SUPPLEMENTARY MATERIAL

Magma transfer at Campi Flegrei caldera (Italy) after the 1538 AD eruption

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Content

Table S1. Details on the reconstruction of the ground elevation at the selected sites. The uncertainty associated with the year has been defined on the basis of the uncertainty of the date of the sources. The resulting errors associated with the dates are (in years): 1515 ± 4 (Capaccio, 1607), 1536 ± 2 (Di Vito et al., 2016), 1538 ± 0.1 (Di Vito et al., 2016), 1540 ± 1 (Istituto Idrografico della Marina, 1987; Ricciardi, 2009), 1582 ± 5 (Cartaro, 1584), 1650 ± 10 (Ricciardi, 2009). Benchmarks refer to the current leveling system, whereas sites refer to the historical measurement sites shown in Fig. 1.

Bench mark	Site Name	Year	Method and related data	Refe-rences
58	Miseno harbour and Roman thermae	1515	Reconstruction of the ground elevation defined on the basis of the position and height on maps (sources) of the manmade structures along the coastline (pillars, harbour structures) and on bathymetric map. Definition of the position and height of a previously submerged and now emerging beach. Surface, subsurface geological and archaeological data.	[1] and Fig. S1
		1536	Reconstruction, using historical maps and chronicles, of the position and height of the following manmade Roman coastal features: roads, pillars, bridge, harbour structures.	[2] and references therein
		1538	Reconstruction of the vertical ground movements based on the variation in elevation of the marine and coastal sediments filling the Miseno Therma and the sea level (sl) in 1251. Evaluation using historical maps of the position of manmade coastal structures submerged until 1536.	[2] and references therein
		1540	Reconstruction of the ground elevation performed on the basis of the interpretation of the coastal features (bathymetry) and sources (coastline representation).	[3, 4] and Fig. S2
		1582	Reconstruction of the ground elevation performed on the basis of the interpretation of the coastal features on maps (bathymetry) and sources (coastline representation).	[3, 5, 6] and Fig. S3
		1650	Reconstruction of the ground elevation performed on the basis of the interpretation of the coastal features on maps (bathymetry). Data provided by [7, 8] used as constraints.	[7, 8, 9] and Fig. S4
49	Baia Castle	1515	Reconstruction of the ground elevation defined on the basis of the position and height on maps of the manmade structures along the coastline (pillars, harbour structures). Definition of the position and height of a previously submerged and now emerging beach. Surface and subsurface geological and archaeological data.	[1] and Fig. S1
		1536	Reconstruction, using historical maps and chronicles regarding the position of the following manmade Roman coastal features: roads; pillars; harbour structures, fishponds.	[2] and references therein
		1538	Reconstruction of vertical ground movements based on the variation in elevation of notches and the sl in 1251. Evaluation based on the position, defined on historical maps, of manmade coastal structures submerged until 1536.	[2] and references therein
		1540	Reconstruction of the ground elevation performed on the basis of the interpretation of the coastal features (bathymetry) and sources (coastline representation).	[3, 4] and Fig. S2
		1582	Reconstruction of the ground elevation based on the interpretation and evaluation of the coastal featured (bathymetry) and sources (coastline representation).	[3, 5, 6] and Fig. S3
		1650	Reconstruction of the ground elevation performed on the basis of the interpretation of the coastal features on maps (bathymetry). Data provided by [7, 8] used as constraints.	[7, 8, 9] and Fig. S4

44	Mercurio thermae	1515	Reconstruction of the ground elevation defined on the basis of the position and height on maps (sources) of the manmade structures along the coastline (pillars, harbour structures) and on bathymetric maps. Definition of the position and height of a previously submerged and now emerging beach. Surface, subsurface geological and archaeological data.	[1] and Fig. S1
		1536	Reconstruction, using historical maps and chronicles, of the position and height of the following manmade Roman coastal features: roads; pillars; harbour structures, fishponds.	[2] and references therein
		1538	Reconstruction of the vertical ground movements based on the variation in elevation of notches and the sl in 1251. Evaluation, using historical maps, of the position of manmade coastal structures submerged until 1536.	[2] and references therein
		1540	Reconstruction of the ground elevation performed on the basis of the interpretation of the coastal features (bathymetry) and sources (coastline representation).	[3, 4] and Fig. S2
		1582	Reconstruction of the ground elevation based on the interpretation of the coastal features (bathymetry) and sources (coastline representation).	[3, 5, 6] and Fig. S3
		1650	Reconstruction of the ground elevation performed on the basis of the interpretation of the coastal features on maps (bathymetry). Data provided by [7, 8] used as constraints.	[7, 8, 9] and Fig. S4
43A	Baia	1515	Reconstruction of the ground elevation defined on the basis of the position and height on maps (sources) of the manmade structures along the coastline and on the bathymetric map. Definition of the position and height of a previously submerged and now emerging beach. Surface, subsurface geological and archaeological data.	[1] and Fig. S1
		1536	Reconstruction, using historical maps and chronicles, of the position of the following manmade Roman coastal features: roads, pillars, harbour structures, and fishponds.	[2] and references therein
		1538	Reconstruction of vertical ground movements based on the variation in elevation between 1536 and 1538, using historical maps and chronicles reporting and describing the relative position of manmade coastal structures.	[2] and references therein
		1540	Reconstruction of the ground elevation performed on the basis of the interpretation of the coastal features (bathymetry) and sources (coastline representation).	[3, 4] and Fig. S2
		1582	Reconstruction of the ground elevation performed on the basis of the interpretation of the coastal features on maps (bathymetry) and sources (coastline representation).	[3, 5, 6] and Fig. S3
		1650	Reconstruction of the ground elevation performed on the basis of the interpretation of the coastal features on maps (bathymetry). Data provided by [7, 8] used as constraints.	[7, 8, 9] and Fig. S4
42	Punta Epitaffio	1515	Reconstruction of the ground elevation defined on the basis of the position and height on maps (sources) of the manmade structures along the coastline (pillars, harbour structures) and on bathymetric map. Definition of the position and height of a previously submerged and now emerging beach. Surface, subsurface geological and archaeological data.	[1] and Fig. S1
		1536	Reconstruction, using historical maps and chronicles, of the position of the following manmade Roman coastal features: roads, pillars, harbour structures, fishponds.	[2] and references therein
		1538	Reconstruction of the vertical ground movements based on the variation in elevation of notches and the sl in 1251. Evaluation using historical maps and chronicles of the eruption of the position of manmade coastal structures, submerged until 1536.	[2] and references therein

		1540	Reconstruction of the ground elevation performed on the basis of the interpretation of coastal features (bathymetry) and sources (coastline representation).	[3, 4] and Fig. S2
		1582	Reconstruction of the ground elevation performed on the basis of the interpretation of the coastal features on maps (bathymetry) and sources (coastline representation.	[3, 5, 6] and Fig. S3
		1650	Reconstruction of the ground elevation performed on the basis of the interpretation of the coastal features on maps (bathymetry). Data provided by [7, 8] used as constraints.	[7, 8, 9] and Fig. S4
Ninfeo	Ninfeo	1515	Reconstruction of the ground elevation defined on the basis of the position and height on maps of the manmade structures along the coastline (pillars, harbour structures. Definition of the position and height of a previously submerged and now emerging beach. Surface and subsurface geological and archaeological data.	[1] and Fig. S1
		1536	Reconstruction, using historical maps and chronicles, of the position of the Roman coastal roads that were described as being at sl.	[2] and references therein
		1538	Reconstruction of vertical ground movements based on historical maps and chronicles describing the marine area around Ninfeo.	[2] and references therein
		1540	No data	
		1582	No data	
		1650	No data	
41	Lucrino	1515	Reconstruction of the ground elevation defined on the basis of the position and height on maps (sources) of the manmade structures along the coastline and on the bathymetric map. Definition of the position and height of a previously submerged and now emerging beach. Surface, subsurface geological and archaeological data.	[1] and Fig. S1
		1536	Reconstruction, using historical maps and chronicles, of the position of the Portus Julius pillars.	[2] and references therein
		1538	Reconstruction of the vertical ground movements based on historical maps and chronicles of the eruption defining the position of manmade coastal structures submerged until 1536.	[2] and references therein
		1540	Reconstruction of the ground elevation performed on the basis of the interpretation of the coastal features (bathymetry) and sources (coastline representation).	[3, 4] and Fig. S2
		1582	Reconstruction of the ground elevation performed on the basis of the interpretation of the coastal features (bathymetry) and sources (coastline representation).	[3, 5, 6] and Fig. S3
		1650	Reconstruction of the ground elevation performed on the basis of the interpretation of the coastal features on maps (bathymetry). Data provided by [7, 8] used as constraints.	[7, 8, 9] and Fig. S4
39	Lucrino 1	1515	Reconstruction of the ground elevation defined on the basis of the position and height on maps (sources) of the manmade structures along the coastline and on the bathymetric map. Definition of the position and height of a previously submerged and now emerging beach. Surface, subsurface geological and archaeological data.	[1] and Fig. S1

