0068 and M0075. Values for PM from Sun and McDonough, 1989.

Figure F22. Whole-rock major elements (normalized, volatile-free, and in oxides) vs. MgO for (impregnated/metasomatized) serpentinized ultramafic rocks and talc-amphibole-chlorite schists from Atlantis Massif. Data from Mid-Atlantic-Ridge abyssal serpentinized peridotites and talc-altered peridotites are presented for comparison. Global abyssal peridotite field defined by data from PetDB (**http://www.earthchem.org/petdb**, May 2016). Data for talc-altered peridotite field from Ocean Drilling Program Leg 209, Hole 1268A (also at PetDB).

Figure F23. Whole-rock major elements (normalized, volatile-free, and in oxides) vs. MgO for gabbroic and chlorite-rich altered mafic rocks from Atlantis Massif. Data for Mid-Atlantic-Ridge volcanic glass and Expedition 304/305 mafic and ultramafic rocks (Godard et al., 2009) are presented for comparison (**http://www.earthchem.org/petdb**, May 2016).

Figure F24. Comparison of Rb, Sr, U, Ba, Pb, Zr, La, and Yb vs. Nb and enriched mid-ocean-ridge basalt (E-MORB), normal MORB (N-MORB), PM, and CI for Atlantis Massif mafic and ultramafic rocks with basalts from global spreading centers, Expedition 357. Data for basalts from global spreading centers (gray dots) from PetDB (**http://www.earthchem.org/petdb**, May 2016). E-MORB, N-MORB, PM, and CI data) from Sun and McDonough (1989).

Figure F25. $\delta^{13}C_{DIC}$ vs. alkalinity in CTD, SP, and pore water samples, Expedition 357. Note the larger scale of $\delta^{13}C_{DIC}$ for the central sites only. Inset is Ca vs. alkalinity.

Figure F26. Highest hydrogen and methane concentrations measured in CTD rosette bottom waters and sensor package Niskin bottles over Atlantis Massif drill sites, Expedition 357. Dark red circles = Lost City (LC) plume samples.

Figure F27. Sensor data, Hole M0068A. Elapsed time = time since the start of the sensor package data file. Penetration depth is from drill logs.

Figure F28. Sensor data, Hole M0068B. Elapsed time = time since the start of the sensor package data file. Penetration depth is from drill logs. A. Cores 1R–4R. B. Cores 5R–9R.

Figure F29. Sensor data, Hole M0075A. Elapsed time = time since the start of the sensor package data file. Penetration depth is from drill logs.

Figure F30. Sensor data, Hole M0075B. Elapsed time = time since the start of the sensor package data file. Penetration depth is from drill logs.

Figure F31. Borehole plug emplacement, Hole M0068B. The plug may not be set in the seafloor as drawn because the assembly was pulled out of the hole during liftoff of the RD2.

Figure F32. Borehole plug emplacement, Hole M0075B.

Figure F33. Physical properties from core scanning and discrete samples, Hole M0075A. MAD: red circle = bulk density, green circle = dry density, blue circle = grain density. *P*-wave velocity: open square = *z*-direction, open circle = *x*-direction, blue dot = *y*-direction. Color reflectance: black = L*, red = a*, blue = b*.

Figure F34. Physical properties from core scanning, Hole M0075B. Color reflectance: black = L*, red = a*, blue = b*. No discrete samples were analyzed.

Figure F35. Grain density and porosity data from MAD analyses, Sites M0075 and M0068. Lithologies are defined by core description (see **Lithology, alteration, and structure**).

Figure F36. Physical properties from core scanning and discrete samples, Hole M0068A. MAD: red circle = bulk density, green circle = dry density, blue circle = grain density. *P*-wave velocity: open square = *z*-direction, open circle = *x*-direction, blue dot = *y*-direction. Color reflectance: black = L*, red = a*, blue = b*.

Figure F37. Physical properties from core scanning and discrete samples, Hole M0068B. MAD: red circle = bulk density, green circle = dry density, blue circle = grain density. *P*-wave velocity: open square = *z*-direction, open circle = *x*-direction, blue dot = *y*-direction. Color reflectance: black = L*, red = a*, blue = b*. Cores 4R and 5R overlap in depth (see **Operations**).

Figure F38. Geometry of logging from the RD2, Hole M0068B.

Figure F39. Total gamma ray downhole logging measurements (green) and core data (gray), Hole M0068B.

Figure F40. Typical AF progressive demagnetization from four samples, Site M0068. Plotted points = successive position in orthogonal projection at the endpoint vector. Solid symbols = projections on vertical plane, open symbols = projections on horizontal plane.

Figure F41. Typical AF progressive demagnetization for one sample, Site M0075. Plotted points = successive position in orthogonal projection at the endpoint vector. Solid symbols = projections on vertical plane, open symbols = projections on horizontal plane.