ISSN 2039-7941
Anno 2011_Numero 11

miscellanea INGV

The photographic dataset of the rotational effects produced by the 2009 L'Aquila earthquake

11

Istituto Nazionale di Geofisica e Vulcanologia

ISSN 2039-7941
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THE PHOTOGRAPHIC DATASET OF THE ROTATIONAL EFFECTS PRODUCED BY THE 2009 L'AQUILA EARTHQUAKE

Luigi Cucci[1], Andrea Tertulliani[1], Corrado Castellano[2]

[1]**INGV** (Istituto Nazionale di Geofisica e Vulcanologia, Sezione Sismologia e Tettonofisica)
[2]**INGV** (Istituto Nazionale di Geofisica e Vulcanologia, Centro Nazionale Terremoti)

11

ISSN 2039-6651
Anno **2011**_Numero **11**

Indice

Introduction 5

Locality 7

Aragno 7
Assergi 8
Barisciano 9
Bazzano 10
Camarda 11
Cansatessa 11
Casentino 12
Castel del Monte 13
Castelnuovo 13
Civitella casanova 14
Colle di Lucoli 15
Colle di Roio 15
Collimento 16
Coppito 17
Filetto 18
Fossa 19
Genzano 20
L'Aquila 21
Monticchio 35
Onna 35
Paganica 36
Pettino 40
Pianola 40
Poggio di Roio 41
Poggio Picenze 42
Prato Lonaro 44
Santa Rufina 45
Sant'Eusanio 47
San Gregorio 48
San Pio 49
San Benedetto in Bagno 49
San Demetrio 50
San Martino d'Ocre 52
Santo Stefano di Sessanio 53
Tempera 53
Torre de' Passeri 54
Vallecupa 55
Villa Sant'Angelo 56

Acknowledgements 59

References 59

Suggested Readings on Rotational Seismology 59

Introduction

In this work we present the complete photographic dataset of the rotational effects produced by the Mw 6.3, 6 April 2009 L'Aquila (Central Italy) earthquake. During the macroseismic survey, performed in the aftermath of the 6 April mainshock in order to estimate the impact of the event, we collected and classified an impressive number of rotational effects on buildings, monuments in villages and cemeteries, and heavy articles of furniture. The observations concern many manufactured objects that have rotated entirely or partially. We have observed the rotation of more than 50 chimneys, built of concrete blocks, bricks, or flues. The rotation can involve the body of the chimney or the top only. Other typical objects were found investigating the cemeteries of the area, where tombstones, gravestones and other objects were rotated. In several occasions the rotation affected capitals or columns on walls or gates.

Cucci and Tertulliani [2011] first presented the whole dataset of rotational effects induced by the L'Aquila earthquake, finding a significant convergence between the distribution of the rotations and of the damage. They also found that surface geology and amplification of the seismic motion at each reported location (i.e. scarce geophysical and/or geotechnical characteristics or unfavorable geomorphological conditions at the site) strongly influenced the occurrence and the nature of the earthquake-induced rotational effects. Conversely, the contribution of the pattern of slip distribution on the fault plane plays only a secondary role in enhancing the rotational motion at each site.

In a further attempt to find relationships between the type of observed rotations and the geophysical characteristics of the site of observation, Castellano et al. [in press] put in evidence that ground rotation is not strongly dependent on topographic effects, and that the clockwise or counterclockwise sense of rotation observed is not predictable at a given site.

The photographic dataset consists of 107 pictures of rotational effects observed in the town of L'Aquila and 39 surrounding localities concentrated in the epicentral area. The pictures are sorted and presented by locality of observation; each photo reports several information such as the geographical coordinates, the type of object rotated, the direction of rotation (cw=clockwise, ccw=counterclockwise), the MCS intensity at the site and the outcropping lithology.

Locality: Aragno

Figure 1

Figure 2

	Lat.	Lon.	Object	Direction	I MCS	Geology
Figure 1	42.396	13.459	chimney	cw	6	Cemented breccia
Figure 2	42.394	13.459	tombstone	ccw	6	Colluvial deposits

Locality: Assergi

Figure 3

	Lat.	Lon.	Object	Direction	I MCS	Geology
Figure 3	42.414	13.505	chimney	ccw	6	Calcareous breccia

Locality: Barisciano

Figure 4

	Lat.	Lon.	Object	Direction	I MCS	Geology
Figure 4	42.325	13.591	chimney	cw	6	Cemented breccia

Locality: Bazzano

Figure 5

Figure 6

	Lat.	Lon.	Object	Direction	I MCS	Geology
Figure 5	42.338	13.454	chimney	cw	8	Massive calcarenite
Figure 6	42.337	13.453	chimney	ccw	8	Cemented breccia

Locality: Camarda

Figure 7

	Lat.	Lon.	Object	Direction	I MCS	Geology
Figure 7	42.39	13.494	chimney	ccw	7.5	Terraced alluvials

Locality: Cansatessa

Figure 8

	Lat.	Lon.	Object	Direction	I MCS	Geology
Figure 8	42.384	13.343	furniture	ccw	6.5	Sandy-gravelly alluvials

