

Phosphate Deposits in the Ediacaran to Early Cambrian Sediment Suite in South China: The Beginning of Widespread Authigenic Calcium Phosphate Formation

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Ediacaran to early Cambrian economic phosphate deposits occur within a broad belt from SW to Central China in the Yunnan, Guizhou, Sichuan, Hubei, Hunan and Jiangxi Provinces with major mining operations, e.g. in Kunyang, Kaiyang, Weng'an, Jingxiang, Yichang, Dongshanfeng, Chaoyang. The deposits are China's main source of phosphate rock with China being the fifth largest producer in the world (USGS 2003) and comprise the second biggest known reserve of phosphate rock.

The Neoproterozoic to Cambrian transition is the time interval of the most drastic global environmental change in Earth history. Changes in the chemical composition of the ocean during the aftermath of the snowball/slushball Earth as well as in the sediment properties due to the invention of benthic metazoan life affected the pathways of authigenic mineral formation in sediment systems. This environmental reorganization is well expressed in the marine formation of authigenic phosphate minerals. Authigenic aluminum phosphates (lazulite, augelite, trolleite, svanbergite, goyazite, crandallite, berlinite, xenotime) are common in sedimentary systems since the Archean. Ca-phosphate deposits (francolite), well-known from the Phanerozoic, are almost absent. These conditions changed with the formation of the first 'calcium phosphate giant' in Earth history during the Ediacaran. This period of worldwide and widespread formation of sedimentary calcium phosphate deposits was followed by the Early and Middle Cambrian phosphate giants, altogether one of the most important intervals of sedimentary phosphate deposition in the Phanerozoic. The probably best study area in the world for the important beginning of the Ca-phosphate deposition and the formation of economic phosphate deposits is the Yangtze platform in South China.

The Ediacaran to early Cambrian sediment suite of the Yangtze Platform, which rests on the Nantuo glaciogenic sediments and the cap carbonates, is composed of partly silicified black shales, cherts, phosphorites and shallow marine carbonates. The Ediacaran succession resembles the widespread, organic matter-rich Doushantuo Formation overlain by the Dengying platform carbonates, mainly carbonate bindstones, interfingering with the dark shales and cherts of the Liuchapo Formation at the platform margin. The Precambrian/Cambrian boundary is a disconformable contact overlain by organic matter-rich Lower Cambrian black shales, phosphorites and dark carbonates of various formations. Phosphorites and phosphate sediments are composed of a wide spectrum of fabrics including in-situ fabrics such as phosphatic mudstone and concretions as well as various granular phosphate grains.

The Al- and Ca-phosphate mineral phases and their geochemistry are being investigated in an ongoing study in order to reveal the style of authigenic mineral formation and the diagenetic processes, and to trace the environmental changes during the Precambrian-Cambrian transition.

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