

# Evidence from Pseira for the Santorini eruption

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Pseira is an offshore island in the Gulf of Mirabello. Because it is located on the northeast coast of Crete, it was directly in the path of both the Thera eruption's ash fall and of the tsunami caused by the cataclysm.<sup>1</sup> Both of these effects have left evidence in the archaeological record on the small offshore island.<sup>2</sup> Earthquakes at about this time also left their mark. The Minoan community of Pseira was able to recover, however, and it continued to be a prosperous seaport on the east-west route between Central Crete and eastern ports.

The island is about 1.75 km<sup>2</sup> in size. A Minoan town occupied both sides of a small harbour facing southeast, toward Crete and away from Thera and the rest of the Cycladic islands. The town was arranged around an open plaza of irregular shape. Much of the land near the harbour consisted of steep slopes, and many of the houses were constructed on more than one terrace. Streets divided the community into blocks of buildings, and staircases led down to the edge of the water where the land was steep. The space for the town was larger during the Bronze Age because relative sea level has risen by at least 2 meters since the second millennium BC.<sup>3</sup>

Pseira was first excavated by Richard Seager in 1906 and 1907.<sup>4</sup> The early excavations concentrated on understanding the large picture of the island's history. They showed that the town had been a prosperous settlement that imported fine pottery and other items from both the coast opposite the small island and from farther away. Seager correctly understood that the island was poor in natural resources, including good land for farming, and that it must have depended on seafaring for much of its livelihood. Its small harbour facing south, with shelter from most of the storms that hit this

part of Crete, would have been the main reason it was settled in the first place.

Beginning in 1994, a new project re-investigated the island, cleaning the architecture found by Seager and excavating several new buildings. The new publications describe both the buildings and tombs uncovered by Seager and those excavated more recently.<sup>5</sup> The project also conducted geological studies,<sup>6</sup> studied the modern flora,<sup>7</sup> documented the soils,<sup>8</sup> and conducted an intensive survey of the island.<sup>9</sup> We now know that in spite of its limited land mass, Pseira Island was extensively farmed. The local economy was complex and diversified. In addition to providing a service with its harbour, Pseirans also used agriculture, the processing of agricultural commodities to make secondary products like wine and oil, and small-scale manufacturing to support its population.

Building AC was a small building that may have been the town's shrine (Fig. 1). Among the discoveries in the western room were fragments of frescoes showing women in elaborate costumes.<sup>10</sup> The final phase of its architecture was from LM

<sup>1</sup> Friedrich 2000, 67–81.

<sup>2</sup> For the ash fall, see Ninkovich & Heezen 1967; McCoy 1980; for the tsunami, see McCoy & Heiken 2000a; 2000b; on sea-borne pumice, see Francaviglia 1990; Friedrich 2000, 80.

<sup>3</sup> On sea level changes, see Flemming & Webb 1986.

<sup>4</sup> Seager 1910.

<sup>5</sup> For the modern project, see Betancourt & Davaras 1995, 1998a, 1998b, 2001, 2002, 2003, 2004, 2006; Betancourt, Davaras & Hope Simpson 2005.

<sup>6</sup> Farrand & Stearns 2004.

<sup>7</sup> Rackham & Clark 2004.

<sup>8</sup> Clark 2004.

<sup>9</sup> Betancourt, Davaras & Hope Simpson 2005.