Locality: Casentino

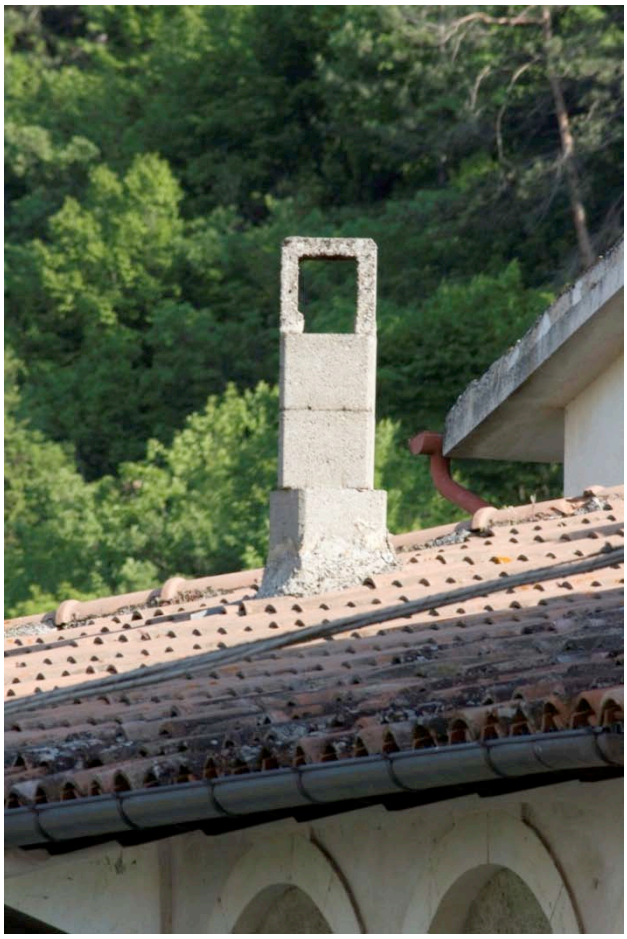

Figure 9

Figure 10

Figure 11

	Lat.	Lon.	Object	Direction	I MCS	Geology
Figure 9	42.279	13.51	chimney	cw	8	Calcareous gravels and breccias
Figure 10	42.279	13.511	vase	cw	8	Calcareous gravels and breccias
Figure 11	42.28	13.514	facade	ccw	8	Sandy silt

Locality: Castel del Monte

Figure 12

	Lat.	Lon.	Object	Direction	I MCS	Geology
Figure 12	42.325	13.727	merlon	cw	6	Massive limestone

Locality: Castelnuovo

Figure 13

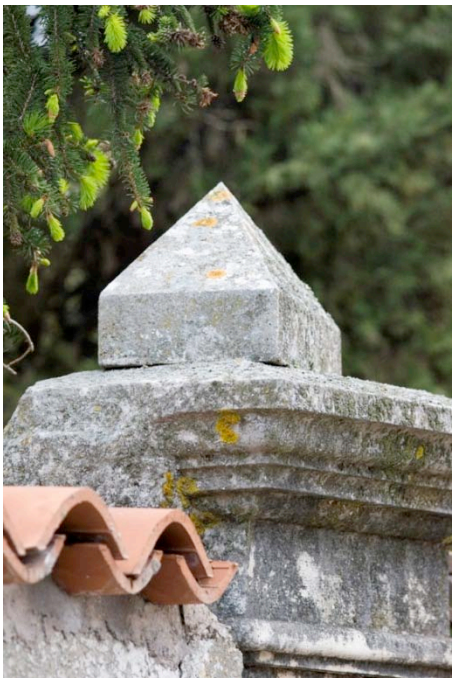

Figure 14

	Lat.	Lon.	Object	Direction	I MCS	Geology
Figure 13	42.298	13.624	monument	ccw	9.5	Sandy silt
Figure 14	42.298	13.625	pinnacle	ccw	9.5	Sandy silt

Locality: Civitella Casanova

Figure 15

	Lat.	Lon.	Object	Direction	I MCS	Geology
Figure 15	42.364	13.889	stone	cw	6	Terraced alluvials

Locality: Colle di Lucoli

Figure 16

	Lat.	Lon.	Object	Direction	I MCS	Geology
Figure 16	42.308	13.334	chimney	cw	7.5	Massive sandstone

Locality: Colle di Roio

Figure 17

	Lat.	Lon.	Object	Direction	I MCS	Geology
Figure 17	42.342	13.349	chimney	ccw	8	Calcarenite

Locality: Collimento

Figure 18

Figure 19

Figure 20

	Lat.	Lon.	Object	Direction	I MCS	Geology
Figure 18	42.29	13.337	chimney	cw	6.5	Calcarenite
Figure 19	42.291	13.338	statue	cw	6.5	Calcarenite
Figure 20	42.292	13.34	chimney	ccw	6.5	Colluvial deposits

Locality: Coppito

Figure 21

Figure 22

	Lat.	Lon.	Object	Direction	I MCS	Geology
Figure 21	42.368	13.341	chimney	ccw	6.5	Eluvial-colluvial deposits
Figure 22	42.368	13.341	chimney	ccw	6.5	Eluvial-colluvial deposits

Locality: Filetto

Figure 23

	Lat.	Lon.	Object	Direction	I MCS	Geology
Figure 23	42.378	13.52	chimney	cw	6	Marly limestone

Locality: Fossa

Figure 24

Figure 25

	Lat.	Lon.	Object	Direction	I MCS	Geology
Figure 24	42.302	13.482	vase	ccw	7.5	Heterometric gravel
Figure 24	42.302	13.482	pillar	ccw	7.5	Heterometric gravel
Figure 24	42.302	13.482	pillar	ccw	7.5	Heterometric gravel
Figure 25	42.291	13.488	chimney	ccw	7.5	Calcareous gravel

Locality: Genzano

Figure 26

	Lat.	Lon.	Object	Direction	I MCS	Geology
Figure 26	42.354	13.330	chimney	cw	6	Silty sand

Locality: L'Aquila

Figure 27

Figure 28

	Lat.	Lon.	Object	Direction	I MCS	Geology
Figure 27	42.35	13.398	capital	cw	8.5	Calcareous breccia
Figure 28	42.35	13.398	capital	ccw	8.5	Calcareous breccia

