TEKTITES: WHY ARE THEY ON THE EARTH, BUT NOT ON THE MOON?

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Tektites are a group of natural glasses that have puzzled mankind for many centuries. After centuries of collecting, and decades of study, we are now closer to an understanding of their origin. First, though, what are tektites? They are chemically homogeneous, often spherically symmetric objects that are in general several centimeters in size, and occur in four known strewn fields on the surface of the Earth. Strewn fields can be defined as geographically extended areas (in the case of tektites larger than just a few square kilometers) over which tektite material can be found. Four such strewn fields (all of Cenozoic age) are known (North American, Central European, Ivory Coast, and Australasian). Traditionally there have been four explanations for the possible origin of tektites – that they are ejecta of impacts or volcanic eruptions on the Earth or the Moon. Until the 1960s, the lunar volcanic hypothesis was predominant. Any discussion of the origin of the tektites needs to explain the similarity of tektites in respect to age and certain aspects of isotopic and chemical composition within one strewn field as well as the existence of tektite material with different compositions present in each strewn field. In general, the major and trace element composition of tektites is almost identical to the composition of the terrestrial upper crust. This fundamental observation was made mainly by S.R. Taylor and co-workers, who, during the 1960s and 1970s, have performed detailed geochemical studies of many tektite types. Mainly due to these and later chemical and isotopic studies, it is now commonly accepted that tektites are the product of melting and quenching of terrestrial rocks during hypervelocity impact on the Earth. The determination of the exact source rocks of tektites is complicated because a variety of target rocks was apparently sampled by each impact event. However, for three of the four strewn fields, source craters have been identified already based on chemical, isotopic, and chronological arguments. Numerical simulation calculations even provide plausible mechanisms that explain how tektites form during an impact event. If tektites are just early-phase distal impact ejecta, the question arises why they have not been found on the Moon. There are probably several answers to that question. First, finding tektites on the Earth by chance on a few selected places are near zero – just as they might be on the Moon, finding tektites at the few Apollo and Luna landing places. Tektites are rare on Earth, too. Second, tektites on the Moon would be different anyway, because surficial melts on the Moon would be made from the lunar surface – mostly regolith – and would, thus, be rich in meteoritic material (tektites on Earth have a very small meteoritic component). Also, tektites on the Moon would have a totally different composition than on the Earth, with no rocks similar to the silica-rich terrestrial upper crustal rocks present. There are some gram-sized melt bombs in the Apollo 16 collection, possibly from the (nearby) South Ray crater, and some small ropy glasses in the Apollo 12 collection, which might be ejecta in a ray from Copernicus, but all this needs to be quantified and confirmed if such glasses could represent tektite analogs. One conclusion remains: tektites are a „local“ product and did not travel through interplanetary space.

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