

THE
UNIVERSITY
OF RHODE ISLAND

University of Rhode Island
DigitalCommons@URI

Graduate School of Oceanography Faculty
Publications

Graduate School of Oceanography

2012

Submarine Volcanism in the Straits of Sicily

Steven N. Carey

University of Rhode Island, scarey@uri.edu

Katherine L. C. Bell

See next page for additional authors

Follow this and additional works at: <https://digitalcommons.uri.edu/gsofacpubs>



Part of the [Oceanography Commons](#), and the [Volcanology Commons](#)

Terms of Use

All rights reserved under copyright.

Citation/Publisher Attribution

Carey, S. N., Bell, K. L. C., Marani, M., Rosi, M., Baker, E. T., Roman, C., Pistolesi, M., & Kelly, J. (2012). Submarine volcanism in the Straits of Sicily. In K. L. C. Bell, K. Elliot, C. Martinez, and S. A. Fuller (eds.), *New Frontiers in Ocean Exploration: The E/V Nautilus and NOAA Ship Okeanos Explorer 2011 Field Season*. *Oceanography* 25(1), supplement, pp. 34-35.

doi: [10.5670/oceanog.2011.supplement.01](https://doi.org/10.5670/oceanog.2011.supplement.01)

This Article is brought to you for free and open access by the Graduate School of Oceanography at DigitalCommons@URI. It has been accepted for inclusion in Graduate School of Oceanography Faculty Publications by an authorized administrator of DigitalCommons@URI. For more information, please contact digitalcommons@etal.uri.edu.

Authors

Steven N. Carey, Katherine L. C. Bell, Michael Marani, Mauro Rosi, Edward T. Baker, Chris Roman, Marco Pistoiesi, and Joshua Kelly



New Frontiers in Ocean Exploration

The E/V *Nautilus* and
NOAA Ship *Okeanos Explorer*
2011 Field Season



Submarine Volcanism in the Straits of Sicily

By Steven N. Carey, Katherine L.C. Bell, Michael Marani, Mauro Rosi, Edward T. Baker, Chris Roman, Marco Pistolesi, and Joshua Kelly

Tectonic extension during the late Miocene to Pliocene (about 10.5 to 2.5 million years ago) formed the Straits of Sicily, or Sicily Channel, between Sicily and the North African continental margin (Civile et al., 2010). Three principal elongated depressions in this deep intraplate rift zone—the Pantelleria, Linosa, and Malta grabens—occur along the length of the channel with maximum depths of 1,317, 1,529, and 1,731 m, respectively (Figure 1). Each graben is filled with thick (> 1,000 m) sedimentary sequences, so-called turbidites (Calanchi et al., 1989), and is generally bounded by northwest-southeast trending faults. The continental crust along the grabens is significantly thinned, with a minimum thickness of 17–18 km found beneath the Pantelleria and Linosa grabens. Subaerial and submarine volcanism occur at various locations within the Straits of Sicily as a result of crustal thinning. Subaerial volcanism is restricted to the islands of Pantelleria in the northwest and Linosa to the southeast (Figure 1).

In contrast, a large number of submarine volcanic centers (at least 10) have been identified within the grabens and along the shallower platforms adjacent to Sicily

(Rotolo et al., 2006). New multibeam mapping around Pantelleria revealed the presence of at least 30 small volcanic cones in 100–650 m water depth (Bosman et al., 2007). Historical activity in the area was recorded as early as 264 BCE, and the last documented submarine eruption took place in 1891, several kilometers northwest of Pantelleria at Foerstner Volcano (Washington, 1909). The 1891 eruption was unusual because it produced meter-size basaltic scoria blocks that rose to the surface and degassed (sometimes exploding) before becoming saturated with seawater and then sinking back to the seafloor (Figure 2).

