



Istituto Nazionale di
Geofisica e Vulcanologia

ENS@Sicile2021 (03-14 July)



Guidebook to the Field Trip

NOTO and OCCHIOLA'

11-12 July 2021

A short overview on main the seismicity in Sicily

The largest earthquakes in Sicily (magnitude higher than 7.0) occur in the eastern part of the island (Fig. 1). The 1169 and 1693 events had their epicentres in the inner sector between Syracuse and Catania, devastating extensively the Val di Noto area. The 1908 earthquake was located to the North in the Messina Straits and caused destruction in the northeastern sector of the region as well as in southern Calabria. These large earthquakes rarely occur, with return periods of some hundreds of years. Moderate ($M=5.5-6.1$) but more frequent events affect the northern sector of the island, along the mountain chain parallel to the Tyrrhenian coast. The western sector of Sicily is also characterised by moderate earthquakes, but they strike with very long return periods (thousands of years); the ghost towns produced by the 1968 seismic sequence are still visible in the territory of the *Valle del Belice* area, representing quintessential places of memory.

Finally, the volcanic areas of Etna, Aeolian Islands and Sicily Channel are characterised by a low-energy seismicity ($M < 5.0$) with very high frequency of occurrence. Here, the earthquakes also produce destruction but only in limited zones because of the shallow depth of hypocentres.

