Figure F1. Expedition 352 sites at the IBM fore arc. Red circle = Site U1442 (proposed site BON-5A), yellow circles = other Expedition 352 sites. White lines = multichannel seismic lines (S. Kodaira, pers. comm., 2013).

Figure F2. Location of Site U1442 along multichannel seismic Line IBr11 (S. Kodaira, pers. comm., 2013). Green bar = sediment, blue bar = igneous basement. CDP = common depth point.

Figure F4. Silty to sandy nannofossil mud with a disseminated ash layer, Hole U1442A.

Figure F5. Silty nannofossil ooze with subtle color banding (off-white to pale brownish gray), reflecting the presence of more or less muddy and silty/sandy layers, Hole U1442A. The remains of one or more thin, discrete ash layers can be seen at the top of the interval; volcaniclastic silt and volcaniclastic sand are dispersed throughout the middle to lower part of the interval.

Figure F6. Relatively homogeneous, brownish nannofossil-rich mud, Hole U1442A. The upper part of the interval is affected by moderate bioturbation, whereas the lower part is muddy with less abundant nannofossils.

Figure F7. Relatively pure, weakly calcareous clay with a manganese-enriched layer, Hole U1442A.

Figure F8. Well-consolidated but unlithified nannofossil-rich ooze, Hole U1442A. Slight color banding is visible.

Figure F9. Sediment directly above the highest levels of the igneous basement, Hole U1442A. A. Tilted silty and sandy nannofossil chalk in which manganese (dark elongate segregations) follows the inclined bedding, as well as a hairline fracture oriented at ~90° to the tilted bedding. B. Tilted primary lamination highlighted by inclined bioturbation. Color variation probably reflects diagenetic mobilization of manganese. C. Contact between nannofossil chalk of Unit IV (upper pinkish color) and the highest levels of igneous basement (Unit 1). Note the subrounded extrusive igneous rock clasts set within a reddish brown, silty volcanogenic matrix.

Figure F10. Age-depth plot with approximate ages from productive intervals, Hole U1442A. Sedimentation rates were approximately constant at ~2 m/My for most of the evolution of Site U1442, becoming high only from ~5 Ma to the present day.

Figure F11. Stratigraphic column of sedimentary units with calcareous nannofossil biozonation indicating approximate ages of each unit.

Figure F12. Stratigraphic summary of basement cores. Opx = orthopyroxene, Ol = olivine, Cpx = clinopyroxene, Pl = plagioclase. Red bars adjacent to lithology column represent fault zones.

Figure F13. Phase assemblage variations. Red bars adjacent to lithology column represent fault zones.

Figure F14. Selected geochemical criteria and magnetic susceptibility measurements used to define igneous units (see **Physical properties**). In addition, the high magnetic susceptibility of high-magnesium andesite relative to less differentiated boninite makes this data useful in recognizing magmatic mingling within the section. Red bars adjacent to lithology column represent fault zones.

Figure F15. Macroscopic features, Hole U1442A. A. Cumulate boninitic lava, comprising high proportions of orthopyroxene and olivine phenocrysts. B. Angular glassy boninite hyaloclastite. Clasts are variably vesicular and are generally surrounded by altered green matrix. C. Highly olivine and orthopyroxene phyric boninitic cumulate. D. Boninite lava with interpillow hyaloclastite breccia. Glassy pillow margins are preserved on the left of the image, whereas angular, highly vesicular clasts enclosed by an altered-glass matrix dominate most of the piece. E. Rectangular aligned boninite clasts enclosed by altered glass (now green clay) and hyaloclastite.

Figure F16. Microscopic features, Hole U1442A. A. Large olivine and orthopyroxene phenocrysts within a hypohyaline matrix (plane-polarized light [PPL]). B. Euhedral olivine and orthopyroxene phenocrysts occurring within a vitrophyric groundmass of acicular augite (PPL). C. Intersertal to intergranular plagioclase and variable altered augite (PPL). D. Glomerocrysts of twinned euhedral augite and plagioclase within a microcrystalline mesostasis of intersertal plagioclase (cross-polarized light [XPL]). (Note the thin section is about twice average thickness). E. Microcrystalline vitrophyric boninite comprising acicular augite and fresh clear glass (PPL). F. Angular, fresh boninitic glass fragments enclosed by a matrix of green altered and devitrified glass (PPL).

Figure F17. Alteration features, Hole U1442A. A. Phenocrysts transformed to smectite and calcite in completely devitrified glass groundmass with elongated dendritic clinopyroxenes (left: XPL; right: scanning electron microscope [SEM]). B. Devitrified and altered boninites. Vesicles are filled with clay and what is left of the glass after devitrification was transformed into zeolite to a certain degree (SEM). C. Olivine pseudomorphically transformed to calcite and smectites in groundmass completely altered to clay and zeolite (XPL). D. Fresh clinopyroxene microlites in glass altered to zeolite. E. Zeolite alteration patch in boninite generally with talc and clays (XPL). F. Alteration corona and crack in orthopyroxene showing talc crystallization (XPL).

