

## **Study on the relationship between bubble-like caves and tafoni in the Laoshan granites, Shandong, China**

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At present, the debate regarding the Quaternary glacier of eastern China has risen once again. Actually, the origins of so-called “glacial pothole” in different locations, different landforms and different rocks are different. In recent years, some scholars have put forward that there is a lot of Quaternary glaciers relics in Laoshan, Qingdao, Shandong Province, one of which is the “glacial pothole”, but the fact that Laoshan is composed of “miarolitic granite” has been neglected. In this region, miarolitic caves with diameters of several cm are very highly developed with influences on the formation of tafoni, which is clearly an inevitable factor. Through multiyear investigations, it has been found that there is a large number of Laoshan granitic miarolitic caves with diameters of 1-2 m and maximum diameter of 3.1 m (bubble-like caves). These caves are nested in the cliff bedrock, and are characterized by spheroid shape, round and smooth cave walls, and are fresh without weathering. Clearly, such large granitic native caves are not specified in classic geology, in which their geneses are the same to granitic miarolitic caves. However, many miarolitic caves have no crystals, and these are known as “bubble-like caves”.

In Type-A Laoshan granites, some large bubble-like caves are found, i.e. miarolitic caves, with a maximum diameter of 3.1 m, significantly larger than that of previously reported granite miarolitic caves, providing new geological knowledge. This is of important significance to the research regarding the native environment for the formation of Laoshan granites. Meanwhile, the real genesis of the “tafoni” micro-topography in the Laoshan granites may be revealed. This discovery also affirms a new genetic type in speleology, the “granitic bubble-like cave”. Granitic bubble-like caves are rare geological relics with high ornamental, popular science and tourism value.

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