



Anthropogenic versus Seismogenic Causes of the Rotation of a Lycian Sarcophagus in Pınara, SW-Turkey

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A Lycian sarcophagus located in the ancient city of Pınara, southwest Turkey, shows a clockwise rotation of 5.37° with respect to its North-South oriented foundation. The city of Pınara was occupied from the Lycian period, through Roman times to the Byzantine era. Considering the seismotectonic potential of the area and numerous other indications of earthquake related damages in the archaeological site, this rotation has also been attributed to earthquake ground motion before. We present a 3D model of the sarcophagus constructed out of 12 million points from a 3D laser scan. The sarcophagus has a foundation block directly worked out of the outcropping rock. On top of this is a 2.46×1.67 m and 0.91 m high base block on which the 1.64 m high coffin and lid of the same height are resting. The sarcophagus shows a crater in the eastern side of the coffin, which was most probably caused by the detonation of an explosive charge during a looting attempt. The direction of the rotation agrees with the sense expected from the blast. Therefore the question arises whether the rotation has a natural, seismogenic, or an anthropogenic cause. A rigid block model of the sarcophagus with a total weight of 26.5 t was derived from the laser scan with application of CAD. With the rigid block model we studied the feasibility of two alternative sources as the cause for the rotation of the coffin: an explosion and earthquake ground motion. Scaled recorded ground motions from local earthquakes and a strong motion record from the recent L'Aquila, Italy, earthquake were used to study the sarcophagus dynamic reactions to earthquake motions. The geometry of the structure requires large ground motion amplitudes to initiate rocking. However, rocking is necessary to produce rotation around the vertical axis by translational movements. The size of the explosion is back calculated from the crater size and compared to the duration and amplitude of an impulse necessary to rotate the coffin. All earthquake simulations produced only minimal vertical rotations of the structure and in all cases the differential movement between the base block and the coffin was insignificant. The simulated blast impulse however was capable to rotate the coffin with respect to the base block. The minimal rotations from earthquake simulations and the plausible explosion charge necessary to rotate the coffin by the observed amount suggest that looting is the probable cause of the misalignment of coffin and base.