

Jeju Island is a volcanic island situated off the southern coast of the Korean Peninsula. The island was produced by volcanic activity which occurred from about 2 million years ago until historic times. The island is 73 km long in the east-west direction and 31 km long in the north-south direction, having an area of 1,847 km². The island has the typical morphology of a shield volcano, characterized by an overall gentle topography and an elliptical shape in plan elongated in the ENE direction (Fig. 5.1).

Basaltic to trachytic lavas occur extensively on the island together with diverse volcanic landforms, including Mt. Hallasan that rises 1,950 m above sea level at the center of the island and about 360 volcanic cones that are scattered throughout the island (Sohn and Park 2007) (Fig. 5.2). In the subsurface, however, numerous hydromagmatic volcanoes (tuff rings and tuff cones) produced by explosive hydrovolcanic activity occur extensively together with intervening volcanoclastic sedimentary deposits (Sohn and Park 2004; Sohn et al. 2008). This is because the volcanic activity of the island commenced in the continental shelf in the southeastern Yellow Sea where abundant water for hydrovolcanic explosion was available. Composed of an early-stage product of hydrovolcanism and a late-stage product of lava effusion, Jeju Island can be defined as a “shelfal shield volcano”, distinguished both from nonmarine shield volcanoes and from oceanic volcanic islands that were built on the deep ocean floors.

Thousands of groundwater bores have been drilled all over the island since the 1960s, greatly improving our understanding of the surface and subsurface geology of Jeju Island (Fig. 5.3). The basement is composed of granite and silicic volcanic rocks of Jurassic to Cretaceous age (Kim et al. 2002). The overlying U Formation is 70–250 m thick and composed of well-sorted, quartzose sand and mud (Koh 1997) that were deposited on the continental shelf before the onset of volcanism at Jeju area (Sohn and Park 2004). The U Formation is overlain by about 100 m of basaltic volcanoclastic and fossiliferous deposits named the Seoguiipo Formation. Recent studies (Sohn and Park 2004; Sohn et al. 2008) reveal that the formation is composed of numerous superposed phreatomagmatic volcanoes intercalated with marine

or nonmarine, volcanoclastic or non-volcanoclastic deposits with intervening erosion surfaces and palaeosol layers. The widespread and continual hydrovolcanic activity together with volcanoclastic sedimentation, as represented by the Seoguiipo Formation, is inferred to have persisted for more than a million years (from ca. 1.8 Ma to 0.8–0.4 Ma) under the influence of fluctuating Quaternary sea levels.

Thereafter, proto-Jeju Island (Fig. 5.4) has grown up above the fluctuating Quaternary sea levels and lava effusion became dominant, resulting in the plateau- and shield-forming lavas together with numerous volcanic cones (Fig. 5.2). K-Ar ages of these lavas range generally between 0.8 and 0.03 Ma (Tamanu 1990; Lee et al. 1994), suggesting that the construction of Jeju Island was almost complete before the Holocene. After the last glacial maximum 18,000 years ago and during the middle Holocene when the coastal regions of Jeju Island became suitable for hydroexplosions, explosive hydrovolcanic eruptions occurred at several places along the present shoreline. These Late Pleistocene to Holocene hydrovolcanic eruptions resulted in several tuff rings and tuff cones with fresh morphology (Sohn and Chough 1989; Chough and Sohn 1990, 1992, 1993). There are also historic records of minor eruptions afterwards about one thousand years ago, although it is uncertain where these eruptions occurred.

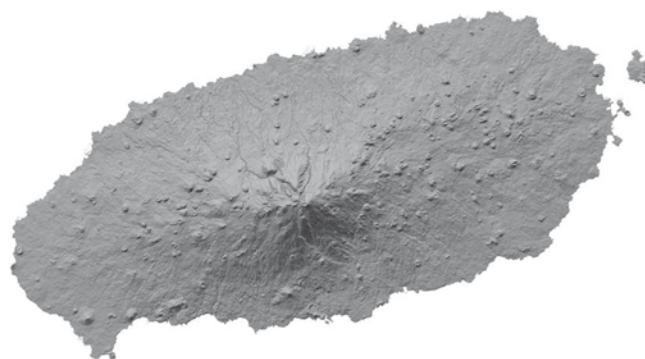


Fig. 5.1 Digital elevation model of Jeju Island, showing the overall shield morphology of the island with a central peak (Mt. Hallasan) and numerous volcanic cones

Fig. 5.2 Geological map of Jeju Island covered by numerous lava flows and volcanic cones (Park et al. 2000)

