THE DISCOVERY OF A PROBABLE WELL-PRESERVED IMPACT CRATER FIELD IN CENTRAL ITALY. J. Ormö[1], A.P. Rossi[1], G. Komatsu[1], M. Marchetti[2], and A. De Santis[2], [1]International Research School of Planetary Sciences, Universita d'Annunzio, Viale Pindaro 42, 65127 Pescara, Italy (ormo@irsps.unich.it), [2]Istituto Nazionale di Geofisica e Volcanologia, Via di Vigna Murata 605, 00143 Roma, Italy (marchettim@ingv.it).

Synopsis: This investigation presents what we propose to be the first discovered impact craters in Italy. They form a crater field in the Sirente plain within the mountains of the Abruzzo region, central Italy. The craters were studied morphologically by detailed leveling, and geologically by drilling and trenching. We used magnetometry to localize possible meteoritic material in the smaller, non-explosion craters in the field. The field has about 17 craters in the size-range of 2-20 m, and a droplet-shaped main crater that is 140 m long and 115 m wide. It has a well developed rim wall about 2.2 m high and 15 m wide. The target consists of loose sediments and the age of the impact event is late Holocene.

Introduction The Sirente crater field is located in the western part of the Prato del Sirente plain. The plain is about 1750 m long and 750 m wide, and is bordered on its southern side by a NW-SE striking fault. Several of the Abruzzo high plains hosted ephemeral lakes during the Late Pleistocene and Holocene with deposition of lacustrine sediments [1]. During the late Holocene many of these lakes dried up and eolian deposition became stronger.

No bedrock is outcropping within the Sirente plain. The valley being a half-graben on the northern side of the high Sirente massif indicates that the valley infill is of great thickness.

The drilling and trenching conducted in this study showed that the upper ten meters or more of the valley infill is fine sand and silt with sporadic limestone blocks. The Sirente crater field is located within the Sirente-Velino Regional Park and is protected by the park regulations. All our activities have been done in agreement with the park authorities.

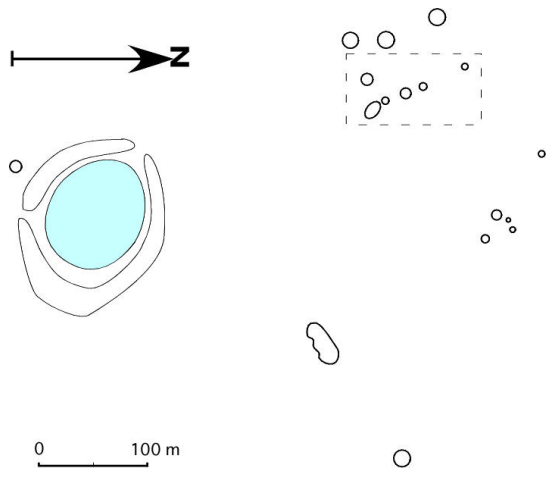

Figure 1. The Sirente crater field. The blue circle shows the outline of the small lake confined within the main crater. Dashed rectangle shows location of Fig. 3.

Description: The crater field is 450 m in length and 400 m wide and has at least 17 smaller craters distributed close to a main crater. (Fig. 1) The main crater is located in the southern end of the crater field and is an order of magnitude greater than the other craters in the field (Fig. 2). All the craters, including the main crater, are developed entirely in yellowish, silty-sandy unconsolidated eolian and lacustrine sediments.