		1536	Reconstruction of the coastline using historical maps and chronicles defining the position with respect to the coastline of Roman roads, pillars and harbour structures.	[2] and references therein
		1538	Reconstruction of vertical ground movements based on historical maps and chronicles of the eruption defining the position of manmade coastal structures and morphological coastline features. Reconstruction also based on the variation in elevation of the shallow-sea sediments.	[2] and references therein
		1540	Reconstruction of the ground elevation performed on the basis of the interpretation of the coastal features (bathymetry) and sources.	[3, 4] and Fig. S2
		1582	Reconstruction of the ground elevation performed on the basis of the interpretation of the coastal features on maps (bathymetry) and sources.	[3, 5, 6] and Fig. S3
		1650	Reconstruction of the ground elevation performed on the basis of the interpretation of the coastal features on maps (bathymetry). Data provided by [7, 8] used as constraints.	[7, 8] and Fig. S4
37	Portus Julius	1515	Reconstruction of the ground elevation defined on the basis of the position and height on maps (sources) of the manmade structures along the coastline (roads, pillars, harbour structures) and on bathymetric map. Definition of the position and height of a previously submerged and now emerging beach. Surface, subsurface geological and archaeological data.	[1] and Fig. S1
		1536	Reconstruction of the coastline using historical maps and chronicles defining the position of the Roman road, pillars and harbour structures.	[2] and references therein
		1538	Reconstruction of vertical ground movements based on historical maps and chronicles of the eruption that define the position of manmade coastal structures and of the morphological coastline features. Reconstruction also based on the variation in elevation of the shallow-sea sediments.	[2] and references therein
		1540	Reconstruction of the ground elevation performed on the basis of the interpretation of coastal features (bathymetry) and sources (coastline representation).	[3, 4] and Fig. S2
		1582	Reconstruction of the ground elevation performed on the basis of the interpretation of the coastal features on maps (bathymetry) and sources (coastline representation).	[3, 5, 6] and Fig. S3
		1650	Reconstruction of the ground elevation performed on the basis of the interpretation of the coastal features on maps (bathymetry). Data provided by [7, 8] used as constraints.	[7, 8] and Fig. S4
124	Apollo temple	1515	Reconstruction of the ground elevation defined on the basis of archaeological/stratigraphical data within and around the monument, and with the definition of the position and height of a previously submerged emerging beach filling the temple.	[1, 2] and Fig. S1
		1536	The sl position was inferred using the benchmarks 39A and 37 and using the historical maps of the Lucrino coastline.	[2] and references therein
		1538	Reconstruction of the vertical ground movements using a detailed historical map.	[2] and references therein
		1540	No data	
		1582	No data	
		1650	No data	

35A	Ripa Puteolana	1515	Reconstruction of the ground elevation defined on the basis of the position and height on maps of the manmade structures along the coastline (pillars, harbour structures. Definition of the position and height of a previously submerged and now emerging beach. Surface and subsurface geological and archaeological data.	[1] and Fig. S1
		1536	Reconstruction of the coastline using historical maps and chronicles defining the position of Roman roads, pillars and harbour structures.	[2] and references therein
		1538	Reconstruction of the vertical ground movements based on historical maps and chronicles of the eruption that define the position of manmade coastal structures and of the morphological coastline features. Reconstruction also based on the variation in elevation of shallow-sea sediments.	[2] and references therein
		1540	Reconstruction of the ground elevation performed on the basis of the interpretation of coastal features (bathymetry) and sources (coastline representation).	[3] and Fig. S2
		1582	Reconstruction of the ground elevation performed on the basis of the interpretation and evaluation of the coastal features (bathymetry) and sources (coastline representation).	[3, 5, 6] and Fig. S3
		1650	Reconstruction of the ground elevation performed on the basis of the interpretation of the coastal features on maps (bathymetry). Data provided by [7, 8] used as constraints.	[7, 8, 9] and Fig. S4
30	Serapeo	1515	Reconstruction of the ground elevation defined on the basis of the position and height on maps (sources) of the manmade structures along the coastline and on the bathymetric map. Definition of the position and height of a previously submerged and now emerging beach. Surface, subsurface geological and archaeological data.	Fig. S1
		1536	Definition of the position of manmade Roman coastal structures and reconstruction of their vertical movements using the position of Roman roads, pillars, buildings and harbour structures. The reconstruction was based on historical maps and descriptions, urban expansion of the town, emergence of thermal baths and Royal edicts.	[2] and references therein
		1538	Reconstruction of the vertical ground movements based on historical maps and chronicles that define the position of manmade coastal structures and of the coastline features. Reconstruction also based on the variation in elevation of the lithodome holes.	[2] and references therein
		1540	Reconstruction of the ground elevation performed on the basis of the interpretation of the coastal features (bathymetry) and sources (coastline representation).	[3, 4] and Fig. S2
		1582	Reconstruction of the ground elevation performed on the basis of the interpretation of the coastal features (bathymetry) and sources (coastline representation).	[2, 3, 4] and Fig. S3
		1650	Reconstruction of the ground elevation performed on the basis of the interpretation of the coastal features on maps (bathymetry). Data provided by [7, 8] used as constraints.	[3, 5, 6] and Fig. S4
FPOZ	Molo Caligolia-no 15th Pillar	1515	Reconstruction of the ground elevation defined on the basis of the position and height on maps (fonts) of the manmade structures along the coastline and on the bathymetric map. Definition of the position and height of a previously submerged and now emerging beach. Surface, subsurface geological and archaeological data.	[1] and Fig. S1
		1536	Definition of the coastline on the basis of the position of pillars, buildings and harbour structures. The reconstruction was based on historical maps and descriptions, urban expansion of the town and Royal edicts.	[2] and references therein

		1538	Reconstruction of the coastline based on historical maps reporting the manmade coastal and harbour structures.	[2] and references therein
		1540	Reconstruction of the ground elevation performed on the basis of the interpretation of the coastal features (bathymetry) and sources (coastline representation).	[3, 4] and Fig. S2
		1582	Reconstruction of the ground elevation performed on the basis of the interpretation of the coastal features on maps (bathymetry) and sources.	[3, 5, 6] and Fig. S3
		1650	Reconstruction of the ground elevation performed on the basis of the interpretation of the coastal features on maps (bathymetry). Data provided by [7, 8] used as constraints.	[7, 8, 9] and Fig. S4
X Pila	Molo Caligolia-no 10th Pillar	1515	Reconstruction of the ground elevation defined on the basis of the position and height on maps (fonts) of the manmade structures along the coastline (roads, pillars, harbour structures) and on bathymetric map. Definition of the position and height of a previously submerged and now emerging beach. Surface, subsurface geological and archaeological data.	Fig. S1 [1]
		1536	Definition of the coastline on the basis of the position of pillars, buildings and harbour structures. The reconstruction was based on historical maps and descriptions, urban expansion of the town and Royal edicts.	[2] and references therein
		1538	Reconstruction of the coastline based on historical maps that adequately show the manmade coastal and harbour structures.	[3] and references therein
		1540	Reconstruction of the ground elevation performed on the basis of the interpretation of coastal features on maps (bathymetry) and sources.	[3, 4] and Fig. S2
		1582	Reconstruction of the ground elevation performed on the basis of the interpretation of the coastal features on maps (bathymetry) and sources.	[3, 5, 6] and Fig. S3
		1650	Reconstruction of the ground elevation performed on the basis of the interpretation of the coastal features on maps (bathymetry). Data provided by [7, 8] used as constraints.	[7, 8, 9] and Fig. S4
28	St. Maria delle Grazie	1515	Reconstruction of the ground elevation defined on the basis of the position and height on maps of the manmade structures along the coastline (pillars, harbour structures). Definition of the position and height of a previously submerged and now emerging beach. Surface and subsurface geological and archaeological data.	Fig. S1 [1]
		1536	Definition of the coastline on the basis of the construction of churches in previously submerged areas (St. Maria delle Grazie and Benedictine Monastery).	[2] and references therein, [10]
		1538	Reconstruction of the coastline based on historical maps that show the manmade coastal and harbour structures.	[2] and references therein
		1540	Reconstruction of the ground elevation performed on the basis of the interpretation of coastal features on maps (bathymetry) and sources (coastline representation).	[3, 4] and Fig. S2
		1582	Reconstruction of the ground elevation performed on the basis of the interpretation of coastal features on maps (bathymetry) and sources (coastline representation).	[3, 5, 6] and Fig. S3
		1650	Reconstruction of the elevation through time performed on the basis of the positioning of the floor of the Paleo-Church compared to the elevation of	[7, 8] and Fig. s S4

			the floor of the present Church.	and S5
25A	Corso Umberto	1515	Reconstruction of the ground elevation defined on the basis of the position and height on maps (sources) of the manmade structures along the coastline and on bathymetric map. Definition of the position and height of a previously submerged emerging beach. Surface, subsurface geological and archaeological data.	[1] and Fig. S1
		1536	Definition of the position of manmade Roman coastal structures and reconstruction of their vertical movements using historical maps and descriptions, urban expansion of the town and Royal edicts.	[2] and references therein
		1538	Reconstruction of the coastline and of the vertical movements using historical maps, position and emersion of fishponds and other manmade coastal remains.	[2] and references therein
		1540	Reconstruction of the ground elevation performed on the basis of the interpretation of the coastal features on maps (bathymetry) and sources (coastline representation).	[3] and Fig. S2
		1582	Reconstruction of the ground elevation based on the interpretation of the coastal features on maps (bathymetry) and sources.	[3, 5, 6] and Fig. S3
		1650	Reconstruction of the ground elevation performed on the basis of the interpretation of the coastal features on maps (bathymetry). Data provided by [7, 8] used as constraints.	[7, 8, 9] and Fig. S4
22	Via Napoli	1515	Reconstruction of the ground elevation defined on the basis of the position and height on maps (fonts) of the manmade structures along the coastline and on the bathymetric map. Definition of the position and height of a previously submerged and now emerging beach. Surface, subsurface geological and archaeological data.	[1] and Fig. S1
		1536	Reconstruction of the coastline and definition of vertical movements using historical maps and descriptions, urban expansion of the town and Royal edicts.	[2] and references therein
		1538	Reconstruction of the coastline and of the vertical movements on the basis of historical maps, position and emersion of fishponds and other coastal remains.	[2] and references therein
		1540	Reconstruction of the ground elevation performed on the basis of the interpretation of the coastal features on maps (bathymetry) and sources (coastline representation).	[3] and Fig. S2
		1582	Reconstruction of the ground elevation performed on the basis of the interpretation of the coastal features on maps (bathymetry) and sources (coastline representation).	[3, 5, 6] and Fig. S3
		1650	Reconstruction of the ground elevation performed on the basis of the interpretation of the coastal features on maps (bathymetry). Data provided by [7, 8] used as constraints.	[7, 8, 9] and Fig. S4
17A	La Pietra	1515	Reconstruction of the ground elevation defined on the basis of the position and height on maps (sources) of the manmade structures along the coastline (roads, pillars, harbour structures) and on the bathymetric map. Definition of the position and height of a previously submerged and now emerging beach. Surface, subsurface geological and archaeological data.	[1] and Fig. S1
		1536	The vertical displacement was estimated as a fraction of the maximum deformation recorded in 1538.	[2] and references therein