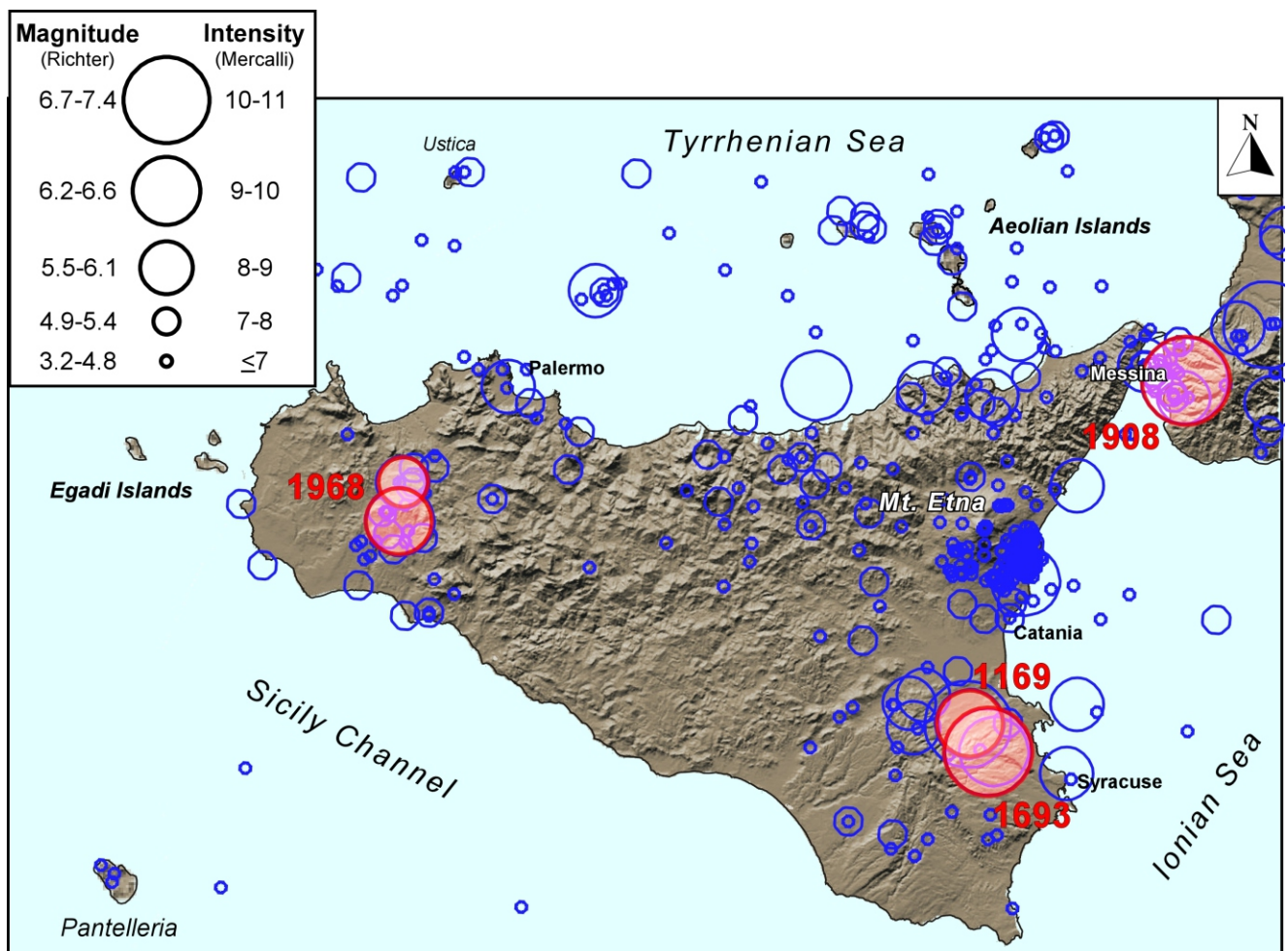


Figure 1. Location of earthquakes in Sicily from 1000 to 2014 according to CPTI15 catalogue (Rovida et al., 2016, http://emidius.mi.ingv.it/CPTI15-DBMI15/description_CPTI15_en.htm).

The 1693 Val di Noto earthquakes

The January 11, 1693 earthquake ($M = 7.3$) caused the largest catastrophe in the seismic history of Italy. It was the mainshock of a seismic sequence lasting for two years which totally destroyed about forty towns in the area between Catania, Syracuse and Ragusa (Fig. 2) and heavily damaged the territory as far as Messina, the interior of Sicily and even Malta in the Sicily Channel. In total there were 60,000 victims.

