The occurrence and mineralogy of iron-rich spherules of Taihu lake suggest they likely were airburst fallout rather than groundwater colloidal deposition

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Fe-rich concretions including spherules occur in the vicinity of Taihu lake, Southeast of China. Their formation is the key to answer the origin of Taihu lake basin. Many hypotheses of the basin origin were proposed, such as lagoon tectonics impact [1-4]. Abundant Fe-rich spherules were reported in the bottom of Taihu lake as Fe-Mn concretions [5]. Wang and others suggested that Fe-rich concretions including Fe-rich spherules were ejecta [4]. Huang and Liu stated these concretions were the limonite concretions from groundwater [6]. This paper is to discuss the origin of the Fe-rich spherolitic concretions whether it is related to an airburst fallout deposition, or a groundwater colloidal deposition in mud layer [7, 8]. The mud layer containing Fe-rich concretions was sandwiched between bottom hard loess and top modern mud, and can be found almost everywhere in the vicinity of Taihu lake. The C14 age of the specific mud layer with concretions is about 7kyr-8kyr [7, 8]. The hard loess as lower sandwich slice has the age of ~11kyr- 20kyr [5]. The modern mud layer as upper slice has the age of ~3kyr-4kyr [9]. The longitudinal age discontinuousness and lateral scattering continuousness of the mud layers indicate that the formation of the layer bearing Fe-rich concretions were more likely related to one event in a short time.

The microstructure and mineralogy of the Fe-rich spherules are not similar to Fe-Mn concretions and limonite concretions. The spherules have typical sizes ranging from half to 3 mm with a 10-20 micron shell. SEM images show the spherules consist of Fe-rich cement, angular quartz grains and clay minerals. EDS data indicates the elements of the Fe-rich cement contain Fe, O, Si, Al and C. Powder XRD confirmed that minerals in spherules include quartz, siderite, limonite, feldspar, clay, and element carbon. HRTEM results are consistent to SEM and XRD results, and show many aggregates of several tens nanometer minerals and abundant sub-micron element carbons in spherules. Based on observation, Fe-rich spherules are more likely formed by accretion of small solid particles within an airburst vapour plume [7, 8], rather than groundwater colloidal deposition.

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