Locality: L'Aquila

Figure 29

Figure 30

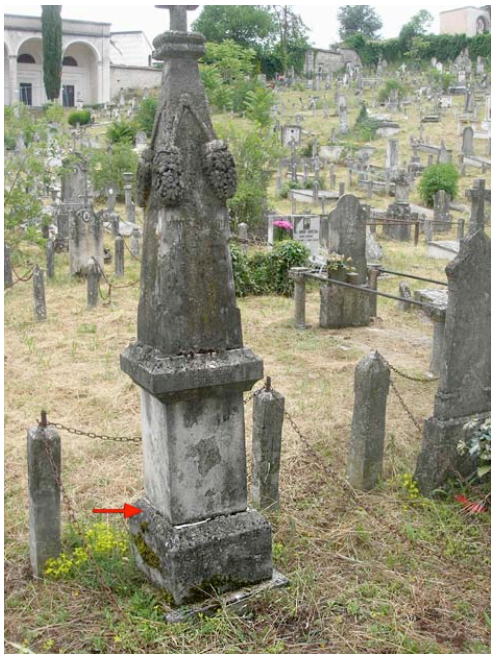

Figure 31

	Lat.	Lon.	Object	Direction	I MCS	Geology
Figure 29	42.351	13.412	grave	ccw	8.5	Calcareous breccia
Figure 30	42.351	13.415	monument	cw	8.5	Calcareous breccia
Figure 31	42.351	13.415	monument	cw	8.5	Calcareous breccia

Locality: L'Aquila

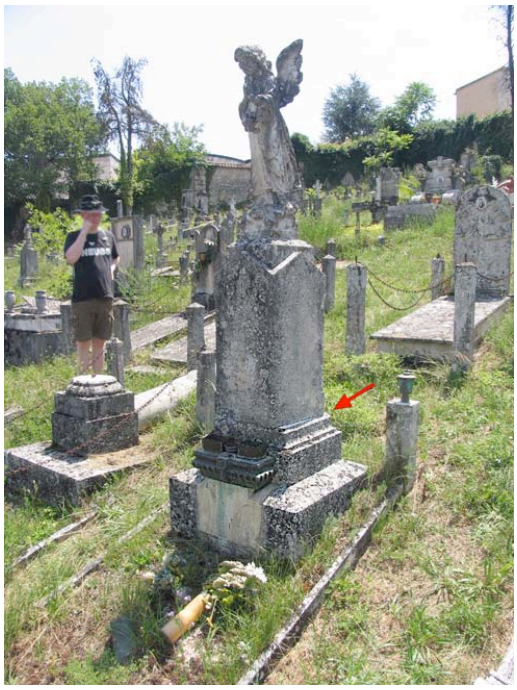

Figure 32

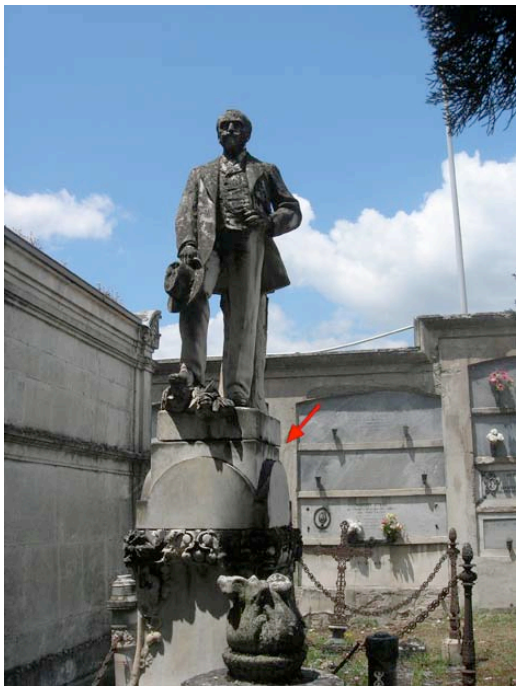

Figure 33

Figure 34

	Lat.	Lon.	Object	Direction	I MCS	Geology
Figure 32	42.351	13.415	monument	cw	8.5	Calcareous breccia
Figure 33	42.351	13.412	monument	cw	8.5	Calcareous breccia
Figure 34	42.351	13.411	vase	cw	8.5	Calcareous breccia
Figure 34	42.351	13.411	vase	cw	8.5	Calcareous breccia