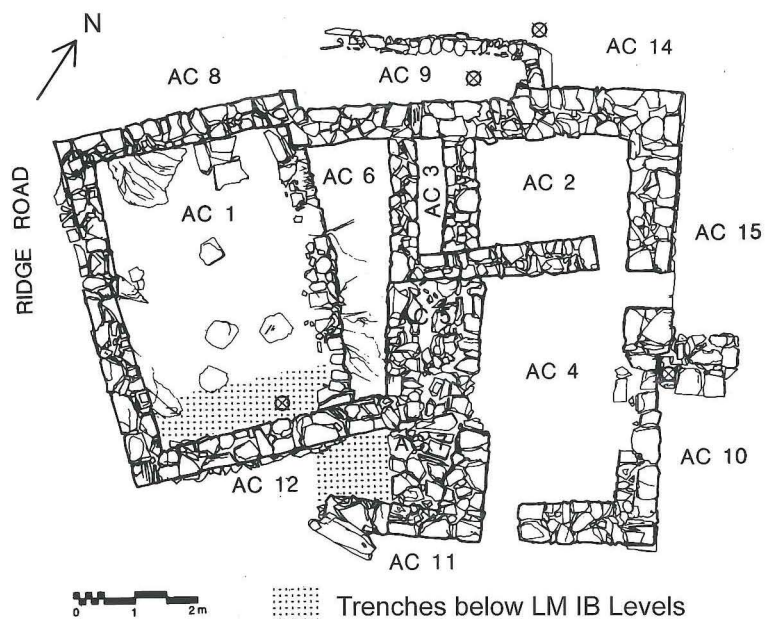


Fig. 1. Plan of Building AC (the Shrine), with the location of trenches excavated to discover the date of the final phase of the architecture. The entrance is offset at the south, facing west.

## Building AC: the Shrine

IB. The small structure has an offset doorway leading into the centre of the building from the south. From here, the visitor could either turn left to enter the room with the frescoes or go down a short staircase and then turn left and enter the most private space, a small back room with a bench at its western end. The bent-axis approach is typical of Minoan buildings with special functions.<sup>11</sup> At the end of this period the building was looted and then destroyed. Its rooms were empty when they were excavated in 1907.

Excavations were conducted by the modern excavations under the LM IB floor inside the largest room and under the street at the south of the structure, both of which were laid down when the building was constructed. These lower levels contained LM IA pottery along with pieces of water-worn pumice.<sup>12</sup> Analysis of the pumice by Charles and Dorothy Vitaliano<sup>13</sup> showed that it came from Thera, proving that the building was constructed after the volcanic eruption. Pumice from the eruption will have taken a few days to wash up on the Pseiran beaches,<sup>14</sup> and one must also allow enough time for it to be gathered for use as tools before being deposited along with pottery in a secondary deposit, so the construction must

post-date the eruption by an unknown amount of time, but not long enough for the pottery styles to change.

The pottery from the deposits under this building compares closely with the LM IA style from the excavations of Akrotiri on Thera. The two sherds shown in Fig. 2 came from the deposit in the street south of the structure, in the deposit of soil that was placed there to cover the levelling course for the south wall. Number AC 111 comes from a closed vessel, probably a bridge-spouted jug with a slightly elevated spout and a decorative band consisting of linked spirals on the upper shoulder. The spirals have large black centres with small white dots added around their edges, which is a motif that is used in East Cretan pottery during LM IA. A similar vessel comes from the destruction level at Akrotiri.<sup>15</sup> The vase from Thera is an import into the Cycladic island, probably from East Crete. It has added red

<sup>10</sup> Shaw 1998.

<sup>11</sup> For the bent-axis approach see Marinatos 1986, 73; Betancourt 2007, 81–2.

<sup>12</sup> Banou 1998.

<sup>13</sup> Vitaliano & Vitaliano 1998.

<sup>14</sup> Francaviglia 1990.

<sup>15</sup> Marinatos 1967–76, VI, pl. 78a, right.

paint used for accents, a typical feature of pottery found at Gournia in the Gulf of Mirabello,<sup>16</sup> and the spirals with large central dots are typical LM IA from this part of Crete.

The other sherd illustrated from this deposit, no. AC 112, is a fragment of a semiglobular cup decorated with linked spirals. The cup had a single handle and a slightly out-turned rim that created an S-shaped profile. Such cups are common in Crete during LM IA, and they also occur at Akrotiri.<sup>17</sup>

In addition to the LM IA pottery and the water-worn pumice found in these LM IA levels, analysis of the soil in the deposits revealed the presence of microscopic traces of Theran ash from the dust cloud released by the volcano.<sup>18</sup>

This building is one of the examples of the clear stratification that occurs in Crete, proving that the Theran eruption occurred near the end of LM IA,<sup>19</sup> and that after enough time had elapsed for water-worn pumice to wash up on the Cretan beaches and be carried up into the town as a material for tools, new architectural constructions were erected within the town of Pseira. The new buildings lasted long enough for stylistic change to occur in the pottery. In the local East Cretan ceramics, spirals during LM IB were made more quickly than in previous times, and the large carefully painted dots were left out of the centres.<sup>20</sup> New pottery was also imported into Pseira from other places. From Knossos, for example, a Special Palatial Tradition consisting of several new shapes along with new Marine Style, Floral Style, and Abstract and Geometric Style designs was developed in central Crete and sent to places like Pseira.<sup>21</sup> All of the examples found on Pseira are from LM IB levels, the next phase after the eruption.

