Figure F1. Regional topography and geodynamic framework of Southeast Asia. Data based on Smith and Sandwell (1997). Solid red lines = regional faults. Red arrows show direction of plate movement and solid red circles mark sites drilled during Expedition 349.

Figure F2. Topographic and bathymetric map of the SCS region. Dashed red line = inferred Zhongnan fault zone. Solid red circles = Expedition 349 sites. Solid white circle = ODP Site 1148. Pink lines = seismic surveys collected during Cruises SO49 (1987) and SO197 (2008) on the R/V *Sonne*. Blue, red, and black lines = seismic data collected by Chinese research institutes and oil companies. Turquoise lines = reflection seismic data acquired in the 1980s from Cruises V3607, V3608, V3613, V3614, and RC2006.

Figure F3. Hypothetical models for the driving mechanisms of the opening of the SCS. A. Opening induced by India-Eurasia continental collision and consequent tectonic extrusion (Tapponnier et al., 1982, 1990; Briais et al., 1993; Leloup et al., 2001; Flower et al., 2001). B. Opening induced by slab pull and subduction of the proto-SCS (Taylor and Hayes, 1980, 1983; Holloway, 1982; Hall, 2002). C. Opening induced by an upwelling mantle plume (e.g., Fan and Menzies, 1992; Xu et al., 2012). D. Opening induced by regional extension related to subduction and retreat of the Pacific plate (Taylor and Hayes, 1980, 1983; Shi and Li, 2012).

Figure F4. Total field magnetic map (based on **global-change.nasa.gov/r/d/[GCMD]GSJ_EASTASIA_CDROM**) showing major magnetic zones (A, B, C1, C1′, C2, D, and E). M1 and M2 are two major magnetic anomalies in the East Subbasin. ZNF = Zhongnan fault zone, LRTPB = Luzon-Ryukyu transform plate boundary, DS = Dongsha Rise; SCMA = offshore south China magnetic anomaly, XS = Xisha, ZB = Macclesfield Bank, LB = Reed Bank, NM = Dangerous Grounds. Red lines = transform faults, solid yellow circles = Expedition 349 sites, solid pink circle = ODP Site 1148. After Li et al. (2008b).

Figure F5. Examples of two groups of contrasting tectonic models for the opening phases of the SCS. A. Multiphase episodic rifting model in which the Southwest Subbasin is the first to open from continental rifting (after Ru and Pigott, 1986). N.P. = Northwest Palawan, S.P. = South Palawan, M.B. = Macclesfield Bank, R.B. = Reed Bank, P.I. = Paracel Islands; F1, F2, and F3 = faults. (Continued on next page.)

Figure F5 (continued). B. Southwestward continuous propagating model in which the Southwest Subbasin is coeval with the central East Subbasin (after Briais et al., 1993).

Figure F6. Proposed sampling transect in the East Subbasin (after Li et al., 2010). A. Total field magnetic anomaly and Bouguer anomaly along the seismic line shown in B. B. Sites U1431, U1432, and U1435 in the East Subbasin and ODP Site 1148 shown on a composite seismic line. Solid lines = sites that fall on the seismic profile, dashed lines = site locations projected onto the line. TWT = two-way traveltime, COT = continent–ocean transition zone, PRMB = Pearl River Mouth Basin, CDP = common depth point. C. Depths to the Moho and Curie point estimated from gravity and magnetic anomalies, respectively. w = width of moving windows.

Figure F7. Seismic profile Line NDS3 showing the short sampling transect in the Southwest Subbasin and location of Sites U1433 and U1434. CDP = common depth point.

Figure F8. A. Bathymetric map of the SCS and surrounding region. Yellow circles = Expedition 349 sites. Solid pink circles = ODP Leg 184 sites. Yellow dashed line = inferred continent/ocean boundary, blue lines = fossil SCS spreading center, white-flagged line = Manila Trench. B. Detailed bathymetry around Site U1431 (green box in A) showing nearby bathymetric highs and the Manila Trench. C. Detailed bathymetry around Sites U1432 and U1435 (red box in A) showing nearby continental shelf, the Manila Trench, and inferred continent/ocean boundary. D. Detailed bathymetry around Sites U1433 and U1434 (blue box in A) showing nearby seamount and Dangerous Grounds and Reed Bank to the south.

