

Hydromagmatics eruptions and quaternary paleoseismicity at Campo de Calatrava, Ciudad Real, (Spain)

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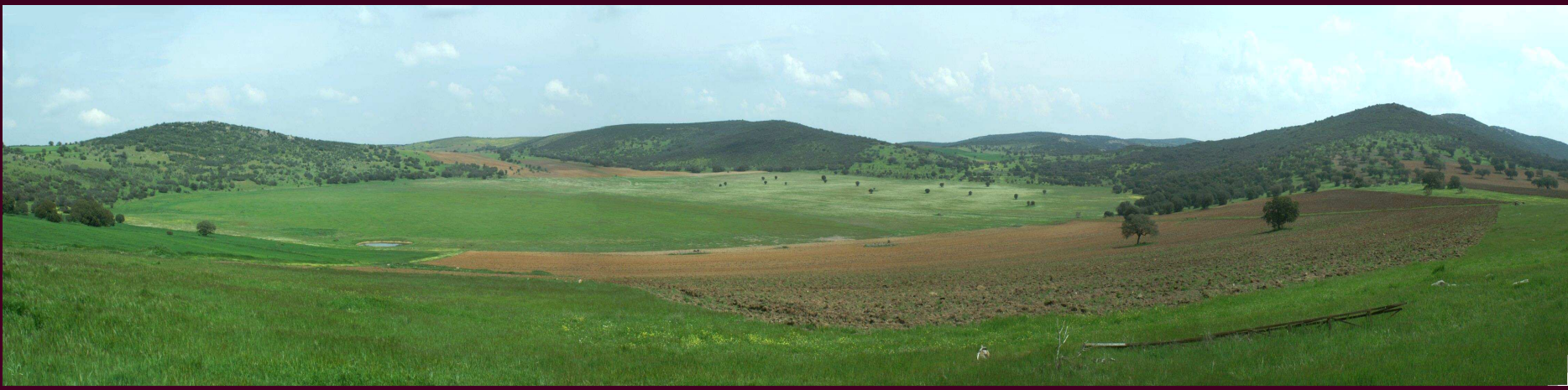
1.INTRODUCTION.

Campo de Calatrava is a natural unity located in the centre of the province of Ciudad Real (central Spain) where some eruptive cycles of different intensity, spatial location and temporality along more than 8 My. took place. Eruptions of this volcanic system derive from the rise of alkaline magmas rich in CO₂, caused by a mantelic anomaly located to little depth under the region, without any development of the processes of magmatic differentiation of them. This has caused some eruptive events of low explosivity (Hawaiian and Strombolian eruptions), characterized by the emission of pyroclasts (cinder cones and spatter cones) and fluid lavas (shield volcanoes and lava flow). The interaction of the magma with the subterranean or sub-superficial water has allowed the development of high explosivity events (hydromagmatics) with formation of wide depressions (maars and tuff ring) and the development of pyroclastic flows (base surge). More than 300 volcanic edifices which are laid out along more than 5,000 km² have been classified.



CAMPO DE CALATRAVA

Pyroclastic flows deposits affected by earthquake. (South of Ciudad Real)



Maars, pyroclastic flows and mud flows of Campo de Calatrava

3.HAZARDS

The latest eruptions of Campo Calatrava occur in the middle Holocene (González et al., 2007 and 2008), makes the area potentially active, and have a hydromagmatic character. Deposits of these events cover hundreds of square kilometers centered under urban areas they most dynamic and fastest growing population (150,000 inhabitants)

Recently have been found (Rodríguez & Barrera, 2002) the existence of significant seismic events (M= 7.5) affecting these deposits. The traces of this paleoseismicity (Alfaro et al. 1995), -Pleistocene-Holocene- have been located in many areas of the volcanic region, with appreciable effect of liquefaction (González et al 2010).