Figure F18. Vein features, Hole U1442A. A. Small piece at the top of Unit 2 containing a zeolite vein and native copper flakes in groundmass. B. Zeolite vein showing partial calcite replacement in a completely altered boninite (XPL). C. Quartz vein in the last core.

Figure F19. LOI vs. H_2O and CO_2, Sites U1442 and U1439. Samples that were excluded based on their higher degree of alteration are shown in lighter colors for both holes.

Figure F20. Total alkali content vs. SiO_2 volcanic rock classification diagram (Le Bas et al., 1986) and MgO vs. SiO_2 and TiO_2 including the field for boninites as defined by IUGS. Compositions are compared to a compilation of published compositions of MORB (Jenner and O'Neill, 2012), island arc tholeiites (GEOROC database; August 2014), and fore-arc basalts (Reagan et al., 2010; Ishizuka et al., 2011) from the IBM subduction system as well as samples from Sites U1439, U1440, and U1441.

Figure F21. Major element oxide content vs. MgO, Site U1442. Compositions are compared to a compilation of published compositions of MORB (Jenner and O'Neill, 2012) and fore-arc basalts (Reagan et al., 2010; Ishizuka et al., 2011) from the IBM subduction system as well as samples from Sites U1439, U1440, and U1441.

Figure F22. Ni and Cr concentrations vs. Mg#, Site U1442. Compositions are compared to a compilation of published compositions of MORB (Jenner and O'Neill, 2012) and fore-arc basalts (Reagan et al., 2010; Ishizuka et al., 2011) from the IBM subduction system as well as samples from Sites U1439, U1440, and U1441.

Figure F23. Zr, Y, and V vs. Ti, Site U1442. Compositions are compared to a compilation of published compositions of MORB (Jenner and O'Neill, 2012) and fore-arc basalts (Reagan et al., 2010; Ishizuka et al., 2011) from the IBM subduction system as well as samples from Sites U1439, U1440, and U1441. ICP-AES for Ti, Y and V, and pXRF data for Zr.

Figure F24. Bedding dips as a function of depth.

Figure F25. Flow banding structure with SPO in volcanic rocks, Hole U1442A. The yellow dashed lines highlight a zone of high iron oxide concentration, which increases toward the upper left corner of the thin section (41R-1W, 0–2 cm; TS216).

Figure F26. Elongate vesicles in basaltic lava that indicate flow direction, Hole U1442A. The vesicle aspect ratio (width/length) is ~1:5 (11R-1W, 75–77 cm; TS182). Red line indicates SPO.

Figure F27. SPO (red line) of fragments in magmatic breccia defining a magmatic foliation, Hole U1442A (52R-1A, 19–30 cm).

Figure F28. Cataclastic and phyllonitic shear zone dip angles as a function of depth.

Figure F29. Slickenside dip angles as a function of depth.

Figure F30. Frequency distribution of slickenside dip angles, Hole U1442A.

Figure F31. Fracture dip angles as a function of depth.

Figure F32. Frequency distribution of fracture dip angles, Hole U1442A.

Figure F33. Network of conjugate steeply dipping to subvertical and inclined (shear) fractures from the fault damage zone of fault Zone 1, Hole U1442A (30R-3A, 103–117 cm).

Figure F34. Slickenside with oblique slickenlines indicating oblique reverse sense of shear, Hole U1442A (54R-2W, 12–20 cm; photo by Mark Reagan).

Figure F35. Vein dip angles as a function of depth.

Figure F36. Frequency distribution of vein dip angles, Hole U1442A.

Figure F37. WRMSL physical properties of sediment cores. Blue points = raw values, red lines = filtered data (mean values in 50 cm range).

Figure F38. SHMSL physical property data and discrete sample MAD measurements of sediment cores. Spectral data: L*, a*, b*: blue points = raw values, red lines = filtered data (mean values in 50 cm range). MAD and porosity: solid circles = discreet values (blue = dry density, black = bulk density, purple = grain density, red = porosity). Black points in MAD are WRMSL GRA density data shown for comparison.

Figure F39. WRMSL physical property measurements of basement cores. Blue points = raw values, red points = filtered data (maximum values of rock pieces ≥10 cm in length), red lines = trend of maximum value in each core. Red bars adjacent to the lithology column denote fault zones.

Figure F40. SHMSL and discrete sample physical property measurements of basement cores. Discrete samples were used for magnetic susceptibility (green diamonds), *P*-wave caliper (PWC), and MAD measurements. L*, a*, b*: blue points = raw values, red points = filtered data (maximum values of rock pieces ≥10 cm in length), red lines = trend of maximum value in each core. Red bars adjacent to the lithology column denote fault zones.