Figure F9. Lithostratigraphic and physical properties summary of Site U1431 based on a composite of Holes U1431D and U1431E. Core magnetic susceptibility and gamma ray attenuation (GRA) density (filtered) were measured on the Section Half Multisensor Logger (SHMSL), moisture and density (MAD) measured on discrete samples, and *P*-wave velocities were measured on the Section Half Measurement Gantry (SHMG). Downhole log data, magnetic susceptibility, and total natural gamma radiation (NGR) are from the main pass of the triple combo tool string, and *P*-wave velocities are from Pass 2 of the Formation MicroScanner (FMS)-sonic tool string. Downhole log depths have been shifted upwards by 5 m to correlate with the core physical property data.

Figure F10. Age-depth model, Site U1431. FAD = first appearance datum, LAD = last appearance datum.

Figure F11. Lithostratigraphic summary of igneous rocks and their lithologic features, Hole U1431E. Lithostratigraphy column includes lithology, igneous lithologic units (1–13), and lithostratigraphic units (VII–XI). EOH = end of hole.

Figure F12. Total alkalis vs. silica, with classification of volcanic rock types of Le Maitre et al. (1989). Dashed blue line divides fields for tholeiitic and alkalic lavas of Hawaii (Macdonald and Katsura, 1964; Macdonald, 1968). Shown for comparison are data for Indian Ocean MORB from the Geochemical Rock Database (**georoc.mpch-mainz.gwdg.de**), the seamounts in the SCS (Tu et al., 1992; Hékinian et al., 1989), OIB of Hainan Island (Wang et al., 2012), and Pacific MORB (Zhang et al., 2009, 2012a, 2012b, 2013).

Figure F13. Titanium oxide vs. phosphate, vanadium, scandium, and strontium. Shown for comparison are data for Indian Ocean MORB from the Geochemical Rock Database (**georoc.mpch-mainz.gwdg.de**), the seamounts in the SCS (Tu et al., 1992; Hékinian et al., 1989), OIB of Hainan Island (Wang et al., 2012), and Pacific MORB (Zhang et al., 2009, 2012a, 2012b, 2013).

Figure F14. Heat flow values for Expedition 349 (large circles) and ODP Leg 184 (medium circles) and the compilation of heat flow data in Li et al., 2010 (small circles).

Figure F15. Lithostratigraphic and physical properties summary, Hole U1432C. Core magnetic susceptibility and GRA density (filtered) were measured on the SHMSL, MAD was measured on discrete samples, and *P*-wave velocities were measured on the SHMG.

Figure F16. Age-depth model, Site U1432. FAD = first appearance datum, LAD = last appearance datum.

Figure F17. Lithostratigraphic and physical properties summary, Site U1433. Physical properties and downhole measurements are from Holes U1433A and U1433B. Core magnetic susceptibility and GRA density (filtered) were measured on the SHMSL, MAD was measured on discrete samples, and *P*-wave velocities were measured on the SHMG. Downhole log data, magnetic susceptibility, and total NGR are from the main pass of the triple combo tool string, and *P*-wave velocities are from the main pass of the FMS-sonic tool string. Downhole log depths have been shifted upward by ~2 m to correlate with the core physical property data.

Figure F18. Age-depth model, Site U1433. FAD = first appearance datum, LAD = last appearance datum.

Figure F19. Lithostratigraphic summary of igneous rocks and their lithologic features with integrated downhole logging observations, Hole U1433B. Lithostratigraphy column includes lithology, igneous lithologic units (1–45), and lithostratigraphic units (III and IV). EOH = end of hole.

Figure F20. Downhole FMS images showing basalt pillows in the 833–836 m wireline matched depth below seafloor (WMSF) interval, Hole U1433B.

Figure F21. Lithostratigraphic and physical properties summary, Hole U1434A. Core magnetic susceptibility and GRA density (filtered) were measured on the SHMSL, MAD was measured on discrete samples, and *P*-wave velocities were measured on the SHMG.

Figure F22. Age-depth model, Site U1434. FAD = first appearance datum, LAD = last appearance datum.

Figure F23. Lithostratigraphic summary of igneous rocks and lithologic features, Hole U1434A. Lithostratigraphy column includes lithology, igneous lithologic units (1–7), and lithostratigraphic units (I–IV). EOH = end of hole.

Figure F24. Lithostratigraphic and physical properties summary, Hole U1435A. Core magnetic susceptibility and GRA density (filtered) were measured on the SHMSL, MAD was measured on discrete samples, and *P*-wave velocities were measured on the SHMG.

Figure F25. Age-depth model, Site U1435. FAD = first appearance datum, LAD = last appearance datum, wavy line = possible hiatus.