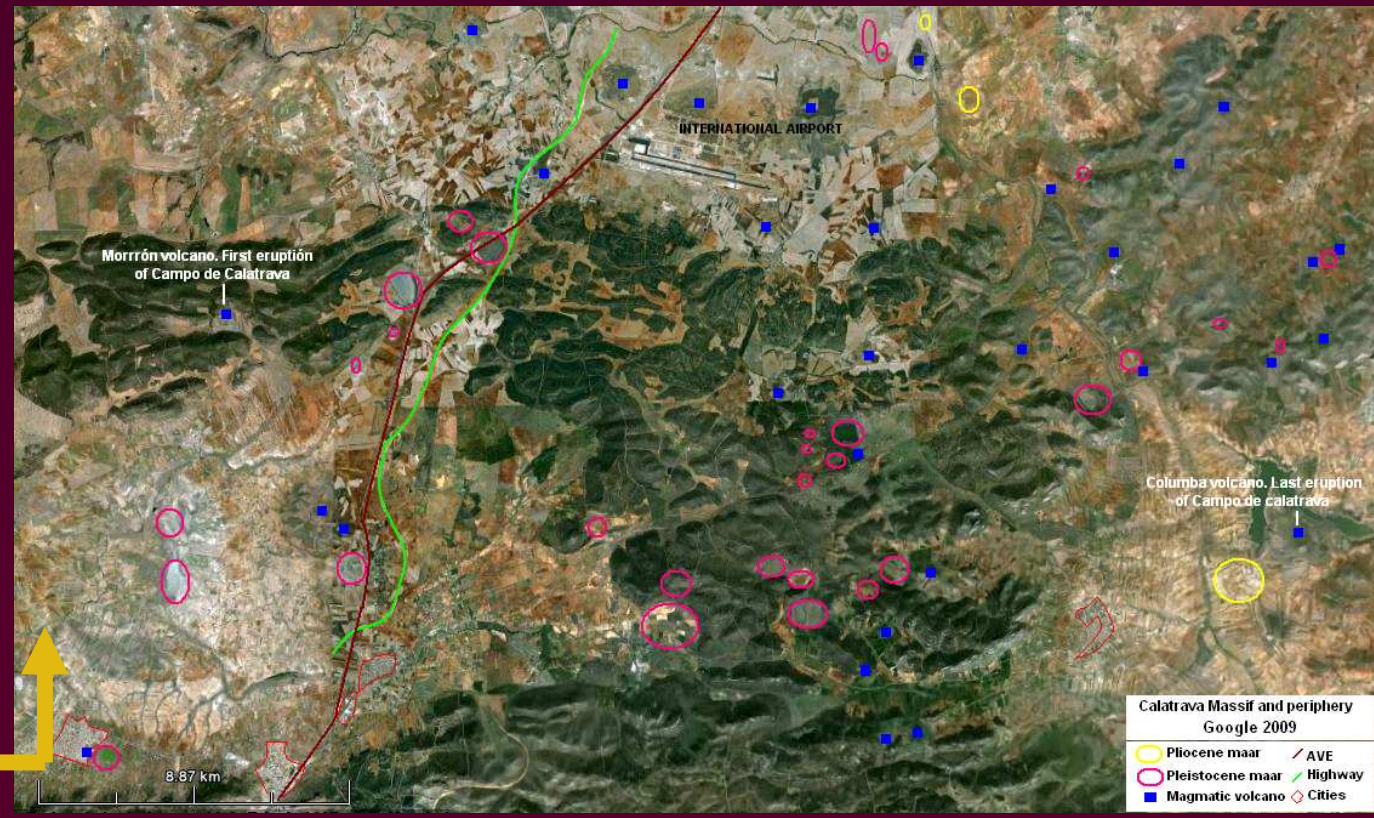
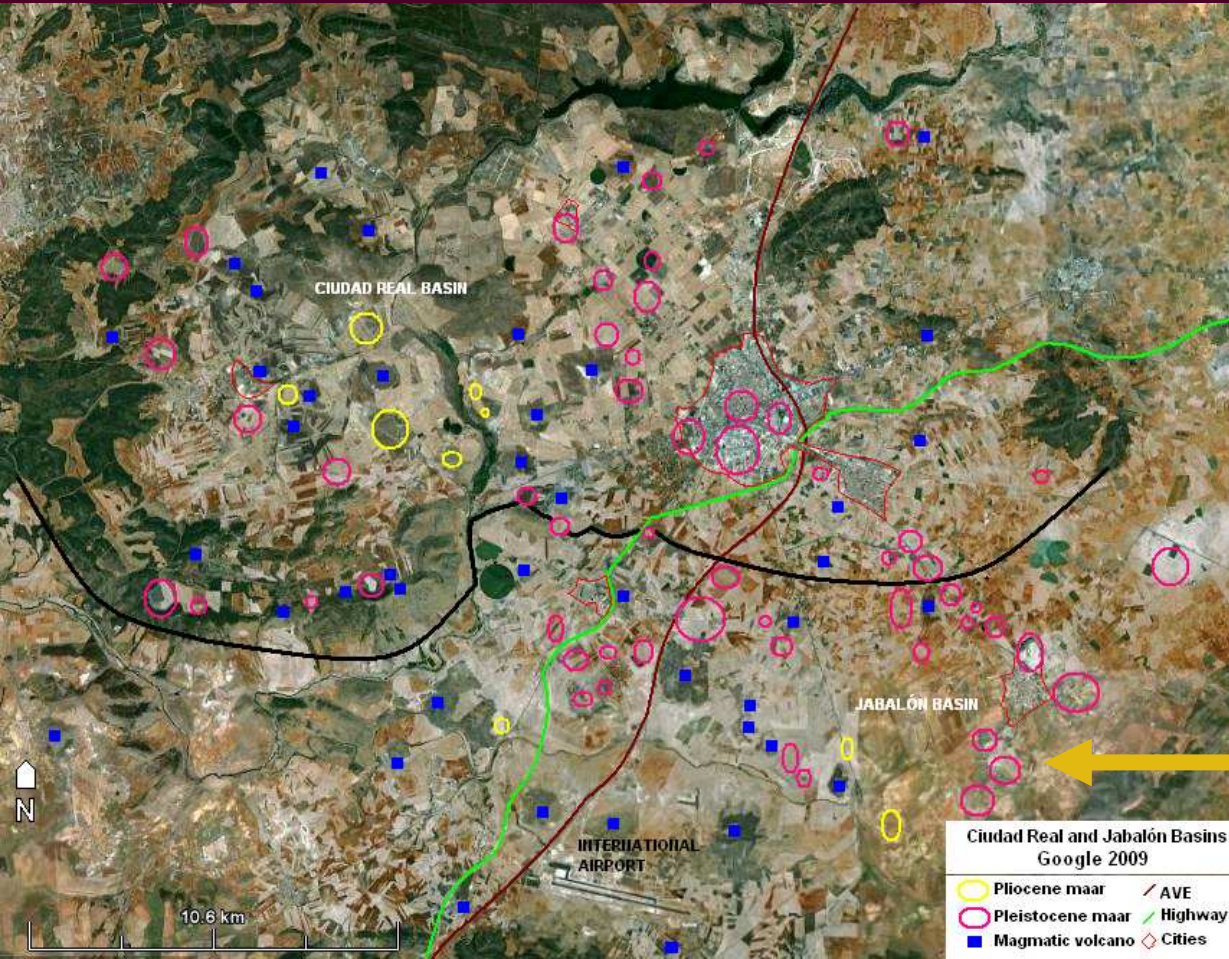
Cities of “Bronce Ibérico” as La Encantada (2000 BC) have damage caused by earthquakes (García-Meseguer, oral communication).