		1538	Reconstruction of the coastline and of the vertical movements using historical maps, position and emersion of fishponds and other coastal remains.	[2] and references therein
		1540	Reconstruction of the ground elevation performed on the basis of the interpretation of coastal features on maps (bathymetry) and sources (coastline representation).	[3, 4] and Fig. S2
		1582	Reconstruction of the ground elevation performed on the basis of the interpretation of coastal features on maps (bathymetry) and sources (coastline representation).	[3, 5, 6] and Fig. S3
		1650	Reconstruction of the ground elevation performed on the basis of the interpretation of the coastal features on maps (bathymetry). Data provided by [7, 8] used as constraints.	[7, 8, 9] and Fig. S4
14	Bagnoli	1515	Reconstruction of the ground elevation defined on the basis of the position and height on maps (fonts) of coastal features and on bathymetric maps. Definition of the position and height of a previously submerged and now emerging beach. Surface, subsurface geological and archaeological data.	[1] and Fig. S1
		1536	The vertical displacement was estimated as a fraction of the maximum deformation recorded in 1538.	[2] and references therein
		1538	Reconstruction of the coastline and of the vertical movements on the basis of a historical map.	[2] and references therein
		1540	Reconstruction of the ground elevation performed on the basis of the interpretation of coastal features on maps (bathymetry) and sources (coastline representation).	[3, 4] and Fig. S2
		1582	Reconstruction of the ground elevation performed on the basis of the interpretation of the coastal features on maps (bathymetry) and sources (coastline representation).	[3, 5, 6] and Fig. S3
		1650	Reconstruction of the ground elevation performed on the basis of the interpretation of the coastal features on maps (bathymetry). Data provided by [7, 8] used as constraints.	[7, 8, 9] and Fig. S4
194	Molo di Nisida pillar	1515	Reconstruction of the elevation performed on the basis of the evaluation and interpretation of the bathymetry along the Ripa Puteolana. Definition of the position and height of an emerging beach that was previously submerged. Surface and archaeological data.	[1] and Fig. S1
		1536	The vertical displacement was estimated as a fraction of the maximum deformation recorded in 1538.	[2] and references therein
		1538	Reconstruction of the coastline and of the vertical movements on the basis of historical maps.	[2] and references therein
		1540	Reconstruction of the ground elevation performed on the basis of the interpretation of coastal features on maps (bathymetry) and sources (coastline representation).	[3] and Fig. S2
		1582	Reconstruction of the ground elevation performed on the basis of the interpretation of coastal features on maps (bathymetry) and sources (coastline representation).	[3, 5, 6] and Fig. S3
		1650	Reconstruction of the ground elevation performed on the basis of the interpretation of the coastal features on maps (bathymetry). Data provided by [7, 8] used as constraints.	[7, 8, 9] and Fig. S4

Table S2. Elevations at all measurement sites in different years. Benchmarks nomenclature according to Di Vito et al. (2016). X and Y are the East and North geographical coordinates in UTM zone 33, WGS84. Columns with "d" are the elevations, columns with "e" are the associated errors. ND = NoData.

Benchmark	Site Name	X (m)	Y (m)	1515 d(m)	1515 e(m)	1536 d(m)	1536 e(m)	1538 (dm)	1538 e(m)	1540 d(m)	1540 e(m)	1582 d(m)	1582 e(m)	1650 d(m)	1650 e(m)
14	Bagnoli	429831	4518474	5.6	0.5	6.2	0.5	6.5	0.5	5.8	0.5	6.5	0.5	6.5	0.5
17A	La Pietra	428822	4518927	5.0	0.8	5.8	0.8	6.2	0.5	5.5	0.6	6.2	0.6	6.3	0.6
22	Via Napoli	427231	4518951	14.4	0.8	15.6	0.8	16.9	0.8	13.5	0.6	14.5	0.6	12.9	0.6
25A	Corso Umberto	426301	4519308	9.5	0.5	10.9	0.8	13.1	1.0	6.8	0.6	7.8	0.6	6.4	0.6
28	St. Maria Grazie	425698	4519496	7.9	0.5	9.3	0.8	11.9	1.0	5.4	0.6	6.7	0.6	5.1	0.6
FPOZ	Molo	425261	4519320	7.6	0.5	9.0	0.8	12.1	1.0	5.3	0.6	6.3	0.6	4.4	0.6
X_Pila	Molo	425389	4519342	2.9	0.5	4.3	0.8	7.3	1.0	0.7	0.6	1.6	0.6	-1.2	0.6
30	Serapeo	425803	4519803	8.5	0.8	9.7	0.8	12.1	0.8	7.3	0.6	8.6	0.6	6.9	0.6
35A	Ripa Puteolana	424241	4520607	5.4	0.3	6.2	0.5	14.2	0.5	8.2	0.6	9.3	0.6	7.6	0.6
37	Portus Julius	423627	4520568	7.3	0.5	8.0	0.5	26.8	2.0	20.8	2.0	21.9	2.0	19.9	1.5
39	Lucrino 1	422758	4520259	-2.1	0.5	-1.5	0.8	11.7	1.5	5.2	1.0	6.7	0.6	4.5	0.6
41	Lucrino	422153	4519831	9.4	0.5	10.0	0.5	15.0	0.5	11.5	0.8	12.3	0.6	10.1	0.6
42	Punta Epitaffio	422108	4519491	22.1	0.5	22.7	0.8	24.5	0.8	23.5	0.8	24.0	0.6	22.9	0.6
43A	Baia	421725	4519312	8.4	0.5	8.9	0.5	10.1	0.6	9.8	0.6	10.2	0.6	9.8	0.6
44	Mercurio	421682	4519025	2.5	0.5	3.1	0.5	4.2	0.5	3.9	0.6	4.3	0.6	4.2	0.6
49	Baia Castle	422265	4518084	48.8	0.5	49.5	0.5	51.3	0.5	49.3	0.6	49.6	0.6	48.5	0.6
58	Miseno	422865	4515494	2.8	0.5	3.4	0.8	4.4	0.8	4.1	0.6	4.2	0.6	4.3	0.6
194	Molo Nisida	429732	4516510	1.7	0.5	2.2	0.5	2.3	0.5	1.9	0.5	2.3	0.4	2.3	0.4
124	Apollo temple	423054	4521512	23.6	0.8	24.0	0.8	35.6	1.5	ND	ND	ND	ND	ND	ND
Ninfeo	Ninfeo	422185	4519426	-7.2	0.5	-6.6	0.5	-2.5	0.5	ND	ND	ND	ND	ND	ND

Table S3. Results from the VSM inversions. X and Y are the East and North geographical coordinates in UTM zone 33, WGS84; r is the radius, $\Delta P/\mu$ is the ratio between overpressure and shear modulus; ΔV is the volume variation; TLC is the Top Left Corner; L and W are the length and width, respectively; Δu is the opening/closure. Poisson coefficient equal to 0.25, shear modulus (μ) equal to 5 GPa. [1] Fixed parameter. [2]Calculated parameter.

UPLIFT	**1515-1536**					
1515	**sill**					
1536	X (m)	Y (m)	depth (m)	r (m)	$\Delta P/\mu$	ΔV (km^3)[2]
data	425750	4517900	5100	1750	0.009	0.099
error	250	250	250	100	0.001	0.028

UPLIFT	**1536-1538**					
1536	**sill**					
1538	X (m)[1]	Y (m)[1]	depth (m)	r (m)	$\Delta P/\mu$	ΔV (km^3)[2]
data	425750	4517900	3100	1150	0.020	0.061
error	-	-	250	100	0.004	0.028
	Mogi					
	X (m)	Y (m)	depth (m)			ΔV (km^3)
data	423200	4520750	950			0.090
error	200	200	100			0.02

SUBSIDENCE	**1538-1540**					
1538	**sill**					
1540	X (m)[1]	Y (m)[1]	depth (m)	r (m)	$\Delta P/\mu$	ΔV (km^3)[2]
data	425750	4517900	3050	1050	-0.113	-0.262
error	-	-	250	100	0.002	0.079
	Mogi					
	X (m)[1]	Y (m)[1]	depth (m)			ΔV (km^3)
data	423200	4520750	1250			-0.062
error	-	-	100			0.002
	deep layer					
	TLC-X (m)[1]	TLC-Y (m)[1]	depth (m)[1]	L (m)[1] x W (m)[1]	Δu (m)	ΔV (km^3)[2]
data	421000	4524000	8000	10000 x 10000	2.66	0.27
error	-	-	-	-	0.5	0.05

UPLIFT	**1540-1582**					
1540	**sill**					
1582	X (m)[1]	Y (m)[1]	depth (m)	r (m)	$\Delta P/\mu$	ΔV (km^3)[2]
data	425750	4517900	3500	1150	0.010	0.030
error	-	-	400	100	0.002	0.014
	Mogi					
	X (m)[1]	Y (m)[1]	depth (m)			ΔV (km^3)

data	423200	4520750	950			0.006
error	-	-	100			7.00E-04
	deep layer					
	TLC-X (m) [1]	TLC-Y (m) [1]	depth (m) [1]	L (m) [1] x W (m) [1]	Δu (m)	ΔV (km^3) [2]
data	421000	4524000	8000	10000 x 10000	0.9	0.09
error	-	-	-	-	0.2	0.02

SUBSIDENCE	**1582-1650**					
1582	**sill**					
1650	X (m) [1]	Y (m) [1]	depth (m)	r (m)	ΔP/μ	ΔV (km^3)[2]
data	425750	4517900	2900	1200	-0.018	-0.062
error	-	-	250	100	0.004	0.029
	Mogi					
	X (m)	Y (m)	depth (m)			ΔV (km^3)
data	423200	4520750	2100			-0.049
error	-	-	100			0.005
	deep layer					
	TLC-X (m) [1]	TLC-Y (m) [1]	depth (m) [1]	L (m) [1] x W (m) [1]	Δu (m)	ΔV (km^3) [2]
data	421000	4524000	8000	10000 x 10000	1.1	0.11
error	-	-	-	-	0.2	0.02

Representative example of reconstruction of elevation: the St. Maria delle Grazie Church

Here we provide a representative example of the methods used to reconstruct the ground level variations, considering the case of the St. Maria delle Grazie Church through time. Further details are also included in Di Vito et al. (2016) and related supplementary material. The reconstruction is subdivided in periods. The reconstruction of the relative sea level through time is reported in Fig. S6.

