



## **Authigenic quartz and its origin in the tight sandstone of the Permian Upper Shihezi Formation in Gaoqing area, Dongying sag, China**

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Great oil production benefit has been found in the tight sandstones of the Permian Upper Shihezi Formation in Gaoqing area, Dongying Sag. Authigenic quartz is a significant cementing material in these sandstones, significantly reducing porosity and permeability. For effective exploration and production, the mineralogical characteristics of authigenic quartz and its origin was systematically studied. Composition of the sandstones consists of quartzarenite and minor amounts of clay minerals (Kaolinite and illite). Three distinct, separate phases of authigenic quartz (referred to as I, II, and III) were distinguished by cathodoluminescence microscopy. The I quartz mainly takes the form of quartz overgrowth, forming at approximately 86.4-114 [U+2103]. It generally shows a light brown luminescence with sacnned CL at the 550nm and 650 nm. The composition of the I quartz is similar to detrital grains. The II quartz takes the forms of quartz overgrowth, microfracture-healing quartz, pore-filling quartz, and microquartz, forming at approximately 100-140 [U+2103]. It generally exhibits non-luminescence with sacnned CL in the 420-480nm range. Li, Al, Ca, Fe, Ge and Ba elements are abundant in the II quartz. The III quartz takes the form of quartz overgrowth and microquartz. It generally exhibits dark brown luminescence with sacnned CL at the 570nm and 650 nm. Al, Mg and Fe elements are rich in the III quartz. Sources for authigenic quartz include internal and external silicon. The internal sources are pressure solution of quartz grains, dissolution of feldspars, and illitization of smectite. External sources include the silicon from mudstone at the top of the sandstones and deep hydrothermal fluids. Source of the I quartz is mainly pressure solution based on the micro-stylolites and similar chemical composition to the detrital grains. Subsequently, the Permian in the Gaoqing area was uplifted and intensely eroded. The dissolution of feldspar and conversion of a small amount of clay minerals occurred, which provided the mainly sources of the II quartz. With the increase of burial depth and temperature, a large amount of smectite was transformed into illite, which provided the mainly sources of the III quartz. The silicon from the mudstone and deep hydrothermal fluids is also a significant source during the growth of the authigenic quartz. The authigenic quartz can destroy both porosity and permeability, which is the main reason of reservoir densification.