If there were an seismic event, volcanic or volcanic-seismic as those carried out in the recent Quaternary, in the same areas, the effects would be very dangerous in the biggest cities. (Ciudad Real and Puertollano) and have an impact on communications infrastructures: highways, AVE and airport, and also on industrial areas of risk as the petrochemical complex in Puertollano.

2. HYDROMAGMATIC DYNAMICS

In Campo de Calatrava, the landforms derived from the hydrovolcanic activity are conditioned by the water location which interacts with the magma and the strength of the materials over the explosion is developed (González, 2002). On the other hand, the presence of geothermal systems or the presence of magma docks which no outcrop to the surface, it has determined an important phreatic activity which forms differ from the derived ones of the phreatomagmatic activity. Maars are the most widespread morphologies in Campo de Calatrava, characterized by the presence of an explosive depression opened under the pre-eruptive topographic surface. In the hard and fragile rocks of the hercynian base, the craters present very craggy and rough internal walls, with drops up to 150 m. They usually lacks of tuff rings and if they have they are incomplete when channeling the pyroclastic flows by paleovalleys. The open craters in sedimentary basins are subcircular or subelliptic, and they are surrounded by well defined tuff rings

The phreatic and phreatomagmatic crisis are accompanied of the emission of explosive breccias, pyroclastic flows, lahars and mudflows. In the center of the volcanic region has produced the largest number of phreatomagmatic events in two areas of the major concentration: a) Ciudad Real and Jabalón river basins, b) Calatrava Massif.