Locality: L'Aquila

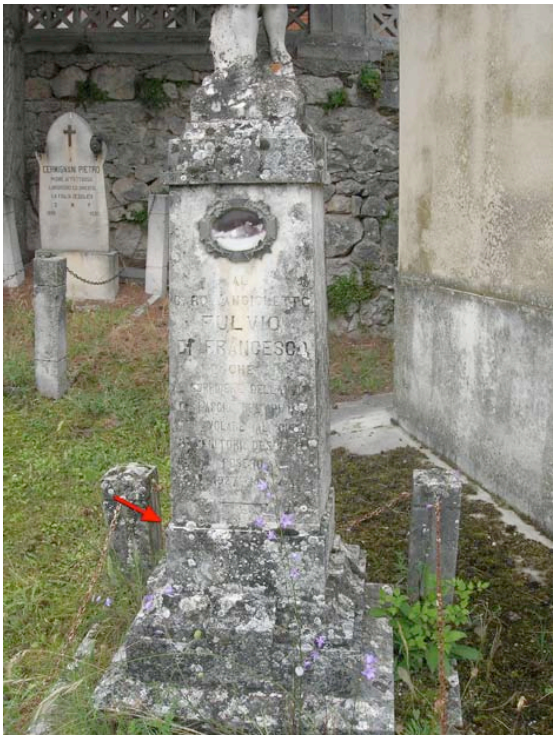

Figure 35

Figure 36

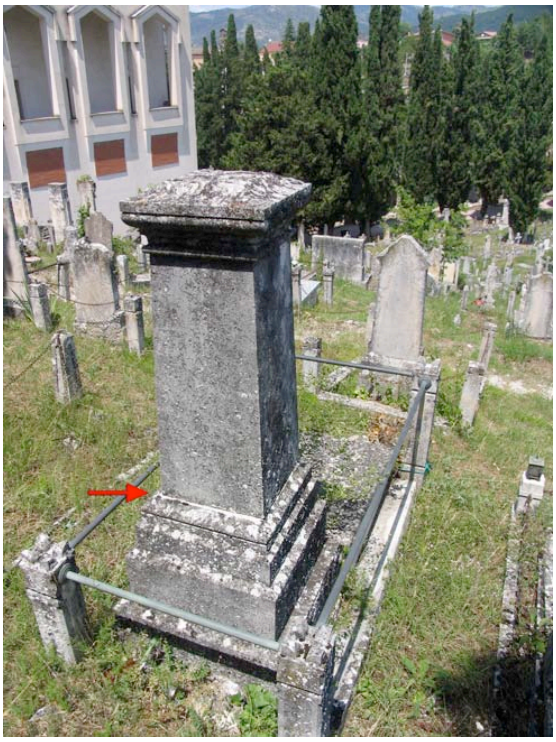

Figure 37

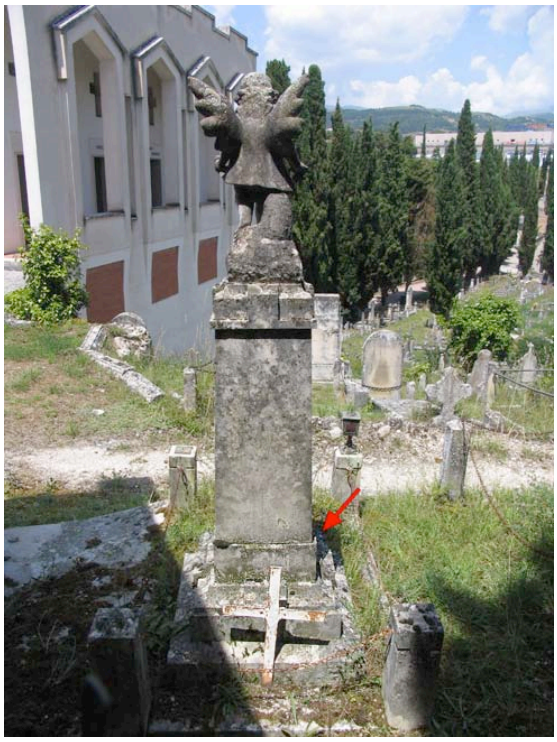

Figure 38

	Lat.	Lon.	Object	Direction	I MCS	Geology
Figure 35	42.351	13.412	monument	cw	8.5	Calcareous breccia
Figure 36	42.351	13.415	monument	cw	8.5	Calcareous breccia
Figure 37	42.351	13.415	monument	ccw	8.5	Calcareous breccia
Figure 38	42.351	13.415	monument	cw	8.5	Calcareous breccia

Locality: L'Aquila

Figure 39

Figure 40

	Lat.	Lon.	Object	Direction	I MCS	Geology
Figure 39	42.346	13.398	marble cover plate	ccw	8.5	Clayey silt
Figure 40	42.347	13.396	chimney	ccw	8.5	Calcareous breccia

Locality: L'Aquila

Figure 41

Figure 42

	Lat.	Lon.	Object	Direction	I MCS	Geology
Figure 41	42.35	13.395	pillar	ccw	8.5	Calcareous breccia
Figure 42	42.359	13.363	chimney	cw	8.5	Terraced alluvials

Locality: L'Aquila

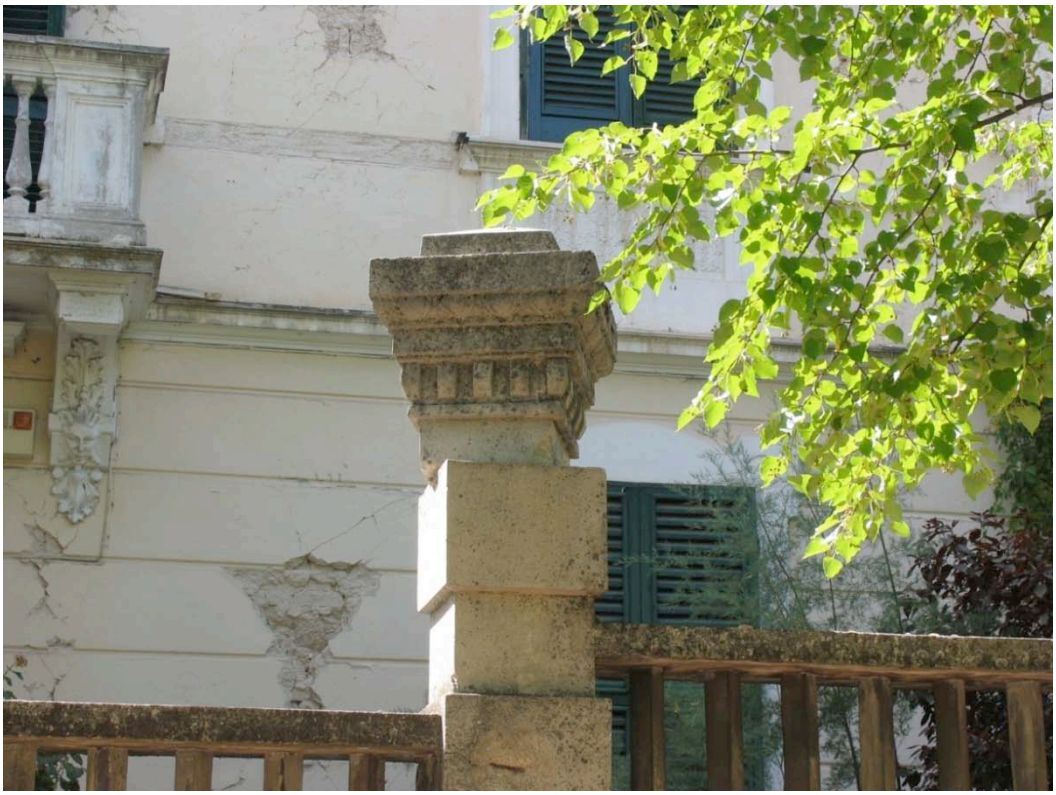

Figure 43

Figure 44

	Lat.	Lon.	Object	Direction	I MCS	Geology
Figure 43	42.342	13.395	capital	cw	8.5	Clayey silt
Figure 44	42.353	13.4	balustrade	ccw	8.5	Calcareous breccia

