

## **Mineral structure of black talc from Guangfeng County, China: implications to its formation and material properties**

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Superlarge unusual black talc deposits (more than half a billion tons) between dolostone layers of the late Neoproterozoic Dengying Formation were discovered in Guangfeng County, Jiangxi Province, southeastern China. The ores exhibits primarily oolitic structures and consists mainly of talc (30–70 wt%), dolomite, and quartz. The black talc crystals are ultrafine nano-plates and its chemical composition is close to pure white talc. Raman spectra and X-ray photoelectron spectroscopy results reveal that the black talc contains small amounts of carbonaceous matter with some structural disorder and impure bonds instead of perfectly structured graphite or graphene, causing the black coloring. Z-contrast transmission electron microscope imaging shows that isolated graphene-like carbon is interstratified with the octahedral–tetrahedral (T–O–T) layers of talc.

Based on the structure of black talc, we propose a sedimentary formation mechanism for the black talc. The black talc was formed through co-precipitation of 1~2 unit cells thick T–O–T layers of Mg-silicates with abundant organic matter in a shallow marine or lagoonal environment. The organic matter may have facilitated the precipitation of Mg-silicates and further diagenesis and re-crystallization of the biomass-coated precursor resulted in the formation of the black talc. The ultra-tiny sizes of black talc make its Brunauer-Emmett-Teller specific surface areas (15.7 to 23.2 m<sup>2</sup>/g) much higher than those of white talc (normally lower than 5.0 m<sup>2</sup>/g). And the interstratification structure of graphene-like carbon with T–O–T layers make black talc a natural organic–clay material that may have potential industrial applications.