Phreatomagmatic vents in Campo de Calatrava

Liquefaction effects under Ciudad Real



Deposits of Rinconcillo volcano

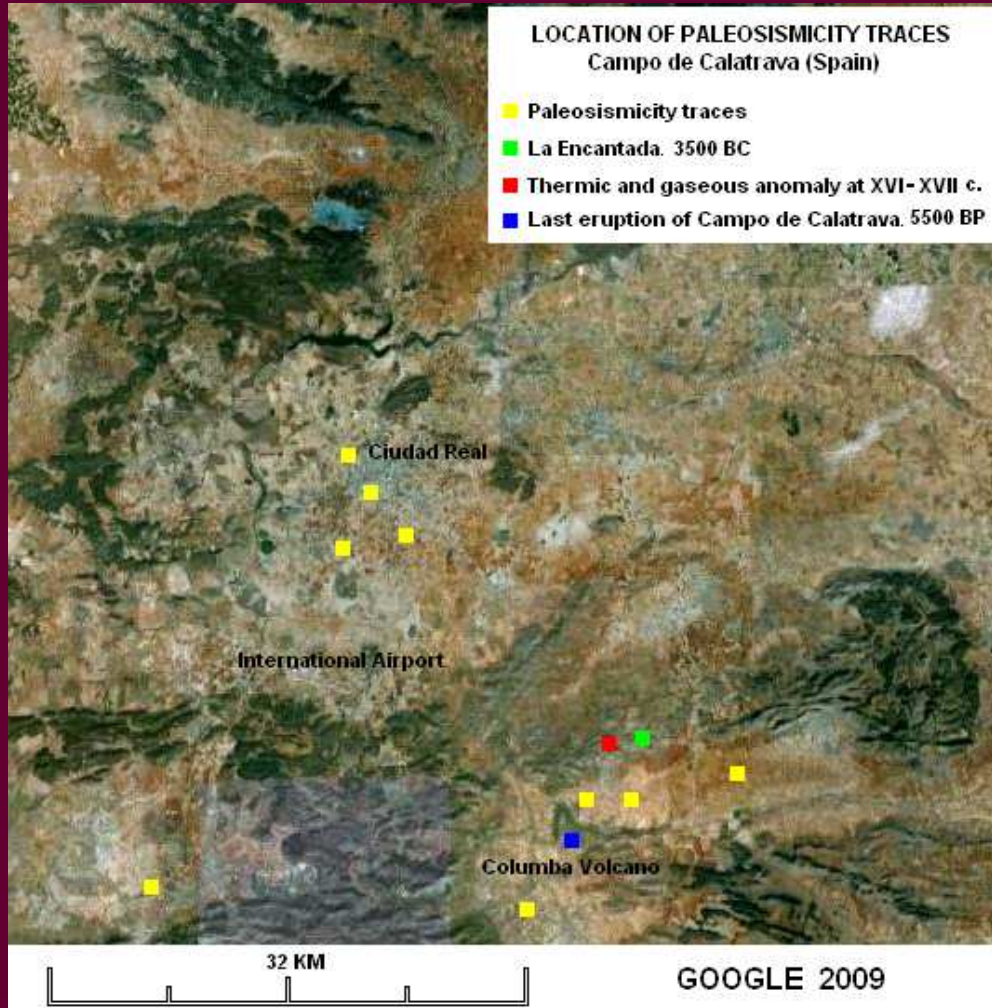


Deposits in Ciudad Real



Paleoseismicity at Campo de Calatrava

Tuff ring of Granátula maar



4.CONCLUSION

The phreatic and phreatomagmatic activity was very intense in the Campo de Calatrava throughout all periods of its eruptive history, with special emphasis on the Pleistocene. Major cities are located within maar or lie on the deposits of its eruptions, traces of paleoseismicity are found in many areas of volcanic deposits affecting those who identify traces of liquefaction. The last eruption of the Campo de Calatrava has an age of 5500 years minor. This eruption was a character pheatomagmatic with emission of multiple base surges. Phreatomagmatic events currently affect a large number of people and vital centers for the development of this territory.

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