Figure F1. Location map, Sites U1612 and U1614–U1616 (red); Expedition 402 proposed drilling locations (purple = primary sites, pink = alternate sites); and Leg 42, 107, and 161 sites (yellow). White lines = locations of seismic reflection profiles.

Figure F2. Location and estimated penetration of Site U1614 on Seismic Reflection Line MEDOC 8 (location in Figure F1). Dashed line = intersection with Seismic Reflection Line MC07. CDP = common depth point, TWT = two-way traveltime.

Figure F3. Seismic Line MC07 connects Vavilov Basin east–west transect (Sites U1612, U1615, and U1616) on Seismic Line MEDOC 9 with Seismic Line MEDOC 8, where Site U1614 is located. A deep sediment trough separates basement highs drilled during Expedition 402 along Seismic Lines MEDOC 8 and MEDOC 9. Dashed lines = intersection with Seismic Reflection Lines MEDOC 8 and MEDOC 9. TWT = two-way traveltime.

Figure F4. Schematic of reentry cone and casing installation, Hole U1614C. Note that depths are not to scale. CSG = casing.

Figure F5. Lithostratigraphic summary, Hole U1614A. Sedimentary and basement units are shown. See lithology key in Figure F8 in the Expedition 402 methods chapter (Malinverno et al., 2025a).

Figure F6. VCD, Hole U1614A. Nannofossil and foraminifera ages and the main physical properties used for unit identification are shown. See lithology key in Figure F8 in the Expedition 402 methods chapter (Malinverno et al., 2025a). cps = counts per second.

Figure F7. Section Half Imaging Logger (SHIL) core images showing representative examples of main lithologies, Site U1614.

Figure F8. Smear slides of main lithologies, Site U1614. PPL = plane-polarized light, XPL = cross-polarized light.

Figure F9. Depositional styles, Site U1614. A. L* and GRA bulk density plots showing changes in depositional styles in Subunit IA. B. Multiple event deposits (red arrows). C. Typical background, homogeneous pelagic sedimentation.

Figure F10. Distinctive features, Site U1614.

Figure F11. Pyrite in Subunit IIB, Hole U1614A. A. Pyritized planktic foraminifera (appears black). B. Pyrite framboids (green arrows). C. Pyrite showing typical gold coloration in transmitted light. A and B are only shown in PPL because they appear opaque in XPL.

Figure F12. Sediments, Holes U1614A and U1614C. A. Volcaniclastic gravel. B. Volcaniclastic silt particles. C. Volcaniclastic tuff particles. D. Pumice grains. E. Sandy silt particles. F. Volcaniclastic ash particles. G. Conglomerate. H. Mudstone.

Figure F13. Planktic foraminifera marker species, Hole U1614A. A, B. *Globigerina bulloides* (2H-CC). C. *Orbulina universa* (2H-CC). D. *Globigerinoides obliquus* (29X-2, 52–54 cm). E–G. *Globigerinella siphonifera* (26X-6, 69–71 cm). H. *Neogloboquadrina acostaensis* (29X-2, 52–54 cm).

Figure F14. Planktic foraminifera marker species, Hole U1614A. A, B. *Globoconella inflata* (29X-2, 52–54 cm). C, D. *Globigerinoides ruber* var. white. E, F. *Globorotalia scitula* (23X-CC). G, H. *Globorotalia crassaformis* (29X-2, 52–54 cm).

Figure F15. Planktic foraminifera marker species, Hole U1614A. A, B. *Neogloboquadrina* spp. (sin) (26X-6, 69–71 cm). C, D. *Globorotalia truncatulinoides* (29X-2, 52–54 cm). E, F. *Turborotalia quinqueloba* (9H-2. 108–110 cm).

Figure F16. Calcareous nannofossil biozonal assignment for examined samples according to Di Stefano et al. (2023) scheme for Mediterranean area, Site U1614. See lithology key in Figure F8 in the Expedition 402 methods chapter (Malinverno et al., 2025a).