Locality: L'Aquila

Figure 45

Figure 46

	Lat.	Lon.	Object	Direction	I MCS	Geology
Figure 45	42.354	13.398	pillar	ccw	8.5	Calcareous breccia
Figure 46	42.352	13.395	marble stone	ccw	8.5	Eluvial-colluvial deposits
Figure 46	42.352	13.395	marble stone	cw	8.5	Eluvial-colluvial deposits
Figure 46	42.352	13.395	marble stone	cw	8.5	Eluvial-colluvial deposits

Locality: L'Aquila

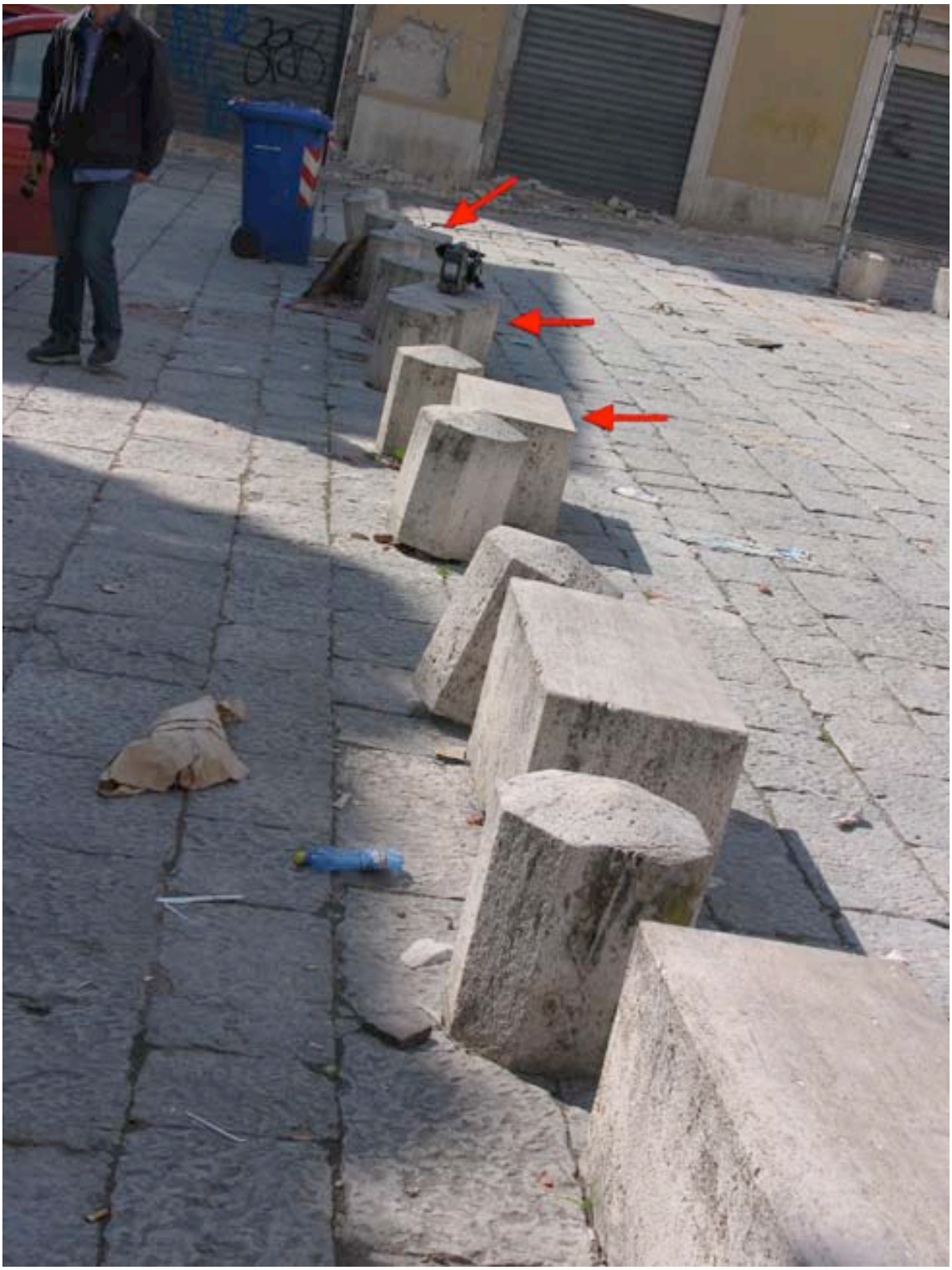

Figure 47

	Lat.	Lon.	Object	Direction	I MCS	Geology
Figure 47	42.352	13.395	marble stone	cw	8.5	Eluvial-colluvial deposits
Figure 47	42.352	13.395	marble stone	cw	8.5	Eluvial-colluvial deposits
Figure 47	42.352	13.395	marble stone	cw	8.5	Eluvial-colluvial deposits

Locality: L'Aquila

Figure 48

Figure 49

Figure 50

	Lat.	Lon.	Object	Direction	I MCS	Geology
Figure 48	42.351	13.397	pillar	cw	8.5	Eluvial-colluvial deposits
Figure 49	42.351	13.397	pillar	ccw	8.5	Eluvial-colluvial deposits
Figure 50	42.351	13.397	pillar	ccw	8.5	Eluvial-colluvial deposits

Locality: L'Aquila

Figure 51

Figure 52

	Lat.	Lon.	Object	Direction	I MCS	Geology
Figure 51	42.352	13.398	vase	ccw	8.5	Calcareous breccia
Figure 52	42.354	13.4	statue	cw	8.5	Calcareous breccia

Locality: L'Aquila

Figure 53

Figure 54

	Lat.	Lon.	Object	Direction	I MCS	Geology
Figure 53	42.354	13.4	statue	ccw	8.5	Calcareous breccia
Figure 54	42.354	13.4	statue	ccw	8.5	Calcareous breccia