Some of the most dramatic evidence for the eruption was excavated from Building AF South. This structure, at the very tip of the Pseiran peninsula, was built at some time after MM IIB, and it stood until near the end of LM IA. The house had an architectural arrangement called a pillar crypt, with a ground floor room whose ceiling was supported by a stout pillar and an upper story above this room with a wooden column over the pillar. When the southern part of the house collapsed near the end of LM IA, the column base fell into

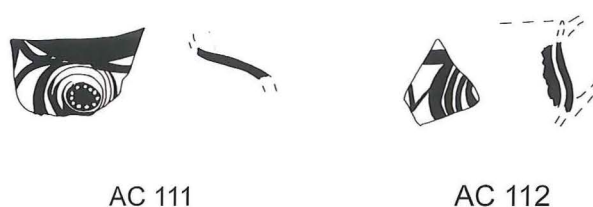


Fig. 2. LM IA sherds found in the deposit placed in the street to cover the leveling course for the south wall of Building AC (the Shrine) at Pseira.

the lower room along with the rest of the upper story. After this destruction, the exposed southern part of the site was left as an exterior terrace, but the builders placed a foundation deposit for their next building across the floor of the destroyed part of the building (Fig. 3). This foundation deposit consisted of lumps of Theran pumice, conical cups, and deep-water marine shells, all of them placed carefully on the stone slab floor before the area was filled in with soil.

Although it was once believed that tsunamis only travelled in straight lines, we now know that small islands can create a different effect. Tsunamis can move around islands from both sides, with the pair of waves meeting with magnified effects on the side away from the origin of the wave. This wrap-around effect was revealed by the devastation of the island of Babi in Indonesia when it was struck by the Flores tsunami in 1992,<sup>22</sup> and the principle behind the wrap-around effect has been demonstrated experimentally<sup>23</sup> as well as with computer modelling.<sup>24</sup> Only a small tsunami struck the north coast of Babi, which faced toward the origin of the wave, but the tsunami split and wrapped around the landmass, so that two waves

<sup>16</sup> Pseira imported most of its pottery from Gournia at this time; for the site, see Hawes *et al.* 1908.

<sup>17</sup> Marinatos 1967–76, VII, pl. 50, upper left.

<sup>18</sup> Vitaliano & Vitaliano 1998.

<sup>19</sup> For the effects of the LM IA pottery on the local LC IA Theran style, see Doulas 1983, 110–3.

<sup>20</sup> Betancourt 1985, 137–40.

<sup>21</sup> Betancourt 1985, 140–8; Müller 1997.

<sup>22</sup> Minoura *et al.* 1997.

<sup>23</sup> Briggs *et al.* 1995.

<sup>24</sup> Yeh *et al.* 2002; for other factors involved, see Imamura *et al.* 1995; Tinti & Vannini 1995.