Figure F17. NRM variation, Hole U1614A. A. Intensity of NRM and NRM after demagnetization at 20 mT peak AF. B. NRM inclination. C. NRM inclination after demagnetization at 20 mT peak AF. Dashed lines in B and C = GAD values.

Figure F18. NRM and NRM after demagnetization at 20 mT peak AF inclination histograms. Dashed lines = GAD values.

Figure F19. AMS, Hole U1614A.

Figure F20. Demagnetization of ARM of sediments and basement rocks, Site U1614.

Figure F21. IRM curves of representative rock samples, Hole U1614C. A. Volume-normalized IRM curves. B. IRM curves normalized by respective maximum values on logarithmic field scale.

Figure F22. NRM basement variation, Hole U1614A. A. Intensity of NRM and NRM after demagnetization at 20 mT peak AF. B. NRM inclination. C. NRM inclination after demagnetization at 20 mT peak AF. Dashed lines in B and C = GAD values.

Figure F23. NRM basement variation, Hole U1614C. A. Intensity of NRM and NRM after demagnetization at 20 mT peak AF. B. NRM inclination. C. NRM inclination after demagnetization at 20 mT peak AF. Dashed lines in B and C = GAD values.

Figure F24. Lithostratigraphic variations in basement rocks, Hole U1614C.

Figure F25. Modal abundance of major minerals in mafic–ultramafic rocks, Hole U1614C.

Figure F26. Abundance of lithologies in (A) entire basement and (B–F) basement lithostratigraphic units, Hole U1614A.

Figure F27. Ternary classification diagram for ultramafic lithologies based on modal abundance of olivine (Ol), orthopyroxene (Opx), and clinopyroxene (Cpx), Site U1614.

Figure F28. Main rock types, Site U1614. A. Plagioclase-bearing lherzolite. B. Plagioclase-bearing harzburgite. C. Dunite. D. Pyroxenite. Yellow arrows = saussuritized plagioclase (plag).

Figure F29. Mica-rich mafic rock, Site U1614. Phl/Bt = phlogopite/biotite, Rt = rutile, Oxide = oxide mineral, Plag = plagioclase (mostly saussuritized).

Figure F30. (A) Ophicarbonate and (B) granitoid, Hole U1614C.

Figure F31. Alteration log of the basement lithologies, Site U1614.

Figure F32. Serpentinized peridotite, Hole U1614C. A, B. Boundary (dashed lines) between serpentinized and weathered olive-rich areas (A: PPL; B: XPL). C, D. Tremolite (± talc ± serpentine) rim (Tre) around large orthopyroxene porphyroclast (Opx) partly serpentinized (C: PPL; D: XPL). E, F. Saussuritized plagioclase (E: PPL; F: XPL). Red arrows = chlorite-rich pseudomorphs.

Figure F33. Weathered olivine-rich area, Site U1614. A. PPL. B. XPL. C. XPL with gypsum plate. Yellow arrows = olivine, red arrows = pore.

Figure F34. Bedding dip angles and frequency of faults, fractures, and folds, Site U1614.

Figure F35. Fault in Unit I, Hole U1614A. A. Close-up of archive half. B. Fault confirmed by X-ray image of working half. Note that fault structure is mirrored between A and B because working half was used for X-ray.

Figure F36. Sedimentary structures and sediment/basement interface, Hole U1614A. A. Faulted and folded laminations (partly due to drilling disturbance). B.

Normal faulting and boudinage in laminations. Note higher fracture density. C. Sediment/basement interface marked by fault plane with striations. Peridotite is highly weathered (reddish pattern) with a weak mantle fabric (altered black minerals). D. First few meters of basement consist of highly brecciated and veined weakly serpentinized peridotite. Note clasts of weathered peridotite showing relics of elongated minerals in highly brecciated area.