Locality: L'Aquila

Figure 55

Figure 56

	Lat.	Lon.	Object	Direction	I MCS	Geology
Figure 55	42.348	13.392	chimney	ccw	8.5	Clayey silt
Figure 56	42.347	13.393	chimney	ccw	8.5	Clayey silt

Locality: L'Aquila

Figure 57

	Lat.	Lon.	Object	Direction	I MCS	Geology
Figure 57	42.352	13.396	pillar	cw	8.5	Eluvial-colluvial deposits

Locality: Monticchio

Figure 58

	Lat.	Lon.	Object	Direction	I MCS	Geology
Figure 58	42.315	13.462	pinnacle	cw	6	Slope debris

Locality: Onna

Figure 59

	Lat.	Lon.	Object	Direction	I MCS	Geology
Figure 59	42.327	13.481	chimney	cw	9.5	Clayey silt

Locality: Paganica

Figure 60

Figure 61

Figure 62

	Lat.	Lon.	Object	Direction	I MCS	Geology
Figure 60	42.359	13.471	monument	ccw	8	Alluvial deposits
Figure 61	42.358	13.4705	chimney	cw	8	Alluvial deposits
Figure 62	42.362	13.467	chimney	ccw	8	Cemented breccias

Locality: Paganica

Figure 63

	Lat.	Lon.	Object	Direction	I MCS	Geology
Figure 63	42.358	13.471	pinnacle	ccw	8	Alluvial deposits

Locality: Paganica

Figure 64

Figure 67

	Lat.	Lon.	Object	Direction	I MCS	Geology
Figure 64	42.361	13.472	vase	ccw	8	Cemented breccia
Figure 65	42.36	13.474	pinnacle	cw	8	Slightly cemented breccia

Locality: Paganica

Figure 66

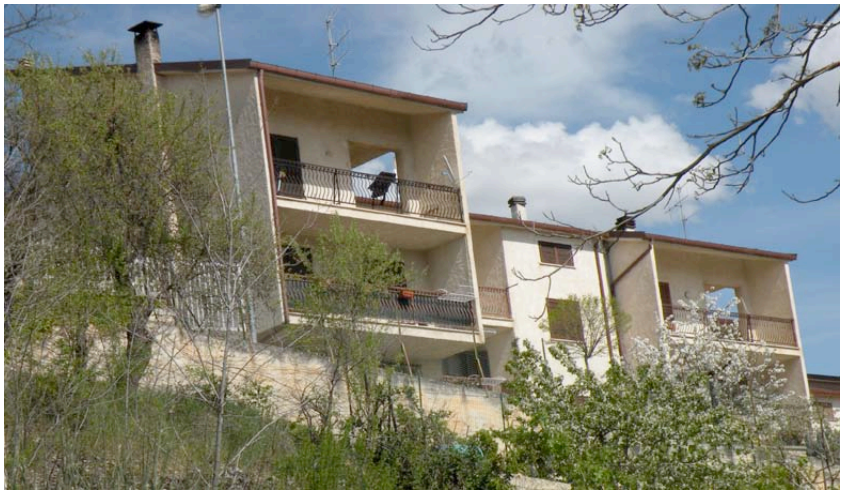

Figure 67

Figure 68

	Lat.	Lon.	Object	Direction	I MCS	Geology
Figure 66	42.359	13.471	chimney	ccw	8	Alluvial deposits
Figure 67	42.365	13.469	chimney	cw	8	Sandy silt
Figure 68	42.359	13.473	chimney	cw	8	Cemented breccia

Locality: Pettino

Figure 69

	Lat.	Lon.	Object	Direction	I MCS	Geology
Figure 69	42.376	13.354	pillar	ccw	7	Heterometric gravel

Locality: Pianola

Figure 70

	Lat.	Lon.	Object	Direction	I MCS	Geology
Figure 70	42.322	13.404	chimney	cw	7	Limestone

Locality: Poggio di Roio

Figure 71

	Lat.	Lon.	Object	Direction	I MCS	Geology
Figure 71	42.331	13.378	chimney	ccw	8.5	Fractured limestone

Locality: Poggio Picenze

Figure 72

Figure 73

	Lat.	Lon.	Object	Direction	I MCS	Geology
Figure 72	42.32	13.538	chimney	cw	8.5	Cemented conglomerate
Figure 73	42.318	13.541	chimney	cw	8.5	Cemented conglomerate

Locality: Poggio Picenze

Figure 74

Figure 75

	Lat.	Lon.	Object	Direction	I MCS	Geology
Figure 74	42.319	13.541	chimney	ccw	8.5	Cemented conglomerate
Figure 75	42.32	13.542	chimney	cw	8.5	Cemented conglomerate

Locality: Prato Lonaro

Figure 76

	Lat.	Lon.	Object	Direction	I MCS	Geology
Figure 76	42.276	13.364	chimney	cw	7	Limestone
Figure 76	42.276	13.364	chimney	cw	7	Limestone

Locality: Santa Rufina

Figure 77

Figure 78

	Lat.	Lon.	Object	Direction	I MCS	Geology
Figure 77	42.331	13.353	chimney	ccw	8	Silty sand
Figure 78	42.33	13.354	chimney	ccw	8	Clayey silt

Locality: Santa Rufina

Figure 79

	Lat.	Lon.	Object	Direction	I MCS	Geology
Figure 79	42.331	13.354	chimney	cw	8	Silty sand

Locality: Sant'Eusanio

Figure 80

Figure 81

Figure 82

	Lat.	Lon.	Object	Direction	I MCS	Geology
Figure 80	42.287	13.523	cross	cw	9	Fluvial-lacustrine sand
Figure 80	42.287	13.523	cross	cw	9	Fluvial-lacustrine sand
Figure 80	42.287	13.523	cross	cw	9	Fluvial-lacustrine sand
Figure 81	42.288	13.524	chimney	cw	9	Fluvial-lacustrine sand
Figure 82	42.286	13.523	capital	ccw	9	Fluvial-lacustrine sand

