

Rare occurrence of jarosite-alunite solid solutions with intermediate Al-Fe contents in the Jurassic Aztec Sandstone, Nevada, U.S.A.

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ABSTRACT

Experimental studies have demonstrated that solid solutions of minerals from the alunite group, with chemical compositions intermediate between the Al and Fe end-members, can be readily synthesized in the laboratory. In contrast, up until about a dozen years ago, there were no confirmed reports of alunite group minerals with intermediate Al-Fe compositions in natural settings, leading some to suggest that minerals with such compositions might not exist in nature. In recent years, however, alunite group minerals with intermediate Al-Fe compositions have been documented in a few isolated locations, which were previously limited to basalt-hosted acid-sulfate fumarole deposits and acid mine drainage pit lakes. These occurrences contrast with nearly all other reports of minerals from this group, whose measured chemical compositions are very close to either the Al or Fe end-members. Here, we report jarosite-alunite solid solutions containing approximately equal amounts of Al and Fe, which are found in mineralized fractures of the Aztec Sandstone in southeast Nevada. Analysis of the minerals by X-ray diffraction, Raman spectroscopy, and visible-near infrared spectroscopy confirms that they are bona fide solid solutions and not intimate mixtures of end-member minerals. This study represents the first documented occurrence of alunite group solid solutions with intermediate Al-Fe compositions in sedimentary rocks. The results further demonstrate that alunite group minerals with a wide range of Al-Fe compositions occur naturally and can persist for millions of years or more in natural systems.

Keywords: Jarosite, alunite, solid solution, sulfate minerals, sedimentary rocks, Aztec sandstone