Figure F41. Thermal conductivity measurements of whole-round cores for sediment (black points) and discrete samples for basement rock (blue points). Solid red line with error bars: mean and standard deviation for the sedimentary thermal conductivity measurements. Red bars adjacent to the lithology column denote fault zones. Thermal conductivity is 0.99 ± 0.099 W/(m·K).

Figure F42. RCB sediment core magnetic stratigraphy, Hole U1442A. Inclination measurements after 30 mT AF demagnetization. Polarity: hatched zones = gaps in recovery where polarity cannot be interpreted. GAD = geocentric axial dipole.

Figure F43. Inclination measurements, Hole U1442A. Although most demagnetized magnetization inclination values are low (small positive or negative), the results are inconsistent, even where the core appears unbroken, and some parts give high inclination values. Dashed vertical lines = 0° and ±47.6°.

Figure F44. Representative demagnetization results for a discrete sample treated with AF demagnetization, Hole U1442A. This sample shows high-coercivity behavior, such that the sample is barely more than half demagnetized by the 30 mT step. Because of the high coercivity, the sample is relatively unaffected by drill string overprint and there is little difference between the NRM and subsequent AF demagnetized directions. A. Equal area stereonet showing the direction of the magnetization vector at different AF steps. B. Orthogonal vector (Zijderveld) plot showing the magnetization endpoints plotted on two orthogonal planes. C. Normalized magnetization strength, M, at a given AF field demagnetization, normalized by the maximum magnetization strength, M_{max}.

Figure F45. Representative thermal demagnetization results for a well-behaved sample displaying partial self reversal (Doubrovine and Tarduno, 2004, 2005), Hole U1442A. Between 250° and 350°C, the normalized magnetization increases and the vector endpoint moves away from the origin, indicating a partial self-reversal. This sample also shows a relatively high Curie temperature as the magnetization falls off steeply at high temperatures. Plot conventions as in Figure **F44**.

Figure F46. Representative thermal demagnetization results for a well-behaved sample for which the NRM decreases gradually over a large temperature range, Hole U1442A. The point at 110°C was measured after heating in an oven without magnetic shielding for the moisture and density measurement. The higher magnetization and inconsistent magnetic direction after that treatment indicates that the sample acquired a spurious overprint during that test. Plot conventions are as in Figure **F44**.

Figure F47. Representative thermal demagnetization results for a well-behaved sample for which the NRM decreases sharply at 500°C, Hole U1442A. Plot conventions are as in Figure **F44**.

Figure F48. pARM acquisition for 8 samples that were used for AF demagnetization, Hole U1442A. Values measured with a sliding window of 10 mT in a direct-current field of 0.2 mT superimposed on an AF maximum field of 100 mT (Jackson et al., 1988). The field indicated on the x-axis corresponds to the higher field in the interval in which ARM is applied. For example, the point at 20 mT is the pARM acquired in the 20–15 mT interval.

Figure F49. Inclination and lithology comparison, Hole U1442A. Inclinations derived from PCA calculations from AF and thermal demagnetization. TH = thermally demagnetized. Red dashed lines = fault locations, gray bands = fault zones (see **Structural geology**).

Figure F50. Discrete sample paleoinclination value histograms, Hole U1442A.

Figure F51. Schematic of logging tool string deployments, Hole U1442A.

Figure F52. Summary of spectral gamma ray measurements, including corresponding core data sets (gray circles). Bottom of drill pipe is at ~95 mbsf.

Figure F53. Summary of triple combo-MSS tool string measurements. R3 = medium resistivity reading, R5 = deepest HRLA resistivity reading, RT = true resistivity (modeled from all depths of investigation), uncal = uncalibrated units). Bottom of drill pipe is at ~96.5 mbsf. Gray circles = core data.

Figure F54. Summary of FMS-sonic tool string measurements. Bottom of drill pipe is at ~80 mbsf. C1 = caliper 1, C2 = caliper 2. Gray circles = core data.

Figure F55. Comparison of main logs recorded during subsequent passes of the triple combo-MSS tool string.

Figure F56. Comparison of caliper data (hole size) and gamma ray data acquired during subsequent tool string passes and tool string deployments (runs).

Figure F57. Statically processed FMS images, Hole U1442A. A. Coherent unit (Unit 2) exhibiting high angle fractures. B. Massive unit divided by a conductive planar feature, Unit 4. C. Ghostly, low resistivity contrast texture, Unit 5. D. Textures encountered in Unit 6.

Figure F58. Through-pipe gamma ray downhole logging data compared to NGR core data, Hole U1442A. Light gray lines = approximate position of pipe joints, dark gray line = pipe depth.