Figure F37. A. Drilled fraction (in percent) and recovered lithologies for each core, Hole U1614C. B. CPF degree rank. C. Brittle fabric degree rank. D. Vein types with depth.

Figure F38. Varying degrees of crystal-plastic deformation in mantle peridotites, Hole U1614C. Contacts between weakly foliated (CPF1), mylonitic (CPF4), and ultramylonitic (CPF5) rocks are sharp. Note that ultramylonitic samples are rimmed or partially replaced by late serpentine and calcite veins. Color scale bar shows increase of CPF intensity.

Figure F39. Dip of CPF vs. depth, Hole U1614C. A. All measured CPFs. B. Weak foliation (CPF1). C. Strong foliation (CPF2). D. Protomylonites (CPF3). E. Mylonite (CPF > 4). Blue lines = depths of recovered granitoids (thick lines = recovered between peridotites (i.e., in middle of a section), thin lines = recovered between different sections).

Figure F40. Deformation structures in mantle peridotites, Hole U1614C. A. Gabbroic vein cut by pyroxene (Px)-rich impregnation bands in partially serpentinized peridotite. Pyroxene-rich bands are partially replaced by serpentine (Serp.) and calcite veins. B. Pyroxene-rich impregnations in partially serpentinized peridotite, slightly tilted from the mantle fabric orientation. C. Contact between ultramylonite or magmatic vein and weathered peridotite (reddish color), partially replaced by serpentine (green) and calcite (white) veins. Note that calcite has sheared serpentine veins, displacing them and forming ellipsoidal clasts of serpentine. D. Faulted mylonite. E. Weathered peridotite intruded by magmatic vein or mylonite, which is rimmed and partially replaced by network of serpentine and then carbonate veins.

Figure F41. Dip of veins vs. depth, Hole U1614C. A. All measured veins. B. Magmatic veins. C. Metamorphic veins overprinting magmatic veins. D. Metamorphic veins. Blue lines = depths of recovered granitoids (thick lines = recovered between peridotites (i.e., in middle of a section), thin lines = recovered between different sections).

Figure F42. Dip of faults vs. depth, Hole U1614C. A. All measured faults. B. Normal faults vs. depth. C. Reverse faults vs. depth. Blue lines = depth of recovered granitoids (thick lines = recovered between peridotites [i.e., in middle of a section], thin lines = recovered between different sections).

Figure F43. IW alkalinity, pH, and salinity, Hole U1614A.

Figure F44. IW sodium and chloride, Hole U1614A.

Figure F45. IW magnesium, calcium, and potassium, Hole U1614A.

Figure F46. IW lithium, boron, strontium, and barium, Hole U1614A.

Figure F47. IW sulfate, ammonium, and phosphate, Hole U1614A.

Figure F48. Calcium carbonate and total carbonate and carbonate phases, Hole U1614A.

Figure F49. Total organic matter, TOC, TN, and TOC/TN, Hole U1614A.

Figure F50. Relationship between TOC and TN contents, Hole U1614A.

Figure F51. pXRF elemental concentrations, Hole U1614A. SHLF = section half, IW SC = IW squeeze cake.

Figure F52. Dissolved methane in headspace gas, Hole U1614A.

Figure F53. Samples taken for pXRF analyses, Site U1614. Red circles = analytical intervals, numbers = analytical numbers shown in Tables T12 and T13.

Figure F54. Samples taken for ICP-AES analyses, Site U1614. Red squares = analytical intervals, numbers = analytical numbers shown in Table T14.

Figure F55. pXRF data variation, Hole U1614C. Numbers in horizontal axis = analytical numbers shown in Tables T12 and T13.

Figure F56. pXRF data variation vs. lithostratigraphic units, Hole U1614C.

Figure F57. K_2O vs. Al_2O_3 plot with pXRF data, Site U1614 (red circles). K_2O and Al_2O_3 enrichments in some samples approach that of phlogopite. ol = olivine, cpx = clinopyroxene, opx = orthopyroxene.