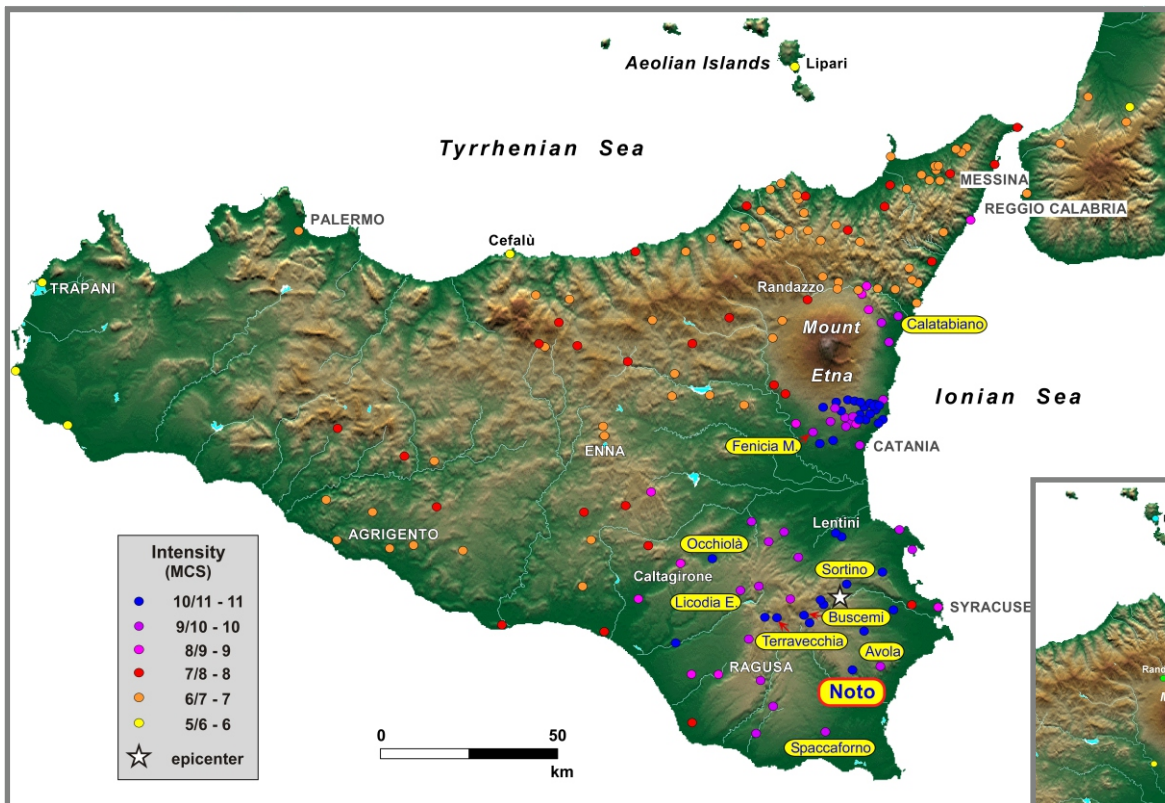


Figure 2. Intensity map of the January 11, 1693 earthquake (macroseismic data from Locati et al., 2016, http://emidius.mi.ingv.it/CPT15-DBMI15/description_DBMI15_en.htm). The localities abandoned and reconstructed in a new site are marked in yellow.



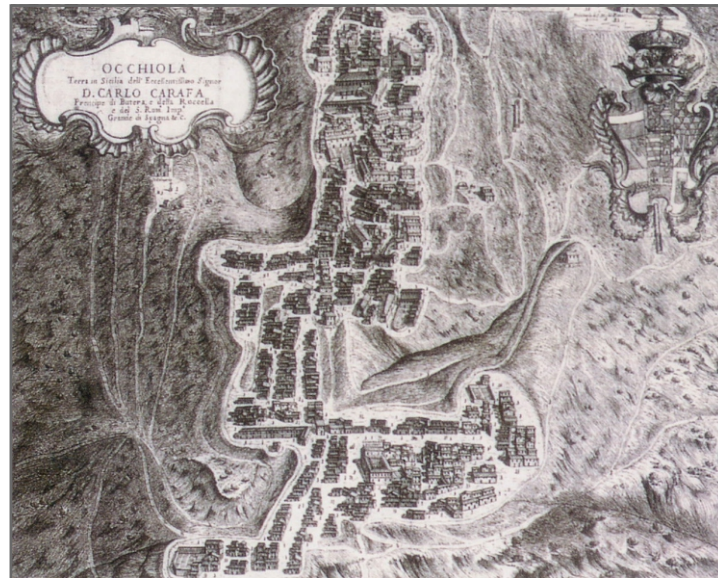
Figure 3. Intensity map of the January 9, 1693 earthquake.

The severity of damage scenario related to this earthquake was increased by a strong foreshock occurring on January 9 ($M = 6.0$), which caused heavy damage ($I=8-9$ MCS) in many localities of southeastern Sicily (Fig. 3).

Whereas the physical and social impacts of the 1693 earthquakes are well known due to a large volume of both contemporary reports and recent studies, their seismotectonic interpretation is still a matter of debate. The various proposed hypotheses of epicentral location, place the seismic source either offshore in the Ionian Sea, or alternatively, inland on the Hyblean Foreland.

Occhiolà

The medieval village, located on the northwestern part of a hill named Terravecchia at 491 m/asl, still presents the imposing ruins of the castle and part of the urban plan (Figs. 4 , 5). In 1693 Occhiolà had about 3,000 inhabitants. The first event, on January 9, frightened the population and caused diffuse damage (I=VII-VIII MCS), but it was the strongest earthquake occurring two days later which totally destroyed the village. Buildings, weakened by the previous shock, were completely raised to the ground (I=XI MCS); half of population (ca. 1470 people) died under the pile of ruins.



'Terra in Sicilia dell' eccellentissimo Signor D. Carlo Maria Carafa Principe di Butera e della Roccella e del S. Romano Impero, Grande di Spagna & C.'
 [Land in Sicily of the most excellent Lord D. Carlo Maria Carafa Prince of Butera and Roccella and the Holy Roman Empire grandee of Spain etc.]