Locality: San Gregorio

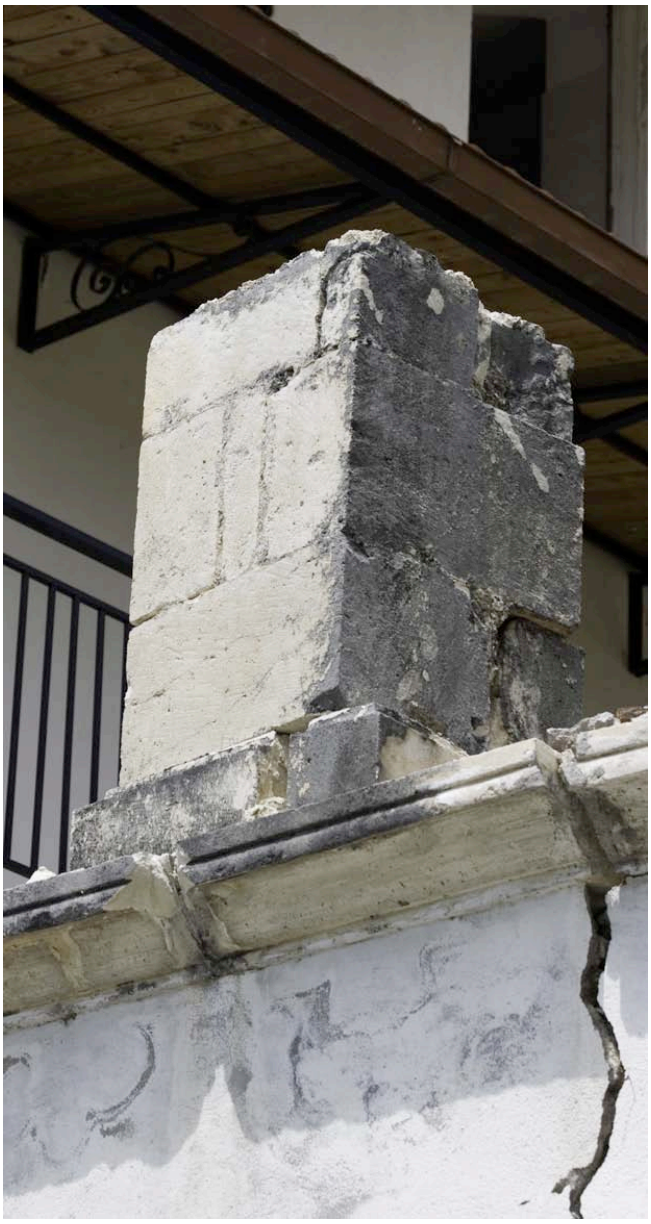

Figure 83

Figure 84

Figure 85

	Lat.	Lon.	Object	Direction	I MCS	Geology
Figure 83	42.327	13.497	chimney	cw	9	Fractured calcarenite
Figure 84	42.333	13.49	pinnacle	cw	9	Calcarenite
Figure 85	42.327	13.496	chimney	ccw	9	Silty sand

Locality: San Pio

Figure 86

Locality: San Benedetto in Bagno

Figure 87

	Lat.	Lon.	Object	Direction	I MCS	Geology
Figure 86	42.283	13.651	pillar	ccw	5.5	Terraced alluvials
Figure 87	42.303	13.44	chimney	ccw	7.5	Eluvial-colluvial deposits

Locality: San Demetrio

Figure 88

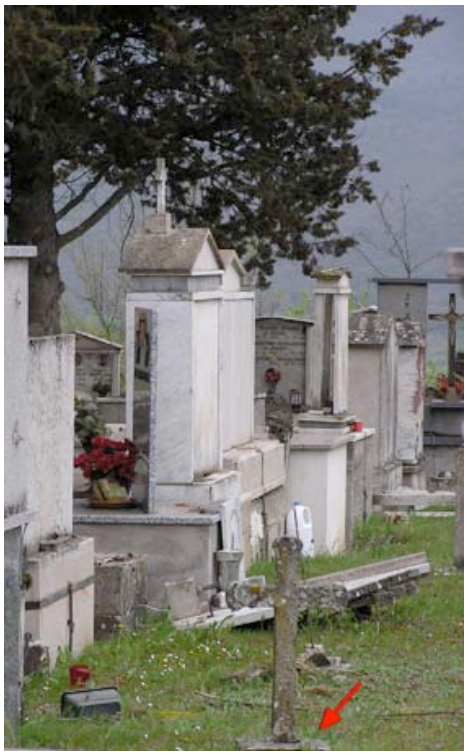

Figure 89

Figure 90

	Lat.	Lon.	Object	Direction	I MCS	Geology
Figure 88	42.278	13.554	cross	cw	6.5	Sandy gravel
Figure 89	42.277	13.554	cross	ccw	6.5	Sandy gravel
Figure 90	42.277	13.554	monument	ccw	6.5	Sandy gravel

Locality: San Demetrio

Figure 91

Figure 92

	Lat.	Lon.	Object	Direction	I MCS	Geology
Figure 91	42.286	13.561	chimney	cw	6.5	Sandy gravel
Figure 92	42.292	13.57	column	ccw	6.5	Sandy gravel

Locality: San Martino d'Ocre

Figure 93

	Lat.	Lon.	Object	Direction	I MCS	Geology
Figure 93	42.273	13.477	chimney	cw	7	Calcarenite

Locality: Santo Stefano di Sessanio

Figure 94

	Lat.	Lon.	Object	Direction	I MCS	Geology
Figure 94	42.343	13.645	chimney	cw	6.5	Massive limestone

