

Airburst impact origin hypothesis of Taihu lake basin in Southeast of China in around 7000 years ago. Zhidong Xie, Shuhao Zuo. State Key laboratory for Mineral Deposits Research, School of Earth Sciences and Engineering, Nanjing University, Nanjing, P. R. China, zhidongx@nju.edu.cn.

Introduction

Taihu lake is the third largest freshwater lake in Southeast of China. The diameter of Taihu lake is about 65 km; the water depth is very shallow and its deepest part is only 3 meters. The bottom of the lake is pretty flat with a very gentle slope, and very young with a hard loess layer which extended to vicinity area, which are dated to only 11k to 12k years ago. Several origin hypotheses of the Taihu lake formation were proposed in recent 60 years, including the origins of tectonic, lagoon, volcano, etc., but none was seriously studied in detail.

The rounded arc shape of southwest of Taihu lake led some geologists to doubt that it was created by a meteorite impact. In the early 1990s, an impact origin was proposed on the basis of fractured quartz, wavy extinction of quartz grains, and claimed shatter cones^[1,2]. However, deformation of quartz and the circular structure can have multiple interpretations. There are no clue when the impact were happened in these proposals. The impact origin hypothesis is very difficult to explain the unique features of Taihu lake, such as wide-shallow-flat-young lake bottom. The impact origin hypothesis has fallen into disfavor, and gradually died out.

Recently, some unique rod-shaped and irregular shaped siderite-quartz-rich materials were found in specific mud layer in vicinity of Taihu lake. The discovery of these materials combining with previous claimed impact evidences revived the impact hypothesis in 2009^[3]. The irregular shaped siderite concretions were regarded as an ejecta materials of impact. However, many questions still remain.

Results

The term “concretion” is used in this paper to indicate the texture of these siderite-quartz rich materials, not infer the sedimentary origin. These concretions consist of aggregates of μm -sized siderite spheroids or siderite crystals as concretion matrix and μm -sized angular quartz grains as matrix debris. Quartz grains are angular with sharp edges and corners. The ration of siderite to the quartz ranges from 80% to 10%.

The sizes of concretions range from μm to cm. Micron-spherule, lapilli, rod and irregular concretions were found widely dispersed in a specific mud layer in the vicinity of Tai lake, while rod concretions were found vertically in the mud layer in Shi Lake. Regular ripples and furrows are common in the surfaces of the rod-shaped and irregular-shaped concretions. In addition, some concretions are sporadically found in higher ground, such as piedmont, hills top or hill slope, not in

lower lake bottom.

The age of mud layer contained siderite concretions were constrained by peat woods and shell by using C14 dating, indicating a non-calibrated age of ~ 7000 years ago, indicating the concretions formed later than 7000 years ago.

Discussion:

The vertical occurrence of rod concretions and the widely distribution features suggest the siderite concretions either grow from bottom or come down from air. Based on the observation and preliminary results of siderite concretions, the origin of the siderite concretions could be explained by three distinct mechanisms: aqueous deposition within the mud, volcanic lapilli formation and lapilli formed in the ejecta plum of an impact. The round shape of Tai lake has been use as evidence of an impact, but the large size and shallow depth of the lake are inconsistent with a young impact structure.

In addition, the recent work on deformation features of quartz grain of sandstone of Taihu lake area does not provide strong and confirmed evidence of impact origin^[4]. The conclusion suggest the impact related evidences by quartz done in twenty years ago need to be re-evaluated and the strong support evidences for the 2009 paper^[3] are negative, and the conclusion of confirmation of impact crater of Taihu lake needed be caution.

An alternative impact model that could produce a shallow crater without major crustal disruption is an aerial burst of an impact. The airburst impact hypothesis may explain the features of huge, shallow, flat, young of Tai Lake basin, and the deformation features caused by relatively lower pressure. The strange and unique siderite concretions containing abundant angular quartz debris may provides evidences for the airburst impact hypothesis. The unique morphology, occurrence, distribution, and mineralogy of these concretions indicate a unique origin, more likely formed by airburst rather than aqueous deposition. It is rewarded and valuable to intensively study the formation origin of Tai Lake by multiple approaches.

References: [1] Y. He, D. Xu, D. Lu et al., 1990. *Chinese Science Bulletin*, 36 (10): 847-850. (in Chinese). [2] E. Wang, Y. Wan, Y. Shi, et al. 1993. *Chinese Science Bulletin*, 39 (5): 149-423 (in Chinese). [3] H. Wang, Z. Xie, and H. Qian, 2009. *Geological Journal of China Universities*: 15: 437-444. (in Chinese). [4] Y. Dong, Z. Xie, and S. Zuo, 2012. *Geological Journal of China Universities*: 18: 395-403. (in Chinese).