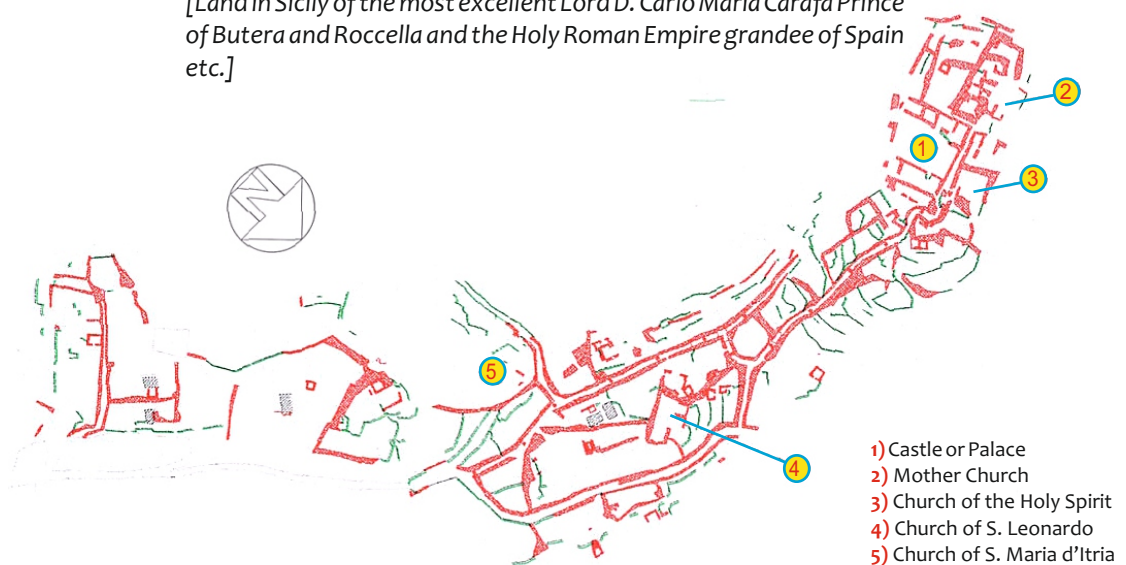


Figure 4. Location of the most relevant edificies (ruins) in the old village of Occhiolà

Occhiolà



Figure 5. Panorama of the S. Nicola hill viewed from the S. Leonardo Church. Ruins on the S. Nicola hill and the castle on the left.

The new town was founded in the same year with the name of Grammichele by Carlo Maria Carafa Branciforte, Prince of Butera, in a site located on the plain a few kilometres from the old one (Fig. 6). It has a characteristic hexagonal plan inspired by the Renaissance models as well as by the interest of the founder in mathematical and astronomical sciences. At the turn of the 19th century the town mainly developed southeastward, thereby altering its strictly geometric original scheme.



Figure 6. Aerial view of the modern town of Grammichele. Note the characteristic hexagonal plan of the historical centre.

Noto Antica

In the Middle Ages, the old settlement of Noto was an important and prosperous stronghold (Fig. 7a) chosen by the Arabs as the chief town of one of the three districts (Val di Noto) in which Sicily was divided.