Before 1515

For this site we have used the information of the X pillars of the Caligoliano pier (see Di Vito et al. 2016).

1515

The coastal area surrounding Rione Terra, already emerged in 1500, emerged further and was enlarged so much to allow the construction of the two churches of St. Maria delle Grazie and the Benedettini convent. The date and the reconstruction of the coastline are discussed in Giamminelli (1996). The image reported in Fig. S1 was realized at the beginning of the 16th century and published by Capaccio in 1607. It permits to recognize many evident coastal features, such as (1) Punta Caruso, (2) the Caligoliano pier (Molo), (3) the Rione Terra, which allow the presumed coastline to be drawn on the map and to use this representation to define the sea level at the beginning of the 16th century. On some of these structures, such as the piers, today there are benchmarks of the altimetric network. Based on the reconstructed data, the Molo Caligoliano emerged almost completely from the sea, including the arches in front of Punta Caruso, which is presently delimited by the bathymetric contour of -5 m (base of the piers). The almost complete emersion of the pier permits to estimate that the sea level around the Rione Terra at the beginning of the 16th century must have been very close to the current bathymetric of – 5.0 ± 0.5 m. This agrees with the position of the St. Maria delle Grazie Church and is the starting point of our reconstruction of the deformation history of this site.

1536

The top of the coastal structures between Baia and Miseno (pillars and coastal roads) was at sea-level in 1536, as well described by Alberti (1550), whereas the structures near Pozzuoli had already emerged, as testified in the 1515. The Author well describes the road between Baia and the Miseno harbour (*mare Morto auct.*) that continued upon the breakwater pillars of the Miseno military harbour. These pillars, although visible, were still underwater in 1536. In fact, in his description of the landscape in 1536, says:

"*... le acque marine hanno poi ogni cosa quivi sommerso insieme con la via Silicata di Selci (come insino ad hora essendo il mare chiaro in più luoghi si vede) la quale è rimasta sotto l'acque coperta ... seguitando più oltre, lungo il lito verso Baie, appaiono parte de sontuosi edifici sopra l'alte rupi, le quali scendono giù al lito, edificati sopra gli alti, et grossi Piloni, che ora sono nell'acque marine. ... Erano posti detti piloni con gli edifici sopra la strada, per la quale si caminava a Baie dalle habitationi poste circa il mare Morto, ma ora vedonsi i fondamenti et etiandio parte di dette fabriche co i piloni nel mare, con la bella strada di selci silicata, come dissi*".

"... then marine water submerged everything, along with the Silicata di Selci road (as till now it is possible to see, thanks to the clarity of the water), which remained covered by the sea… carrying on down, along the coast toward Baia, the remnant of sumptuous buildings appear along the slopes that shelve to the sea, just on top of the big Pillars, which presently stay into the water. …These pillars and buildings were placed above the road from the Mare Morto houses to Baia, but now their foundations and part of them, with the pillars, stay into the sea, as well as the nice paving-stone road, as I mentioned before".

1538

The uplift of the entire area is deeply discussed in Di Vito et al. (2016). Furthermore, using the print by De Hollanda reported in Fig. S2, it is possible to recognize and pinpoint the following features which permitted to evaluate the elevation in 1538. The features used are: (1) the Monte Nuovo cone, still degassing, (2) Portus Julius pillars in the Punta Caruso offshore, (3) Pozzuoli fishponds, and other coastal remains still submerged in Fig. S1.

1540

Evidence of subsidence of the coastal area. The reconstruction of the 1540 ground elevations was carried out by interpretation and reconstruction of the bathymetry along the Ripa Puteolana. The hypothetical coastline was reconstructed considering an engraving dated between 1538 and 1542 by "Maestro del Trabocchetto" (Fig. S3). For the reconstruction, the ground elevation was evaluated on the basis of the current bathymetry at -5 m, in correspondence with various reference points. The current bathymetry of 5 m is the one that brings out the various inlets (see the red arrow) along the Ripa. These correspond to the archaeological coastal Roman remains positioned between from 2 to 4 m below sea level.

1582

Map of Campi Flegrei coastal area in 1582 (Ager Puteolanus, Fig. S4) after the Monte Nuovo eruption, showing the emerged Roman remains. The position of the emerged features was used to estimate a new uplift of the area. In particular, the image evidences: (1) breakwater pillars of the Miseno military harbour with the bridge, (2) the Monte Nuovo cone, (3) and (4) Baia and Pozzuoli fishponds, and other coastal remains, (5) Portus Julius pillars in the Punta Caruso offshore. All these features were partially submerged in the 1540 image in Fig. S3.

1650

After this date all the sources and images are in agreement with a progressive, general subsidence of the area until the 20th century. Fig. S5 does not show coastal structures emerging from the sea. The reconstruction of the church above the previous one, at a higher elevation in 1860, the stairs of the new church invaded by the sea and the new ground level after the backfilling of the entire area in 1913 testify the general subsidence (Fig. S5).

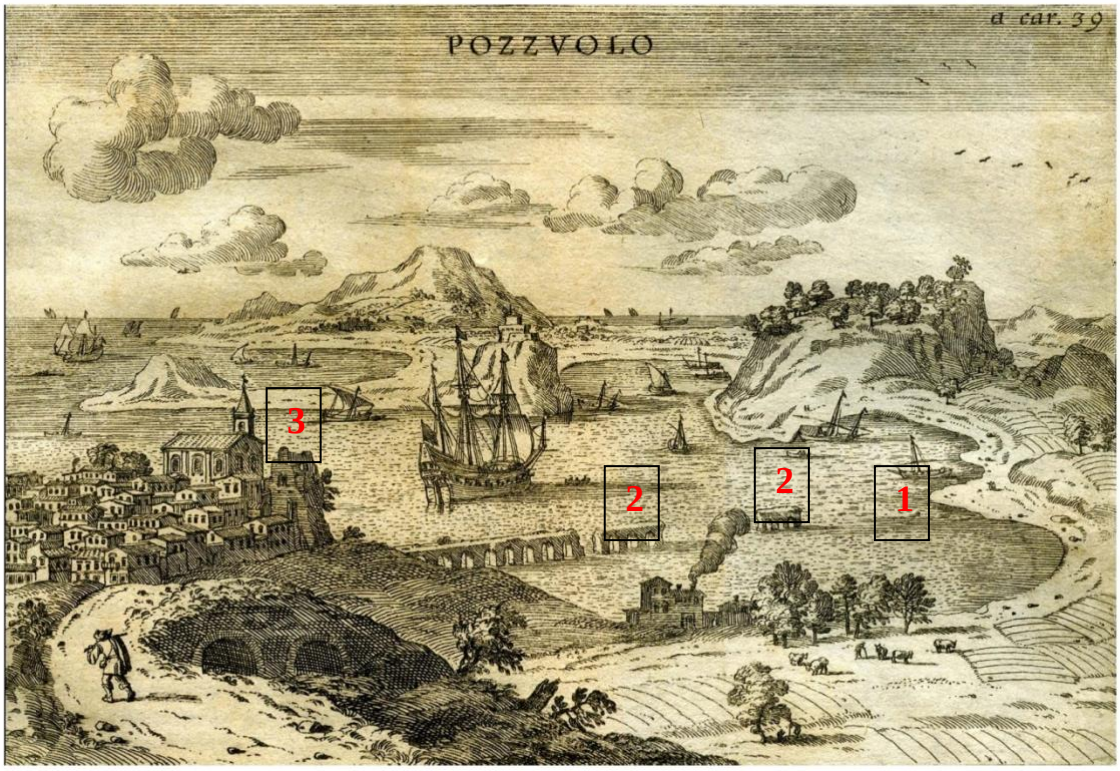

Figure S1. Unknown, engraving dated around the beginning of the 1500s (before the eruption of Monte Nuovo) and published by "Capaccio" in 1607. The analysis of the image allows to recognize many evident coastal elements, such as (1) Punta Caruso, (2) the Caligoliano pier, (3) the Rione Terra, which allow the presumed coastline to be drawn on the map and to use the representation to define the sea level at the beginning of the 16th century.