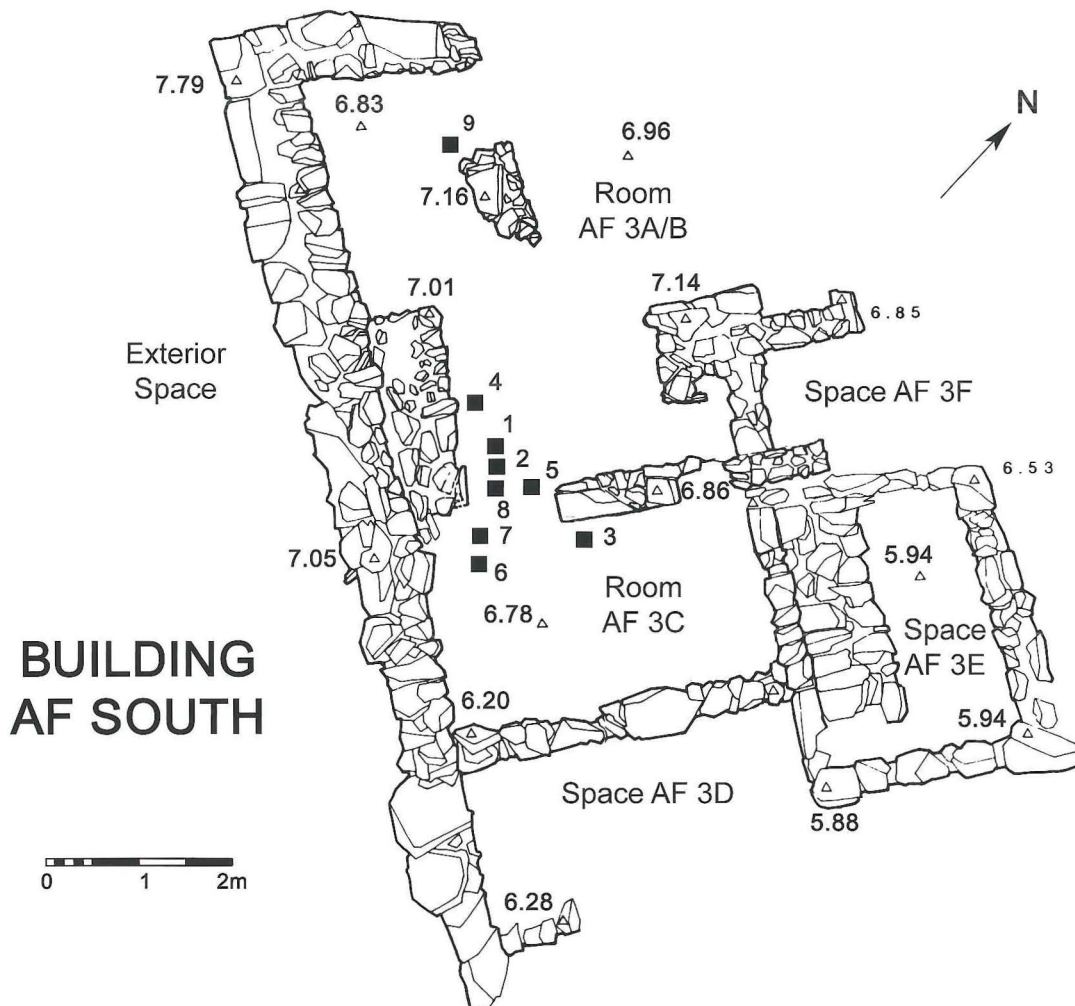


Fig. 3. Plan of the house at the tip of the Pseiran peninsula (Building AF South), showing the placement of large marine shells and a conical cup as a foundation deposit after the architecture was destroyed in LM IA and before the next building was constructed.

hit the south coast with magnified effects. Pseira, with a maximum width of 1.75 km, is smaller than Babi, which is 2 km across and whose size is made larger by a coastal reef. The Pseiran peninsula, projecting out into the sea on the side of Pseira way from Thera, may have received just such a tsunami effect. If this wrap-around effect caused the Theran tsunami to hit the peninsula, Building AF South would have received a devastating blow. Whether the destruction was from tsunami or earthquake, the residents clearly associated the event with beliefs that required Theran pumice and marine shells from deep under the sea as items to be included in their ritual associated with the foundation of the building's successor. They were

also a practical people, and the new building they built to replace AF South was constructed higher up on the peninsula, farther away from the sea.

One other piece of information helps us understand the reaction of the inhabitants of Pseira to the partial destructions near the end of LM IA. The Minoans who lived on Pseira were farmers, and their land was extensively terraced in order to create small, level, plots for agriculture. Two of these agricultural fields were excavated.<sup>25</sup> They revealed that Minoan artefacts, including sherds from broken clay vessels, were present deep within the soil. Analysis for organic residue demonstrated that the

<sup>25</sup> Hope Simpson 2005.

sherds and other debris had come in with manure and trash from the town, buried in the fields to act as fertilizer.<sup>26</sup> Microscopic traces of Thera ash from the windblown dust cloud were found within the upper part of agricultural terrace number G2, high up on the hill north of the town on Pseira Island.<sup>27</sup> This ash would have been deposited over the island from the cloud of volcanic dust that rose after the eruption and was blown to the south and east. Its presence as deep as *c.* 20 cm below ground level, within the soil, shows an additional reaction of the practical residents of this small island. They simply tilled the ash into the soil where it could

act as a good fertilizer, and they continued to grow their crops.

The town was rebuilt, and the LM IB period lasted for several decades before the town would be destroyed by warfare.

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<sup>26</sup> Bull, Betancourt & Evershed 1999.

<sup>27</sup> Goldberg 2005.