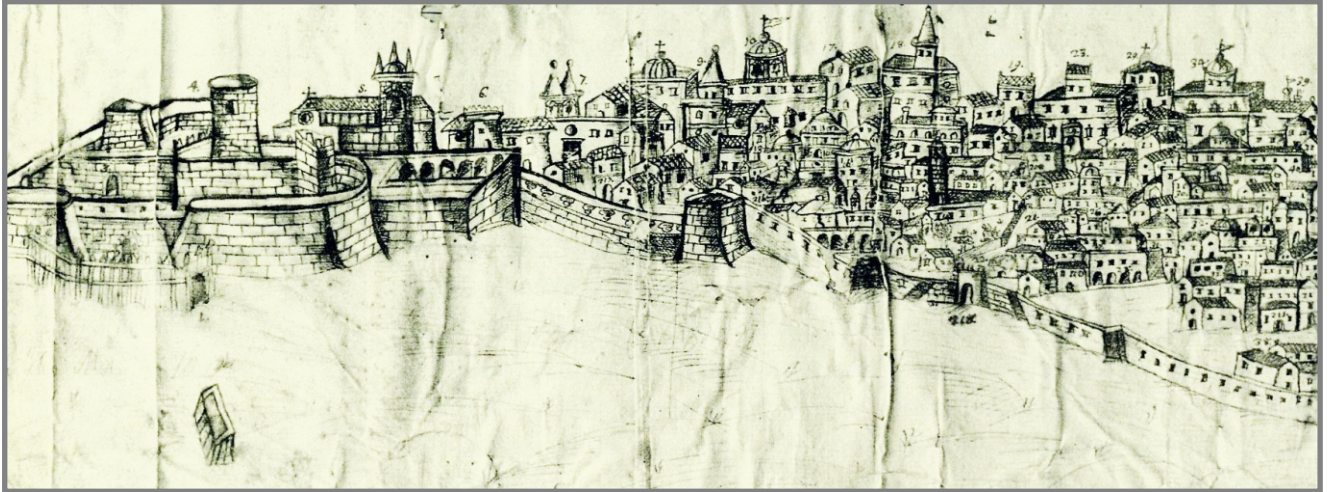


Figure 7a. View of Noto Antica before the 1693 earthquakes, considered an "impregnable admirable place". Detail of the castle and walls seen from the West.



Figure 7b. Reconstruction of the old city of Noto before the 1693 earthquakes (Hofer, 1996). Sites visited during the field trip: 1) Castle; 11) College of Jesuit Friars; 13) Senate-House; 14) Cathedral.

Noto covered a vast area of land and benefited from great economic wealth that, especially during the 15th and 16th centuries, led to a great deal of cultural turmoil. Starting in the 16th century, the town transformed its medieval urban layout, rearranging the main squares and streets, new buildings, and erecting new churches and convents.

Noto Antica was completely surrounded by walls, of which large visible stretches still remain. The layout of the old city, although barely visible now as it lies under thick vegetation that has covered the few remains of buildings, was centred around a main road which, running along the top of the ridge of the hill, connected the entrances to the city (Fig. 7b). The main entrances were the *Porta Reale* to the North and the *Porta della Marina* to the South.

Noto Antica was severely damaged by the 1542 earthquake ($I=8$ MCS) and almost raised to the ground by the 1693 earthquakes. The January 9 foreshock produced severe effects on the town ($I=8-9$ MCS), ruining several edifices and causing 200 fatalities. Two days later, the January 11 mainshock totally destroyed ($I=10-11$ MCS) houses, churches, convents and monasteries; there were 3,000 deaths out a total of 12,000 inhabitants.

The earthquakes of 1693 abruptly interrupted the growth of the city.

Sources reveal that: "what suffered the most was the little castle, that has now been reduced to what resembles a heap of stones, and to repair the entire damage will probably incur expenses of around five thousand *Scudi*."

The upper part of the "master" tower remains (Fig. 8), as well as most of the curtain wall next to it; aboveground remains are visible in a few places. The perimeter of the quadrilateral fortification is very visible in some areas and covered with plants in others; the corner towers have collapsed in parts. Most of the rubble of the castle is scattered within the perimeter; shrubs with roots are growing within the wall structures.



Figure 8. Noto Antica: left, ruins of the Castle Tower; right, entrance to the town through the Royal Gate.

The town was definitively abandoned in 1702; the ruins of Noto Antica, in a scenographic position on Mount Alveria at 409 m/asl, now constitute the most effective warning to local communities about the hazard impending on their own territory.

The reconstruction in the Val di Noto was the culmination of the greatest period of settlement improvement and land reorganisation taking place in Sicily during the 16th and 17th centuries. The need for settlements to be located on hill tops had diminished and new towns and villages could be built with a more 'open' plan and where their location allowed better integration with transport routes. This in turn increased trade and improved the quality of life.

The modern Noto

The medieval structure and the mountain location of the old town forced inhabitants to reconstruct a new settlement in a different site ten kilometres downhill; from 1694 the first religious buildings were erected in a more accessible site and without fortifications (Fig. 9).



Figure 9. View of the modern Noto in 1750-60 in the plan by the architect Labisi.

During the second and third decades of the 18th century, the buildings became monumental, the domes of the churches were completed and the fronts of houses were raised with upper storeys. The baroque town features a regular urban plan with orthogonal roads; the main road (Cassaro) crosses the town from the royal gate. The modern Noto is on the Unesco Heritage List (Fig. 10).



Figure 10.
The modern Noto: night landscape of the Sicilian Baroque.