Figure F58. Bulk chemistry of Site U1614 mantle rocks compared to peridotite compositions collected from related geologic settings. A. MgO vs. Al_2O_3. B. K_2O vs. Al_2O_3. C. CaO vs. Al_2O_3. D. TiO_2 vs. Al_2O_3. Iberian margin data from Hébert et al. (2001); back-arc data from Akizawa et al. (2021); MORB data from Niu (2004), Regelous et al. (2016), and Godard et al. (2009); PUM data from McDonough and Sun (1995); DMM data from Workman and Hart (2005). Pl = plagioclase.

Figure F59. LOI and ICP-AES major and minor element geochemistry variations of igneous rocks, Hole U1614C. Mg# = Mg/(Mg + Fe) atomic ratio. Pl = plagioclase.

Figure F60. ICP-AES minor/trace element geochemistry variations of igneous rocks, Hole U1614C. Pl = plagioclase.

Figure F61. Plutonic rock compositions plotted on TAS diagram for plutonic rocks, Site U1614. Classifications are according to Middlemost (1994).

Figure F62. (A) Bulk calcium carbonate content variation and (B) its correlation with bulk CaO content in igneous rocks, Hole U1614C. Pl = plagioclase.

Figure F63. XRD spectra depicting representative phase characterization of dunites, Hole U1614C. Cr-spl = chrome spinel, Lz = lizardite, Mg-cal = Mg-bearing calcite, and Ol = olivine.

Figure F64. A–D. Whole-round and section half XSCAN images, Hole U1614C. Section half scans of basement rocks revealed internal architecture of vein networks and metamorphic fabrics, whereas whole rounds were too thick and attenuated all X-rays, yielding poor results.

Figure F65. Physical properties, Hole U1614A. Small points = WRMSL data, large circles = discrete measurements. cps = counts per second. See lithology key in Figure F8 in the Expedition 402 methods chapter (Malinverno et al., 2025a).

Figure F66. Physical properties for basement section, Hole U1614C. Small points = WRMSL data, large circles = discrete measurements. cps = counts per second. GRA density: small gray dots = raw data, small red dots = 12% correction applied because of incomplete core liners. See lithology key in Figure F8 in the Expedition 402 methods chapter (Malinverno et al., 2025a).

Figure F67. K concentrations and NGR total counts, Hole U1614B. cps = counts per second.

Figure F68. Comparison of peridotite physical properties, Hole U1614C and Site 651. Top: complete Leg 107 data in sediment through basement. Bottom: upper 20 m of peridotite drilled in Hole U1614C to facilitate comparison with peridotite recovered during Leg 107. Inlay data are plotted together: blue-and-red dots = Site 651, blue dots = Hole U1614C.

Figure F69. Left: V_P profile from WRMSL and discrete Gantry measurements from both Holes U1614A and U1614C with fitted velocity-depth functions. Red line = ultrasmooth three-degree polynomial, green line = less smoothed Savitzky-Golay filter. Right: TWT plot of Site U1614 core tops (green stars) computed using less smoothed velocity function overlain on Seismic Reflection Profile MEDOC 8 (courtesy of Institute of Marine Science of the Spanish National Research Council [ICM-CSIC]) (Ranero and Sallarès, 2017). SP = shot point.

Figure F70. Temperatures measured near the seafloor and downhole in the Vavilov Basin and local temperature gradient from a least-squares line fit, Site U1614.

Figure F71. Oxygen concentration profile, Hole U1614A. A. 0–70 mbsf. B. Uppermost 50 cm. See lithology key in Figure F8 in the Expedition 402 methods chapter (Malinverno et al., 2025a).

Figure F72. PFD tracer concentrations measured using GC, Hole U1614A. A. Concentrations in drilling fluids, core exterior surfaces, and core interior. B. Concentrations in core exterior surfaces and core interiors for microbiological analysis.