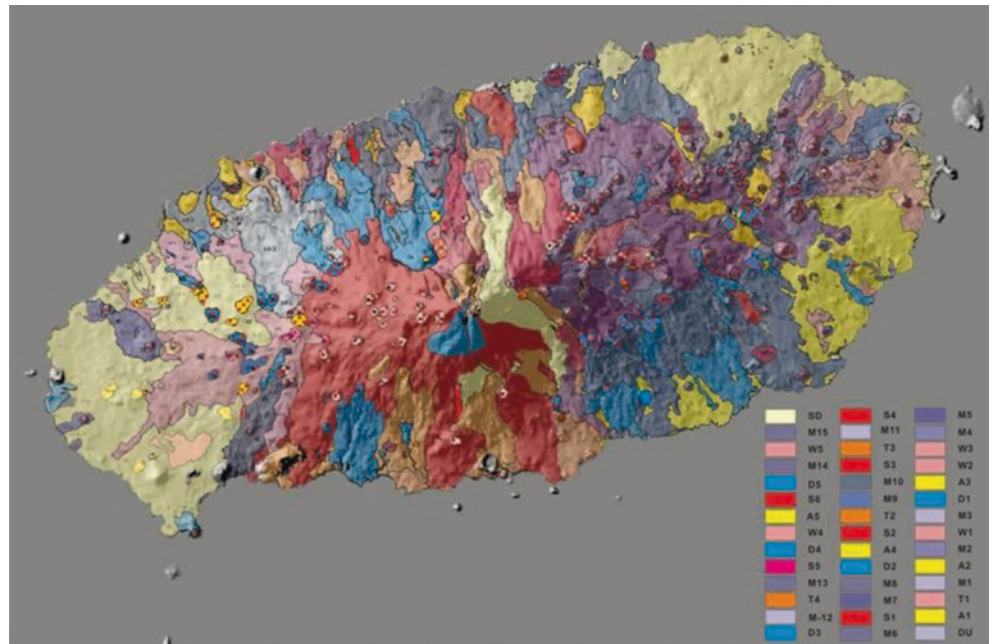


Fig. 5.3 Illustration of the sub-surface stratigraphy and lithology of Jeju Island

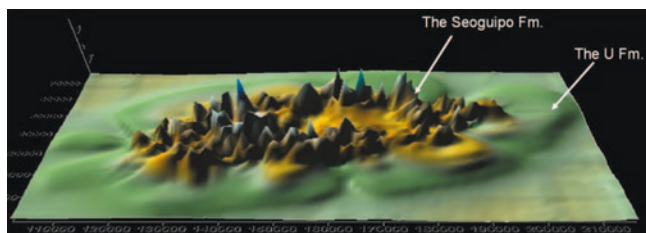
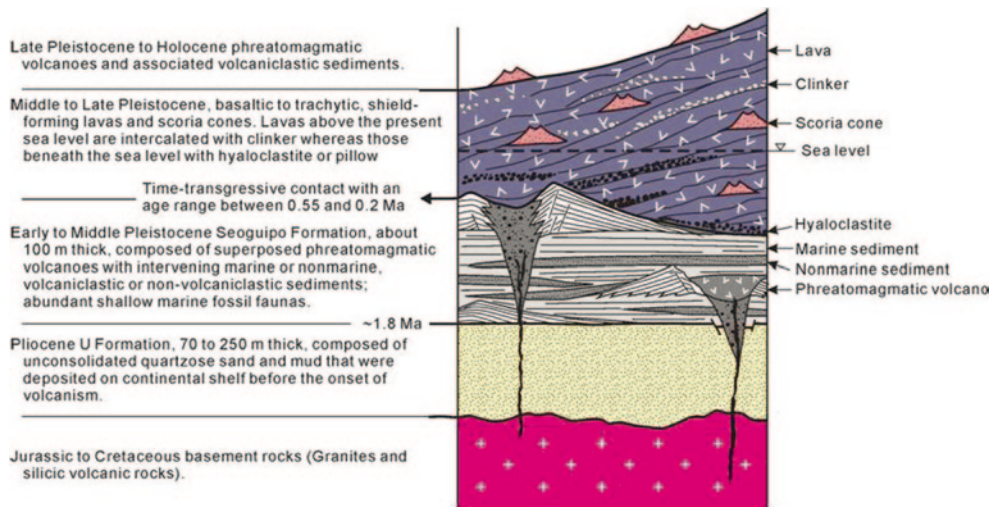


Fig. 5.4 Computer-generated image of the upper surface of the Seoguiipo Formation, showing the probable appearance of ancient Jeju Island before the effusion of the shield-forming lavas. This image was compiled from about 1,400 borehole data (Sohn and Park 2007)