Only the most prominent of the craters were mapped. The surface of the plain has numerous undulations and shallow depressions possibly representing additional crater structures. The diameters of the mapped craters vary from 2 m to 20 m. Some have an apparent depth of 1.5-2 m, whereas others are only shallow circular depressions. Only one of the small craters has a low rim wall on one side. A magnetic survey with a Geometrics Cesium G858 magnetometer coupled with DGPS showed distinct magnetic anomalies (20-30 nT) linked to most of the prominent small craters (Fig. 3). The plain in general and the main crater were magnetically calm. The magnetic anomalies can be ascribed to objects characterized by a remanent magnetization with different direction with respect to the present geomagnetic field. Excavation of an approximately 10 m wide crater to 4.5 m depth did not reach the object causing the magnetic anomaly. However, the excavation gave valuable information on the subsurface structure of the crater. At the rim the pedogenesis reaches to about 1 m depth, which is the normal thickness in the plain, whereas at the center of the crater a black organic soil dominates to at least 4 m. Between the rim and this about 3 m wide central column of soil is a section dominated by slump structures and lenses of deformed organic-rich soil. The slumped section is interpreted to have formed by collapse of the crater somewhat like the breccia lens in craters formed in solid targets. Water may have percolated down in the disturbed sediments of the central part of the crater causing pedogenesis to great depth. The excavation will be resumed in the near future and continued until the object causing the anomaly is found.

The main crater has a slight droplet shape and is 140 m long and 115 m wide rim-to-rim. It has a well-

developed, saddle shaped rim wall that rises at a maximum of 2.2 m above the surrounding plain. Drilling through the rim showed that the target surface at the rim is positioned about 1 m lower than today's plain surface. The true height may therefore be about 3 m. A shallow moat outside the western part of the rim, and compressed sediments in one drill core, give further indications for a downwarping of strata at the rim rather than the uplift that could be expected. Downwarped and compressed strata have been noticed at experimental TNT explosion craters in loose sediments [2], as well as at the impact craters formed in loess at Campo del Cielo, Argentina [3]. This circumstance indicates that the Sirente crater field can serve as a well-preserved example for cratering mechanics studies of small craters formed in loose sediments. We will further investigate the implications that this may have for the understanding of small craters visible in MOC images of Mars.

Preliminary radiocarbon dating of the target surface preserved below the rim wall indicates a formation in the late Holocene. The young age is consistent with the apparent little modification of the rim wall and the distinct surface expression of some of the smaller craters. The morphology of the main crater and its relation to a crater field with buried objects with remanent magnetization strongly points to an impact origin. The main crater is in the size range of explosion craters and has many features comparable to craters formed in loose sediments, both experimental and meteoritic impact craters. This crater represents a rare example of well-preserved, small explosion craters from impacts into unconsolidated target materials.

References: [1] Giraudi (1997) *Il Quaternario*, 10, 191-200. [2] Jones (1977) In: Roddy, Pepin, and Merrill (Eds.) *Impact and Explosion Cratering*, Pergamon Press: NY, 163-183. [3] Cassidy and Renard (1996) *Meteoritics & Planetary Science*, 31, 433-448.

Figure 2. The Sirente main crater. The crater is about 140x115 m in diameter and has a 2.2 m high rim wall.

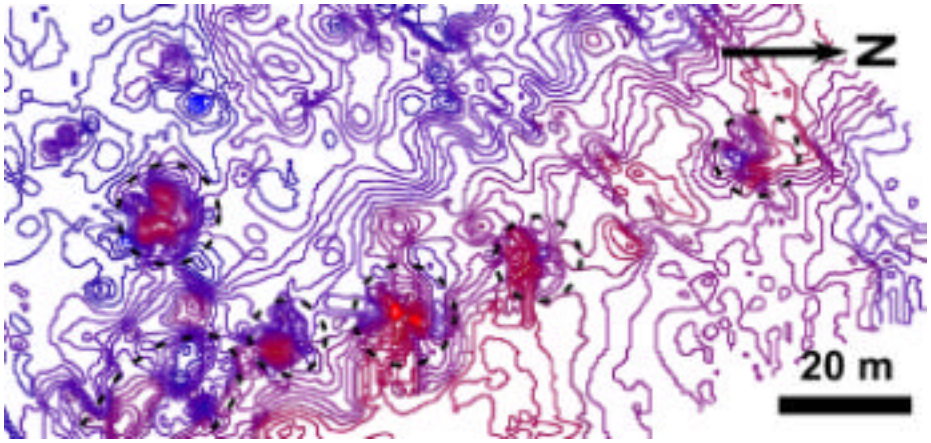

Figure 3. Intensity of total magnetic field of a section of the crater field. Mapped craters are indicated by dashed circles.