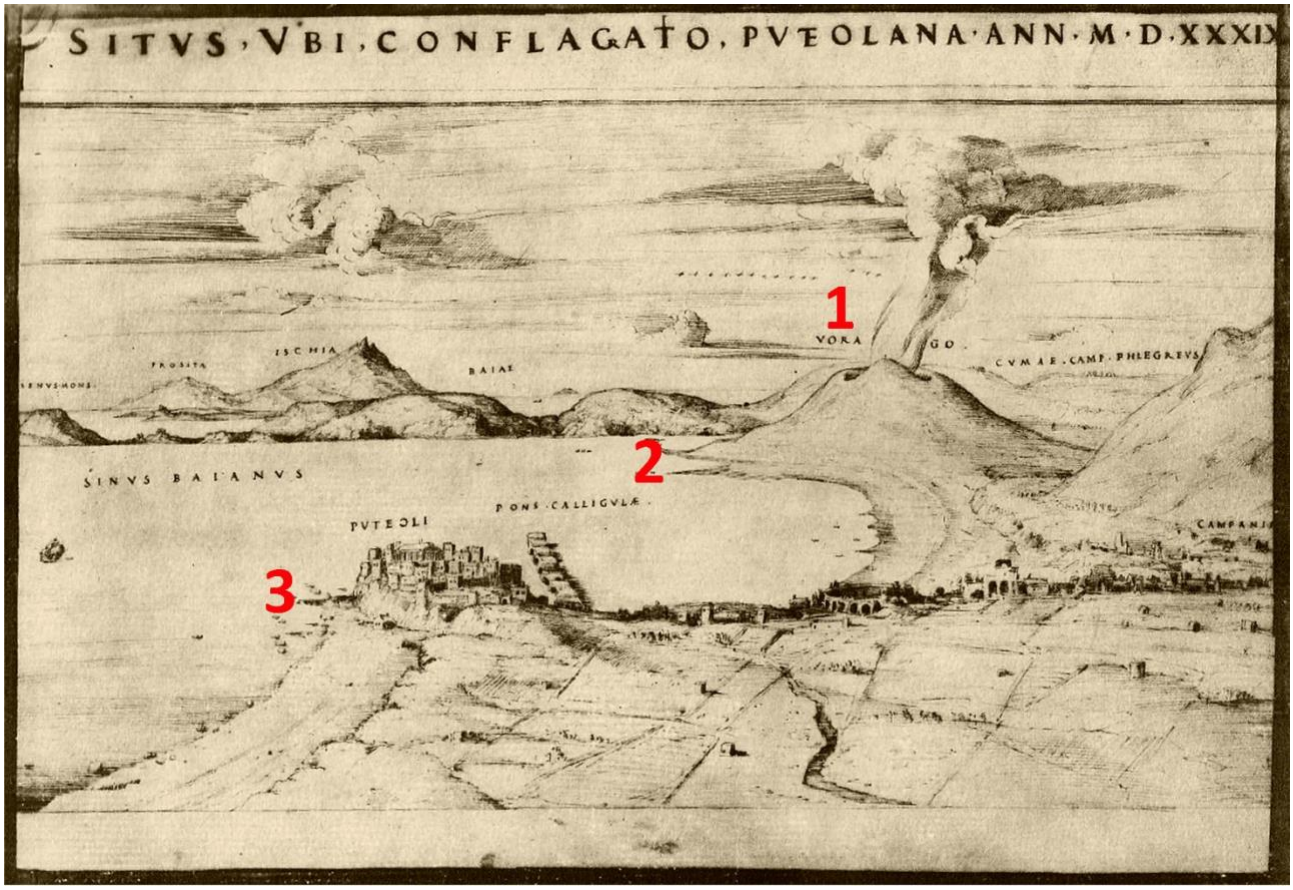

Figure S2. De Hollanda (1539). Campi Flegrei coastal area (Ager Puteolanus) soon after the Monte Nuovo eruption, showing the emerged Roman remains, which allowed estimation of the local pre-eruptive uplift: (1) the Monte Nuovo cone, (2) Portus Julius pillars in the Punta Caruso offshore, (3) Pozzuoli fishponds.

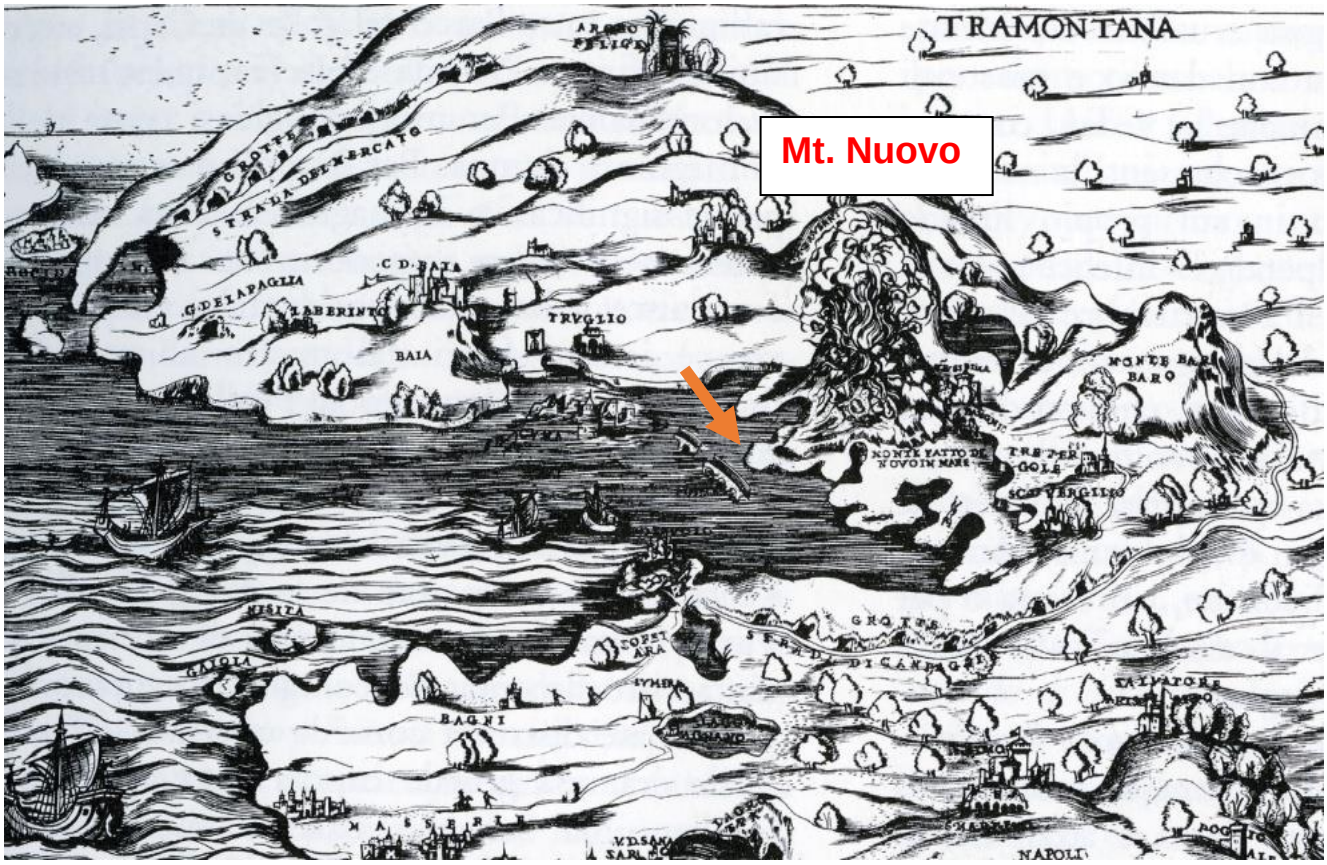

Figure S3. Ripa Puteolana (1540). Engraving dated between 1538 and 1542 by "Maestro del Trabocchetto". The orange arrow evidences the coastline retreat. These structures correspond to the archaeological coastal Roman remains positioned between from 2 to 4 m below sea level. Image after Ricciardi (2009).

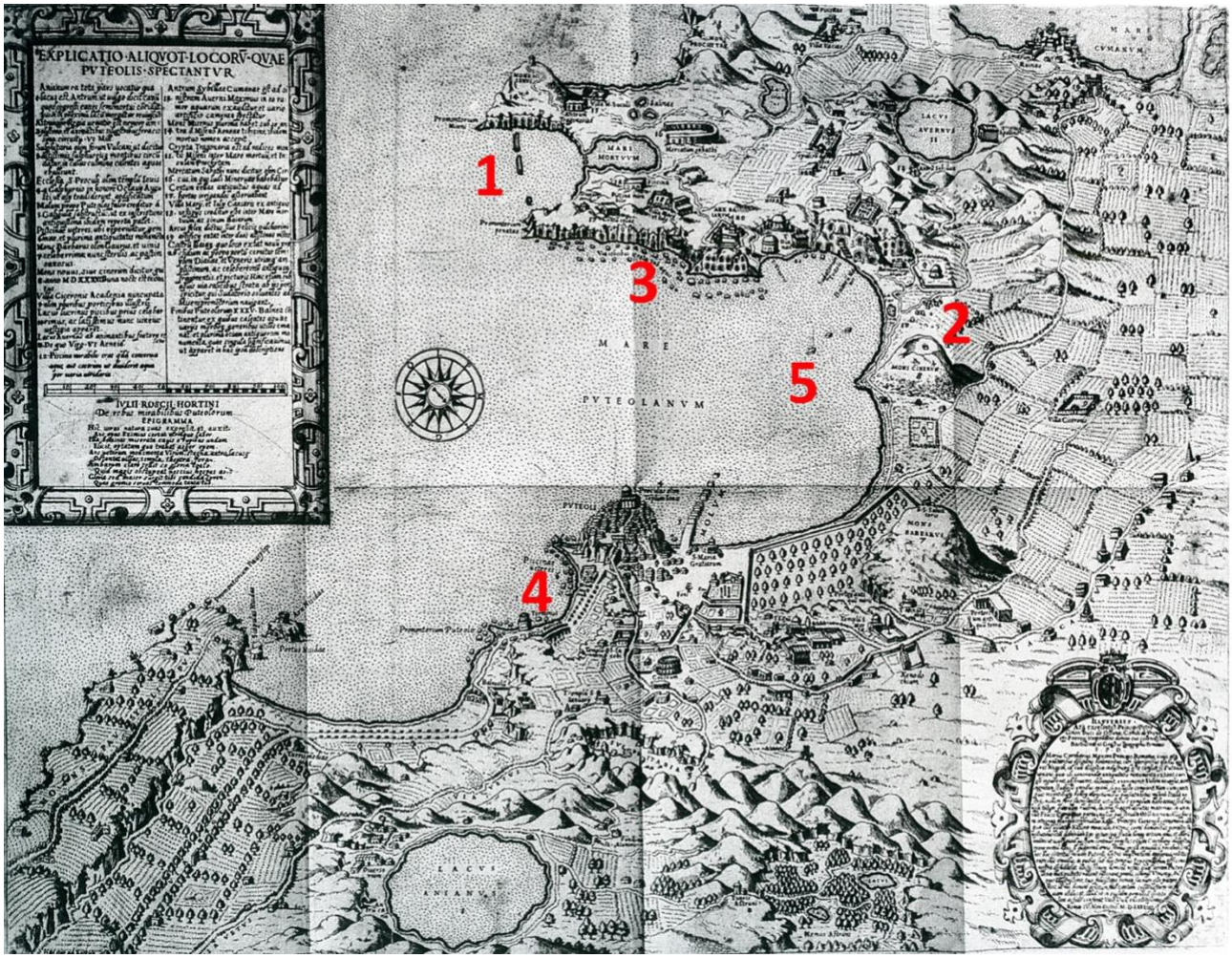

Figure S4. Map of Campi Flegrei coastal area in 1582 (Ager Puteolanus) after the Monte Nuovo eruption, showing the emerged Roman remains. (1) Breakwater pillars of the Miseno military harbour with the bridge; (2) the Monte Nuovo cone; (3) and (4) Baia and Pozzuoli fishponds, and other coastal remains; (5) Portus Julius pillars in the Punta Caruso offshore. Image by Cartaro (1584), modified after Di Vito et al. (2016).

