

# **Crystal Chemistry of Cadmium Oxysalt and associated Minerals from Broken Hill, New South Wales**

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## Abstract

Secondary minerals, formed at low temperature, are the product of the oxidation of primary sulphide ore bodies. The formation and mineralogy of oxidized zones, which phases are stable and which are not, and how toxic heavy metals become incorporated into the crystal structures of the constituent minerals have implications for the heavy metal mobility in the environment and in the disposal of heavy metal and the remediation of contaminated sites

This thesis presents an investigation of the the crystal chemistry of a suite of Cd, Pb, Zn, Cu, Se and As oxysalt minerals from Broken Hill, NSW; the new mineral species plimerite, nyholmite, liversidgeite and edwardsite, as well as gartrellite, munakataite, osakaite and cadmian serpierite. Crystal structures were studied using single-crystal X-ray diffraction data, in conjunction with the results from electron microprobe analysis, powder X-ray diffraction, infrared absorption spectroscopy, Raman spectroscopy and Mössbauer spectroscopy. The crystal structures are classified according to the mode of polymerization of strongly bonded coordination polyhedra: chains, sheets or frameworks. The chemical compositions of the minerals and their stabilities are discussed in terms of a combination of hierarchical ordering, bond-valence theory and the valence-matching principle.

For the first time in natural minerals, extensive solid solutions involving cadmium have been observed. Solid solutions between Cd and Zn (in nyholmite), Cd and Ca (in serpierite), and Cd and (Pb+Ca) (in sampleite-lavendulan-zdenekite and conichalcite-duftite) are examined.

The minerals examined in this study have implications for the mobility of heavy metals in the environment and in remediation of heavy metal contaminated sites.

## Declaration

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## List of published papers

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