Carlsonite, \((\text{NH}_4)_3\text{Fe}^{3+}\text{SO}_4\cdot7\text{H}_2\text{O}\), and huizingite-(Al), \((\text{NH}_4)_4\text{Al}_3\text{SO}_4\cdot6\text{H}_2\text{O}\), two new minerals from a natural fire in an oil-bearing shale near Milan, Ohio

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**ABSTRACT**

The new minerals carlsonite (IMA2014-067), \((\text{NH}_4)_4\text{Fe}^{3+}\text{SO}_4\cdot7\text{H}_2\text{O}\), and huizingite-(Al) (IMA2015-014), \((\text{NH}_4)_4\text{Al}_3\text{SO}_4\cdot6\text{H}_2\text{O}\) formed from a natural fire in an oil-bearing shale near Milan, Ohio. Carlsonite crystals are yellow to orange-brown thick tablets, flattened on \{001\}, or stout prisms, elongated on [100], up to about 0.25 mm in maximum dimension. The mineral has a tan streak, vitreous luster, Mohs hardness of 2, brittle tenacity, irregular fracture, perfect {001} cleavage, calculated density of 2.167 g/cm\(^3\), and is easily soluble in H\(_2\)O. Carlsonite is optically biaxial (+), \(\alpha = 1.576(1), \beta = 1.585(1), \gamma = 1.563(1)\), and is easily soluble in H\(_2\)O. Huizingite-(Al) is optically biaxial (+) with \(\alpha = 1.543(1), \beta = 1.545(1), \) and \(\gamma = 1.563(1)\) (589.6 nm light). Raman and infrared spectroscopy was conducted on both minerals. Electron microprobe analyses provided the empirical formulas \([\text{NH}_4]_4\text{Fe}^{3+}\text{SO}_4\cdot7\text{H}_2\text{O}\) and \([\text{NH}_4]_4\text{Al}_3\text{SO}_4\cdot6\text{H}_2\text{O}\) for carlsonite and huizingite-(Al), respectively.

**INTRODUCTION**

This paper reports the descriptions of the first two terrestrial (non-meteoritic) minerals to have been first discovered in the state of Ohio. These minerals, carlsonite and huizingite-(Al), formed as the result of a non-anthropogenic fire in an oil-bearing shale along the Huron River.

Carlsonite is named for Ernest H. Carlson (1933–2010). Carlson (Ph.D., McGill University 1966) was professor of mineralogy at Kent State University in Kent, Ohio, from 1966 until his retirement in 2009. He was a Fellow of both the Society...