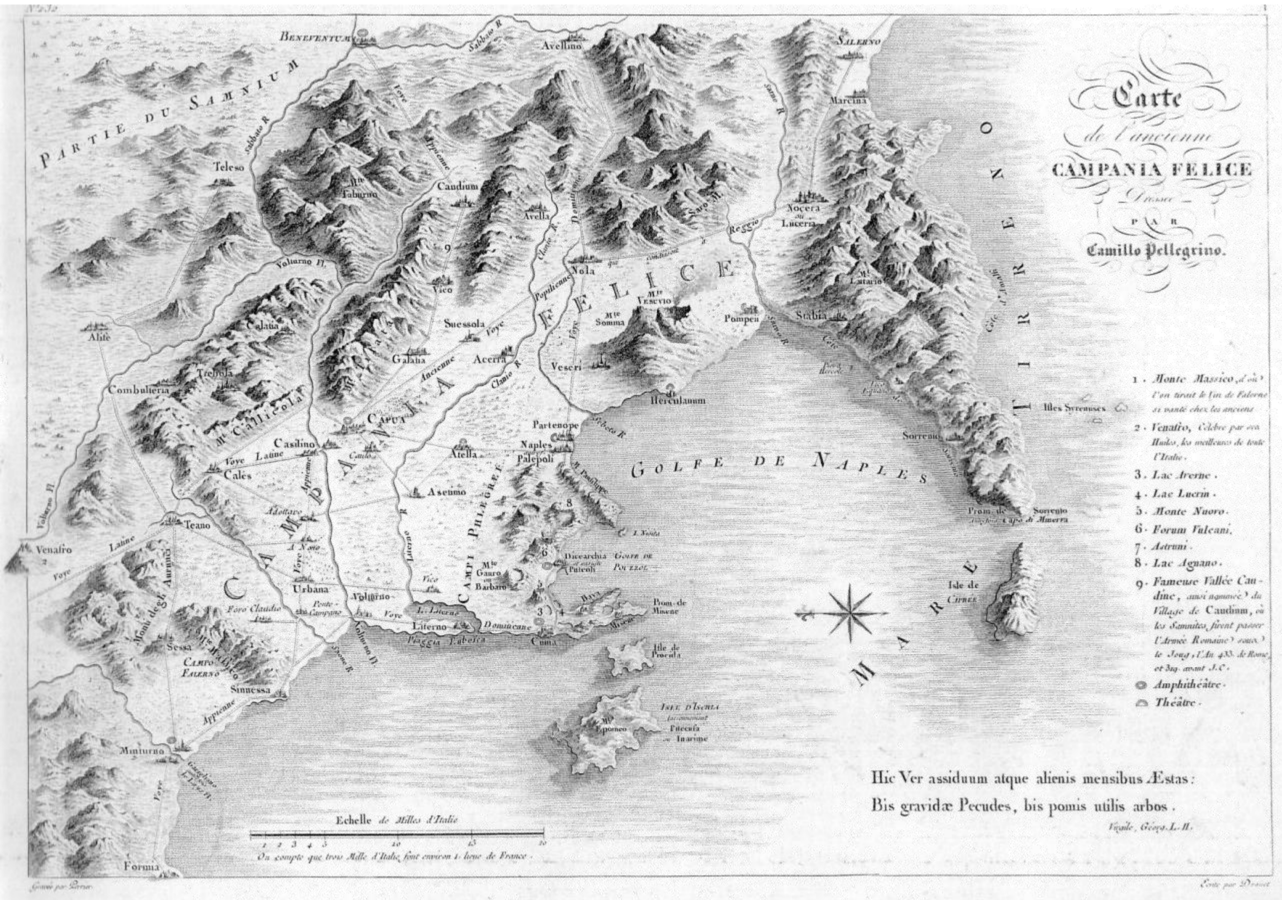

Figure S5. Camillo Pellegrino (1651). Map of Campania Felix, “Carte de l'ancienne Campania Felice”, *Apparato alle antichità di Capua, ovvero Discorsi della Campania Felice*, Ed. Francesco Savio Stampatore della Corte Arcivescovile, Napoli (1651), after Ricciardi (2009).

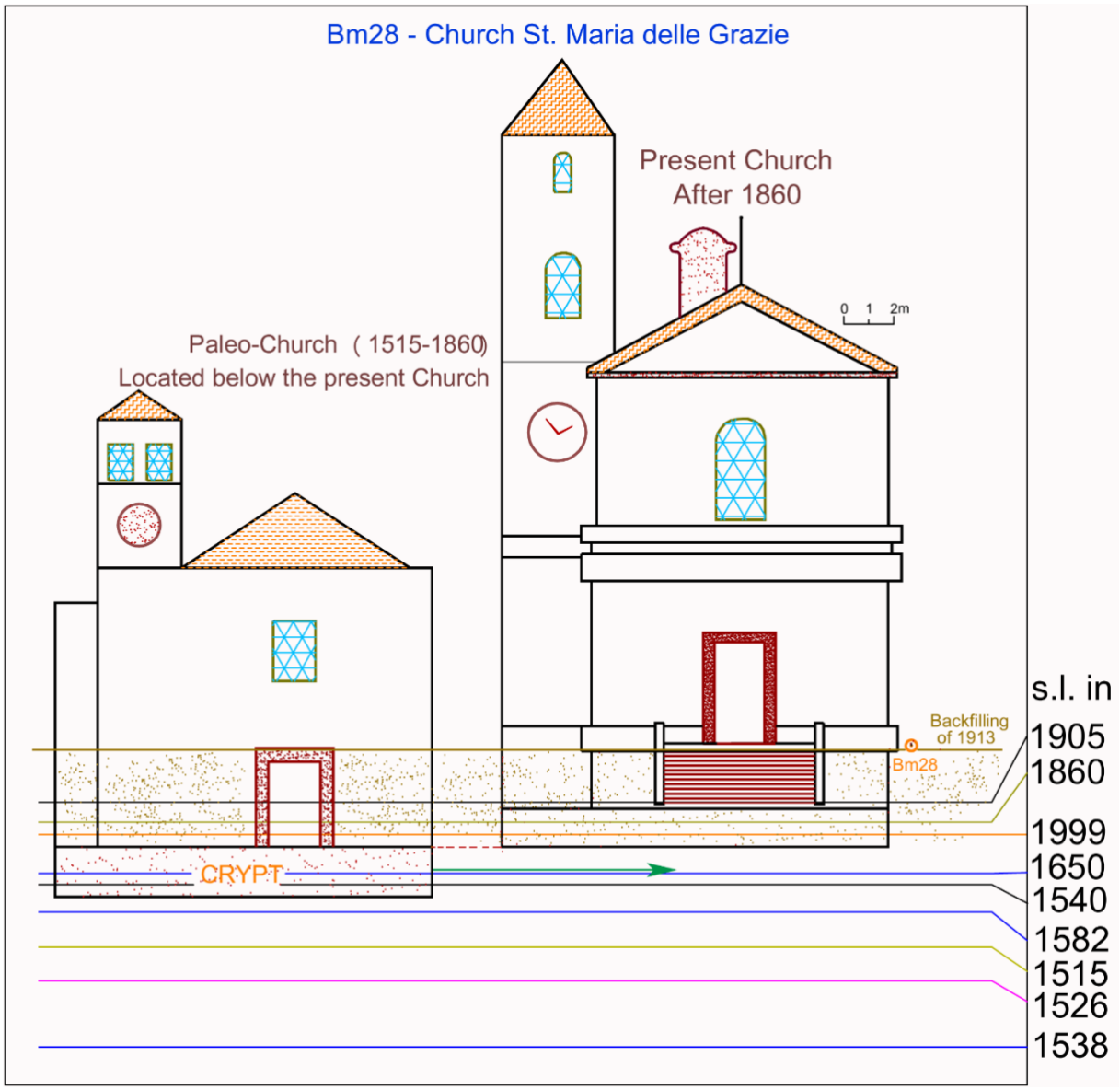

Figure S6. Reconstruction of the relative position of the St. Maria delle Grazie Church and the relative sea level through time. The second Church was constructed on the previous one after the progressive submersion by the sea. The site corresponds to the benchmark 28 of the Osservatorio Vesuviano levelling network.