Locality: Tempera

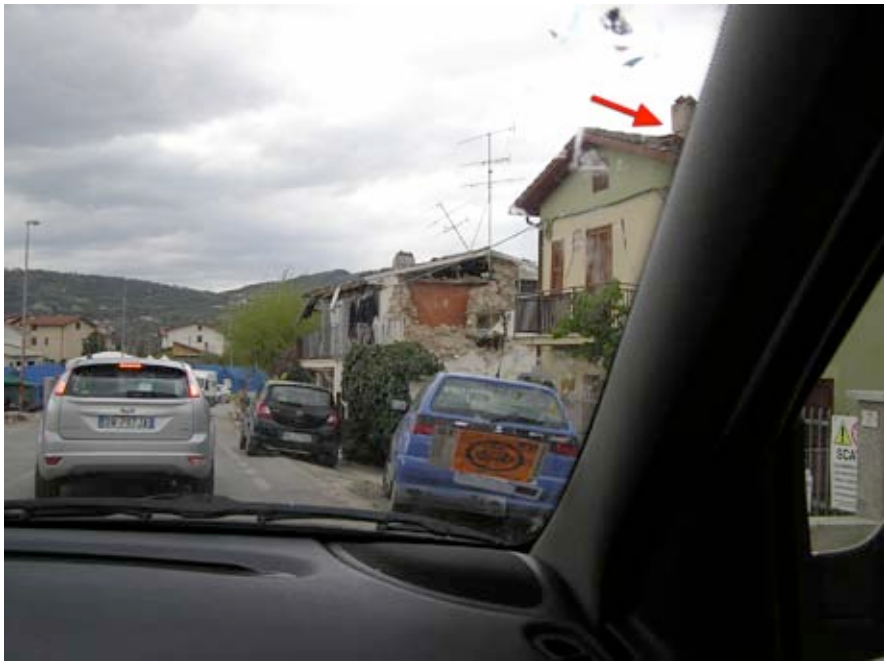

Figure 95

	Lat.	Lon.	Object	Direction	I MCS	Geology
Figure 95	42.367	13.458	chimney	ccw	9	Sandy gravel

Locality: Torre de' Passeri

Figure 96

	Lat.	Lon.	Object	Direction	I MCS	Geology
Figure 96	42.244	13.933	chimney	ccw	6	Sandy gravel

Locality: Vallecupa

Figure 97

Figure 98

Figure 99

	Lat.	Lon.	Object	Direction	I MCS	Geology
Figure 97	42.253	13.574	vase	not available	7.5	Sandy silt
Figure 98	42.254	13.575	statue	cw	7.5	Sandy silt
Figure 99	42.252	13.575	chimney	ccw	7.5	Sandy silt

Locality: Villa Sant'Angelo

Figure 100

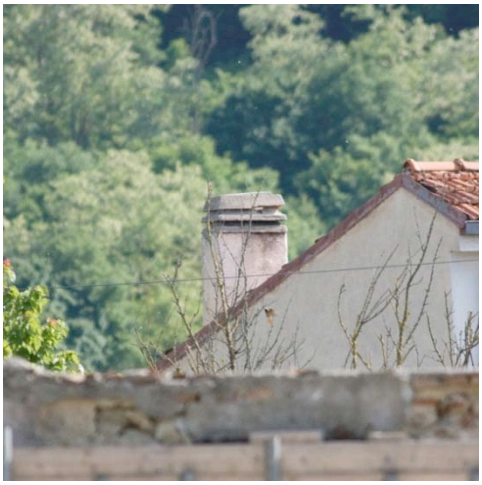

Figure 101

Figure 102

Figure 103

	Lat.	Lon.	Object	Direction	I MCS	Geology
Figure 100	42.27	13.538	chimney	ccw	9	Gravel
Figure 101	42.27	13.538	chimney	cw	9	Gravel
Figure 102	42.27	13.537	chimney	cw	9	Gravel
Figure 103	42.269	13.533	chimney	ccw	9	Gravel

Locality: Villa Sant'Angelo

Figure 104

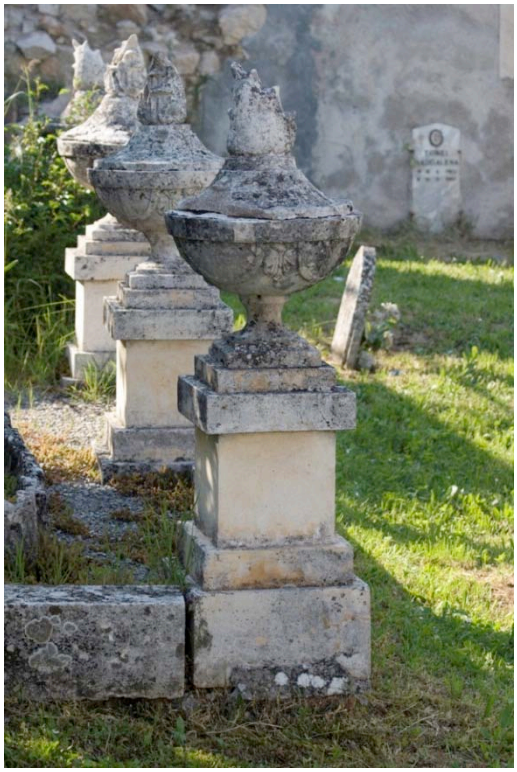

Figure 105

Figure 106

	Lat.	Lon.	Object	Direction	I MCS	Geology
Figure 104	42.265	13.536	gravestone	ccw	9	Sandy silt
Figure 105	42.265	13.536	pillar	ccw	9	Sandy silt
Figure 106	42.265	13.536	tombstone	cw	9	Sandy silt

Locality: Villa Sant'Angelo

Figure 107

	Lat.	Lon.	Object	Direction	I MCS	Geology
Figure 107	42.265	13.536	monument	ccw	9	Sandy silt

Acknowledgements

Ina Cecic, Matjaz Godec and Tiziana Tuvé provided some of the photos of the dataset.

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Daniela Riposati | Laboratorio Grafica e Immagini | INGV

Via di Vigna Murata, 605
00143 Roma
Tel. +39 06518601 Fax +39 065041181

http://www.ingv.it

Istituto Nazionale di Geofisica e Vulcanologia