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Archeoseismological, paleoseismological and GPR investigations in the Roman Ruins of Baelo Claudia (southern Spain)

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The Roman archeological site of Baelo Claudia (Cádiz, South Spain) is located within the Gibraltar Arch, a region with no significant recent or historical seismicity. Previous studies emphasized the occurrence of repeated strong archeoseismic damage (intensity 8805; IX MSK) at Baelo Claudia. In the 1st century, an earthquake destroyed wide parts of the infrastructure, but due to the economic importance the city was rebuild. Later in the 4th century, another destructive quake hit the city. It can be observed in the ruins - the columns and walls fell on clean pavement and are still preserved in this situation - that the event marked the end of roman settlings in this place. Yet the seismic source of the earthquakes is not clear. Paleoseismological studies showed, however, that both the Carrizales and Cabo de Gracia Faults in the immediate environs of Bolonia might produce a seismic event big enough to destroy the city. A multidisciplinary study has been carried out including the detailed mapping of surface deformations and building damage, surface geology and geomorphology, collection of structural data, and an extensive ground penetrating radar survey. The obtained data are not con-

clusive when considered separately, but evident links between archeoseismic damage, structural and GPR data indicate that the destruction of the city was linked to seismic shaking. For the geophysical survey, 7 km of radar profiles have been collected in the ruins, using the 300 MHz GSSI antenna and the SIR2 system in most cases. In addition, some 240 cm low-frequency profiles have been taken in order to image the deeper structures of the area. We aimed to find out whether there are coseismic features like landslides and liquefaction or even buried faults inside the ancient city walls. As well, we expected tilted or destroyed walls and buildings that are still covered by the post-roman colluvium. The data document earthquake-related damages like fallen boulders and tilted walls. The post-roman colluvium can be distinguished from the older sediments. This border marks the event horizon of the last earthquake after which the settling stopped. The colluvium thickness (or the depth of the sliding horizon) provides information about erosion and sedimentation processes in the area. Furthermore this knowledge allows to determinate promisingly locations for probing and/or trenching. In parts of the ruins, it was possible to detect a landslide body and to determine its dimensions.