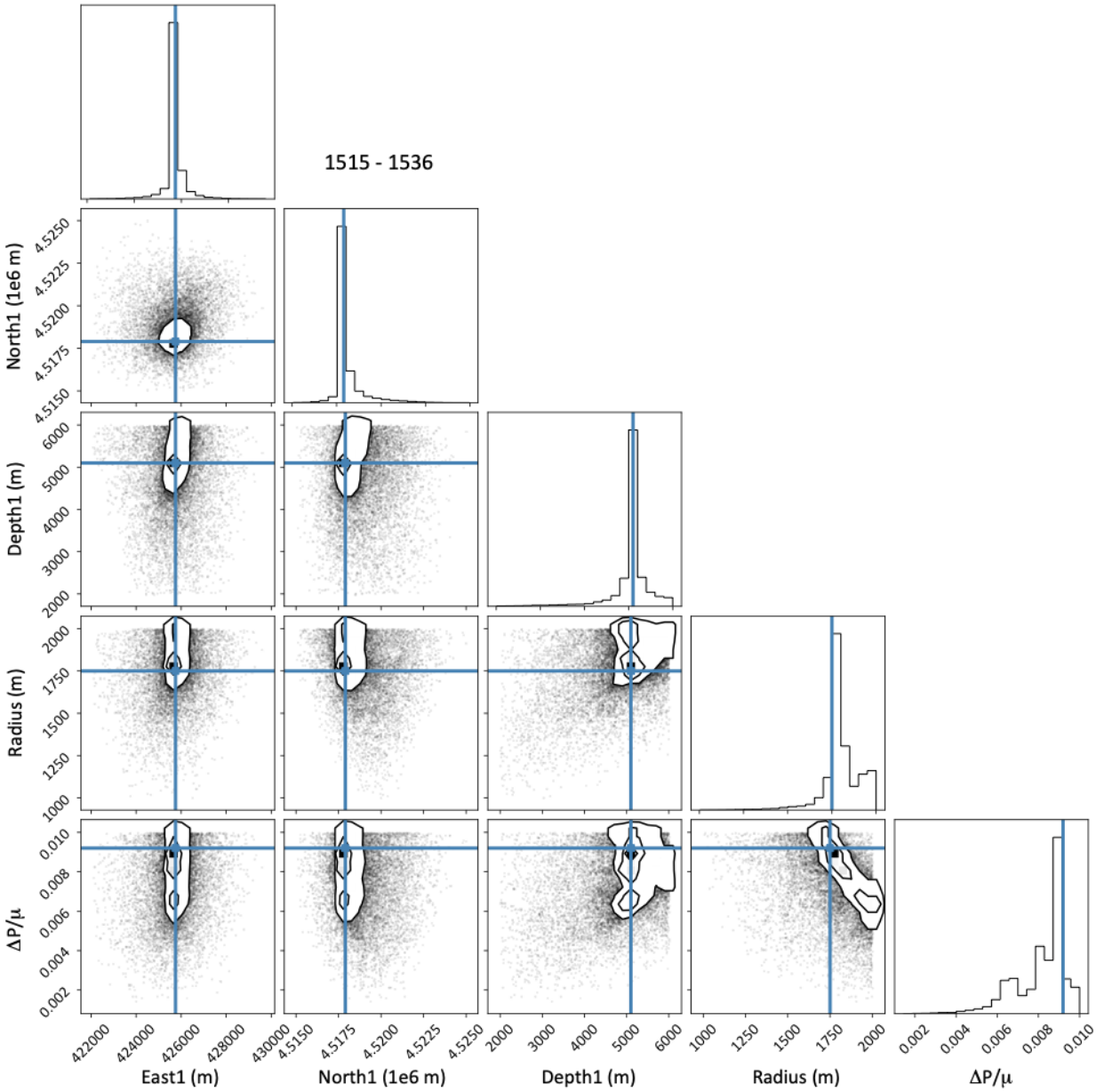

Figure S7. 1D and 2D marginal parameter distributions for the sill-like source during 1515 – 1536. East1 and North1 are the easting and northing, respectively, in UTM projection (zone 33), WGS84. ΔP/μ is the ratio between overpressure and shear modulus. The blue lines are the best-fit solutions for each parameter.

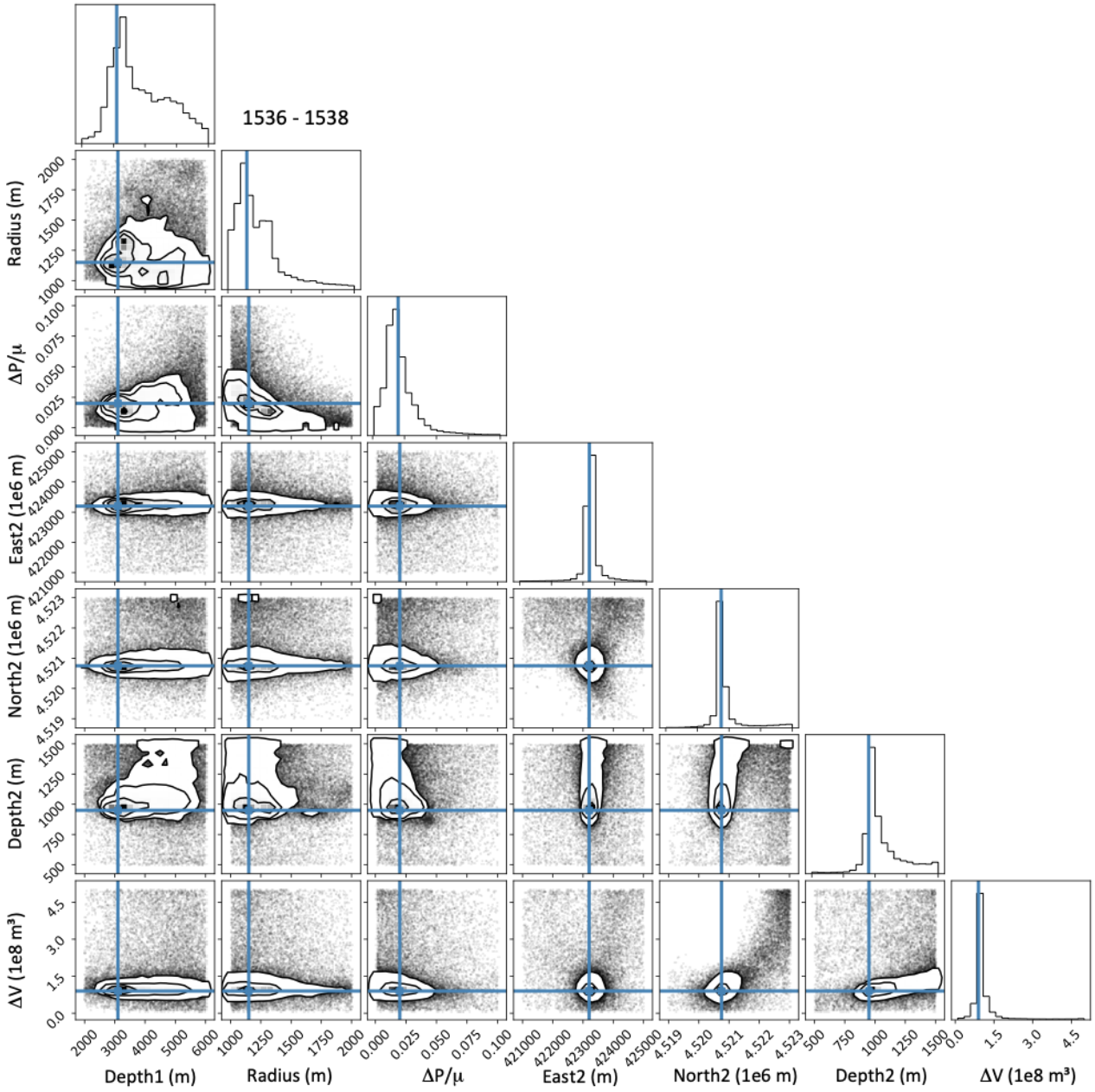

Figure S8. 1D and 2D marginal parameter distributions for the sill-like and the spherical sources during 1536 – 1538. Depth1, Radius and ΔP/μ (ratio between overpressure and shear modulus) are referred to the sill-like source. East2 and North2 are the easting and northing, respectively, of the spherical source in UTM projection (zone 33), WGS84. Depth2 and ΔV (volume variation) are also referred to the spherical source. The blue lines are the best-fit solutions for each parameter.