In 2011, E/V *Nautilus* scientists went to the area northwest of Pantelleria to investigate the location of the 1891 vent and to examine the structure, relative age, and composition of the numerous volcanic cones. We confirmed the location of the 1891 eruption vent about 4 km off the northwest coast (Figure 3). Surrounding the vent, a small mound with a peak at 255 m water depth, was an extensive field of large scoria blocks distributed on a seafloor mantled by fine-grained sediment (Figure 4). These blocks were likely transported briefly on the sea surface by local

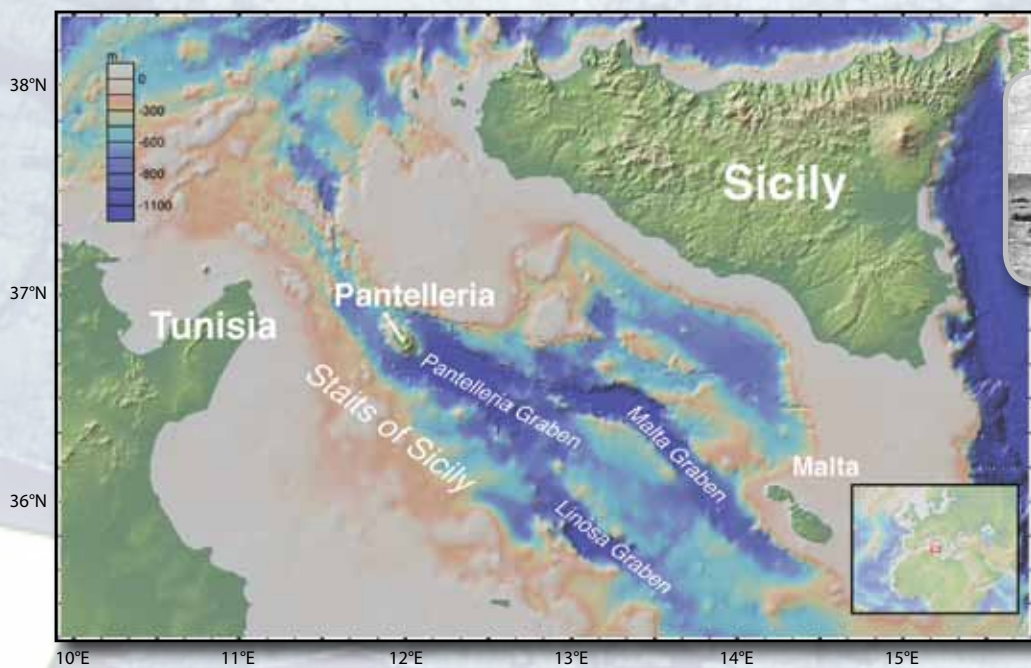


Figure 1 (left). Bathymetric map of the Straits of Sicily showing the location of the Pantelleria, Malta, and Linosa grabens.

Figure 2 (above). Lithograph of floating scoria blocks from the 1891 submarine eruption of Foerstner Volcano, Northwest Pantelleria. From Butler (1892)

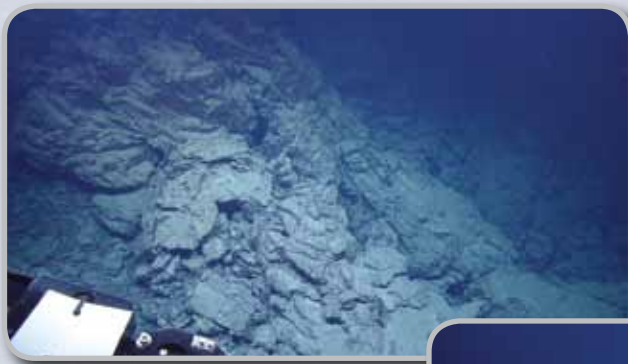


Figure 3 (above). Vent area of the 1891 submarine eruption off the coast of Pantelleria, Italy. Pillow-like lava tubes are characterized by abundant decimeter-scale gas voids.

Figure 4 (right). Scattered 1891 scoria blocks on fine-grained sediment at 350 m water depth off the coast of Pantelleria, Italy. The largest individual blocks are about 1 m in diameter.



