THE ORBIT OF THE ORGUEIL METEORITE FROM HISTORICAL RECORDS.

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Introduction: Establishing a link between meteorites and their parent bodies is a key issue in planetary sciences. So far, the orbits of only four meteorites have been precisely established by photographic camera networks, while video technique and satellite observations have helped establish three less precise orbits. All these meteorites originate from the main asteroid belt.

The Orgueil meteorite is a CI1 chondrite that fell in southern France more than a century ago, May 14th 1864, shortly after 8 pm. Orgueil is a cornerstone and puzzling meteorite since it is chemically pristine but highly processed by hydrothermal alteration. The chemical composition of CI1 chondrites is virtually identical to that of the solar photosphere, defining the cosmic abundance [1]. Determining the orbit of Orgueil would help to constrain the origin of CI1 chondrites. We have used the primary records of the fireball observations across France to constrain a 'paleo-orbit' for the Orgueil meteorite, 140 years after it fell.

Results: Our orbit reconstruction is based on the cross-checked examination of all reported fireball observations, most of which can be found in Daubrée [2]. The atmosphere entry point is estimated to be H=70 km, Lo=0.26°W, La=44.29°N and the meteoroid terminal point is estimated to be H=19 km, Lo=1.34°E, La=43.89°N, after a luminous path of almost 150 km. The atmospheric trajectory we calculated is similar to that determined from Laussedat [3]. The argument of perihelion (326-332°), the longitude of ascending node (234.5°) and the inclination (1.3-2.7°) depend little on the fireball velocity, contrary to the semi-axis and eccentricity. The semi-axis varies from 2.4 AU to 13 AU and the eccentricity between 0.59 and 0.93. The identified orbits range from typical Apollo asteroid orbit (low entry velocity) to Jupiter family comets orbits (high entry velocity). We will discuss at the conference the likely velocity of the Orgueil fireball, and propose a most probable orbit for the Orgueil meteorite. Comparison with other meteorite orbits will be made [4,5], and constraints on the origin of CI1 chondrites will be proposed.

References:

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