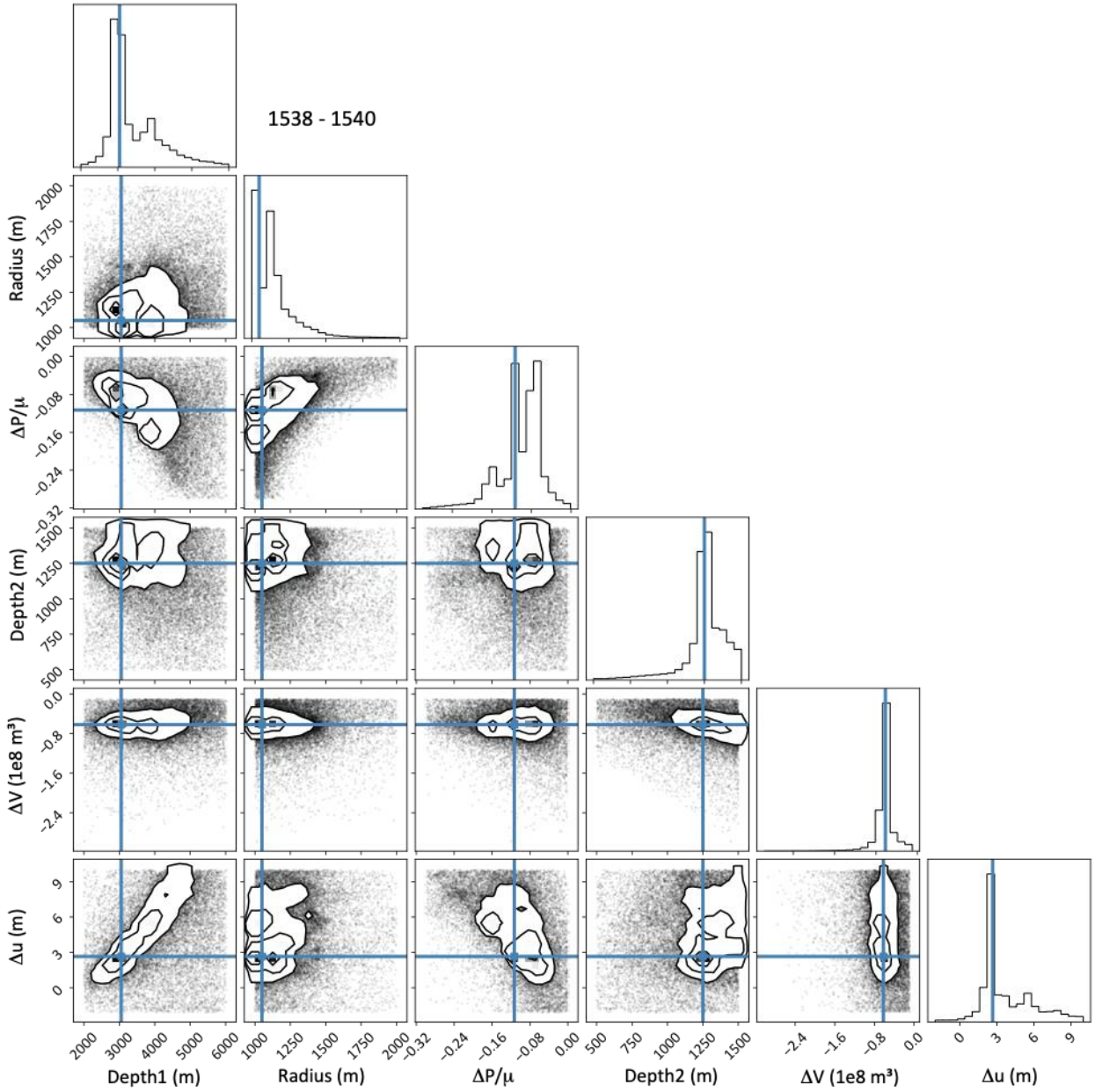

Figure S9. 1D and 2D marginal parameter distributions for the sill-like, the spherical and deep sources during 1538 – 1540. Depth1, Radius and ΔP/μ (ratio between overpressure and shear modulus) are referred to the sill-like source. Depth2 and ΔV (volume variation) are referred to the spherical source. Du is the opening of the deep layer. The blue lines are the best-fit solutions for each parameter.

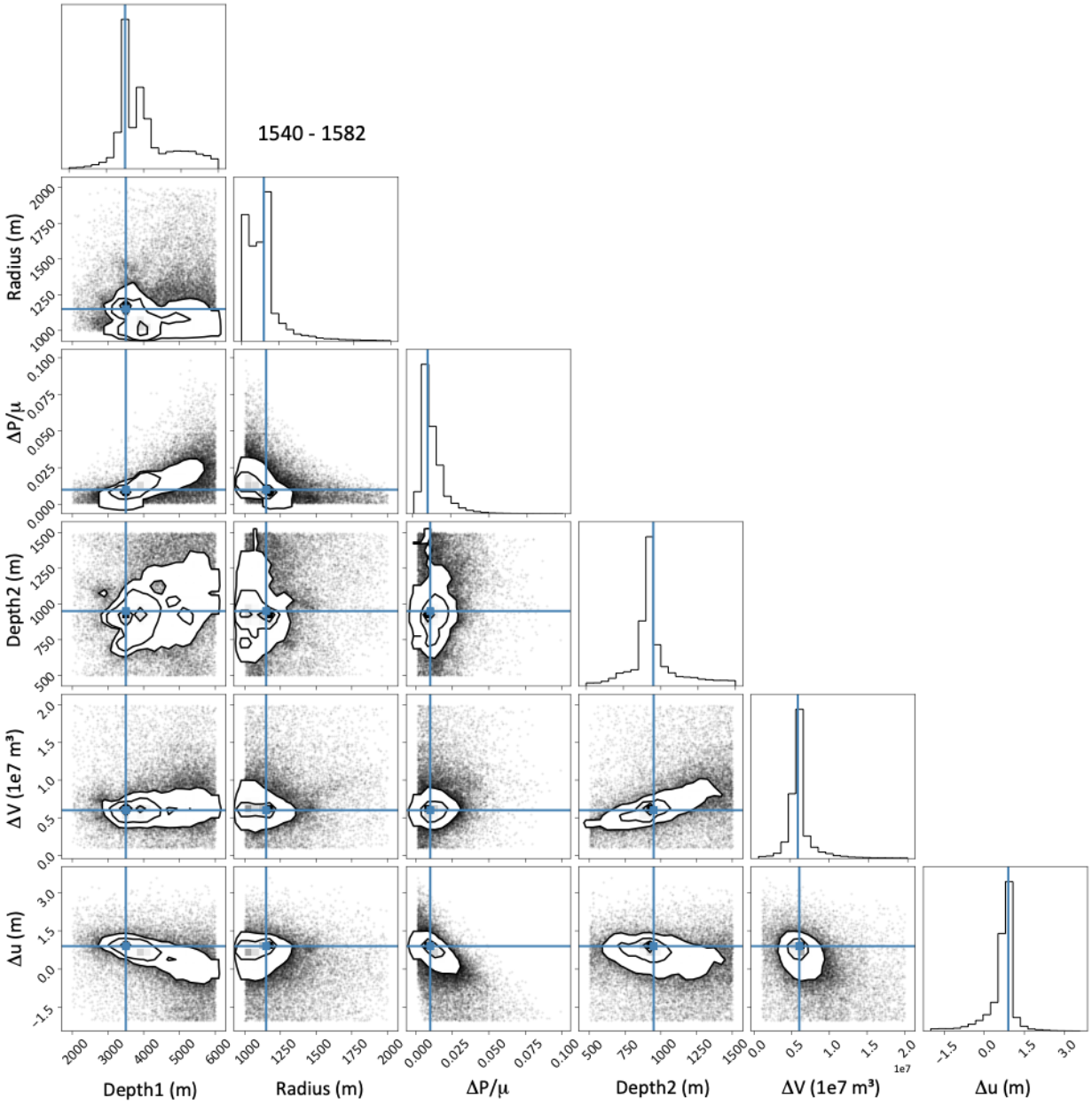

Figure S10. 1D and 2D marginal parameter distributions for the sill-like, the spherical and deep sources during 1540 – 1582. Depth1, Radius and ΔP/μ (ratio between overpressure and shear modulus) are referred to the sill-like source. Depth2 and ΔV (volume variation) are referred to the spherical source. Du is the opening of the deep layer. The blue lines are the best-fit solutions for each parameter.

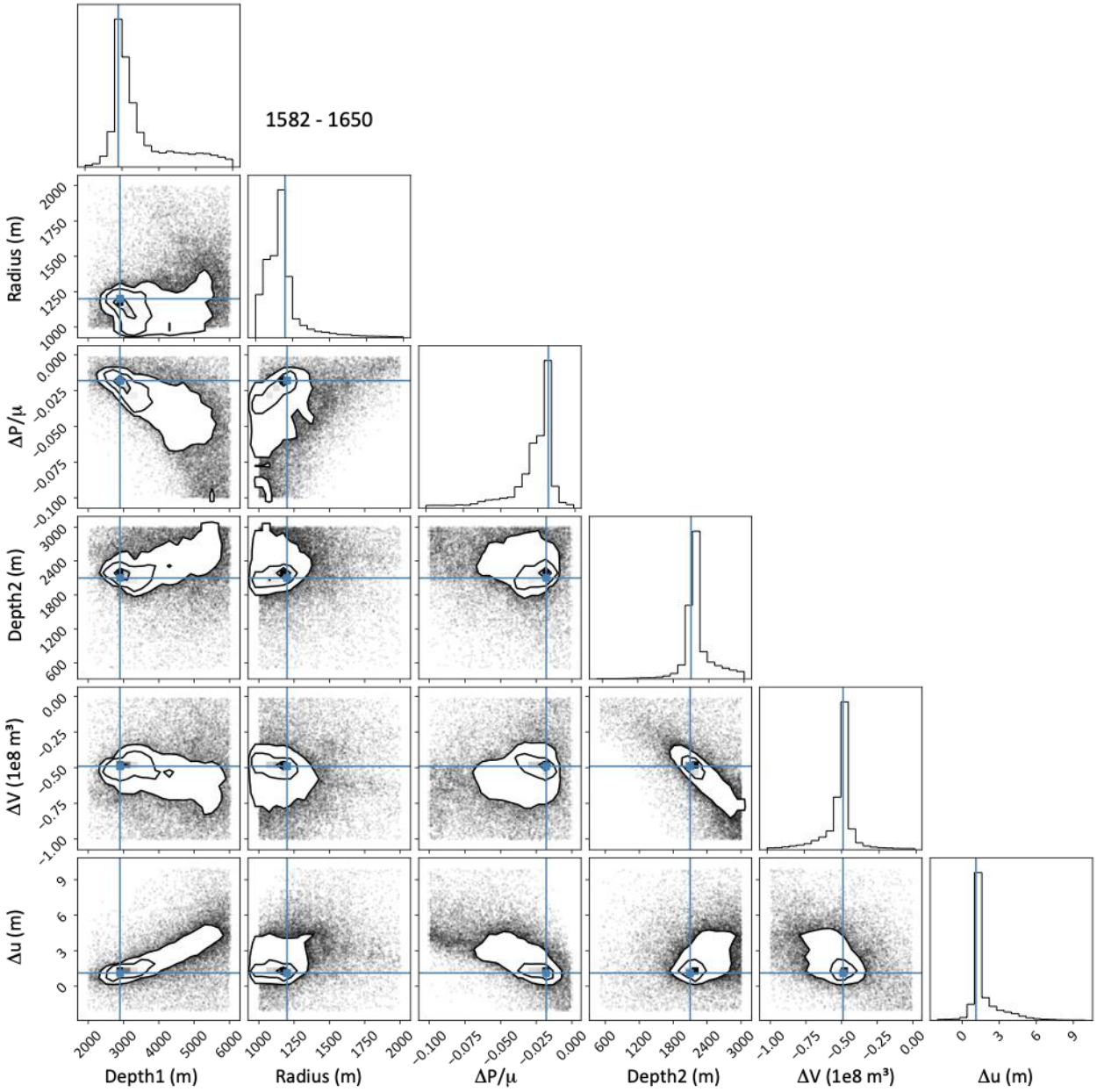

Figure S11. 1D and 2D marginal parameter distributions for the sill-like, the spherical and deep sources during 1582 – 1650. Depth1, Radius and ΔP/μ (ratio between overpressure and shear modulus) are referred to the sill-like source. Depth2 and ΔV (volume variation) are referred to the spherical source. Du is the opening of the deep layer. The blue lines are the best-fit solutions for each parameter.

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