Figure 5 (right). Hollow scoria block from the 1891 submarine eruption off the coast of Pantelleria, Italy. Scale bar is 30 cm long. Note the large gas cavities that produced sufficient buoyancy for the blocks to rise to the sea surface.

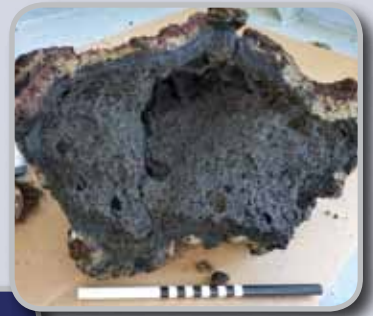
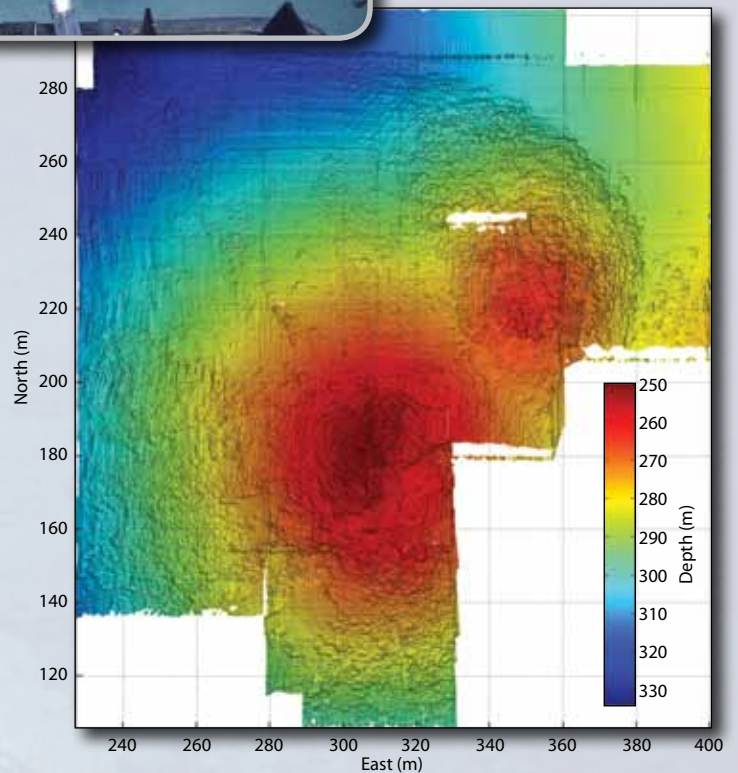


Figure 6 (below). High-resolution bathymetric map of the 1891 submarine vent area and block field off the coast of Pantelleria, Italy.



currents before sinking back to the bottom. Many of the blocks were hollow and easily broken when grabbed with the manipulator arm of the ROV *Hercules* (Figure 5). We conducted a high-resolution multibeam mapping survey of the vent site and adjacent block field to help understand the nature of the submarine eruption processes and the dispersal pattern of the eruptive products (Figure 6). This first attempt at high-resolution imaging of a submarine vent system of this scale will likely lead to important insights into the evolution of this interesting eruption style.

Exploration of 11 other cones northwest of Pantelleria revealed only one with relatively fresh volcanic rocks. This cone was located just east of, and is significantly larger than, the 1891 vent site. Geochemical analyses of samples collected on this cone will be compared to the 1891 scoria to see whether this vent site may also have been associated with the most recent eruption. The other cones were characterized by the development of a biogenic mineralized crust covering outcrops of volcanic rock. Virtually all of these cones exhibited extensive areas of dead coral fragments, often coated with manganese precipitates, near their summits (Figure 7). This debris may represent drowned coral beds that developed during the last sea level low stand approximately 11,000 years before present. ^{14}C dating of sampled coral fragments will be used to assess this hypothesis.



Figure 7 (above). Dead coral beds being sampled by *Hercules*' manipulator arm at 400 m water depth on the slopes of a volcanic cone northwest of Pantelleria Island, Italy.