*American Mineralogist, Volume 97, pages 1519–1522, 2012*

## Letter

# XAS evidence for the stability of polytellurides in hydrothermal fluids up to 599 °C, 800 bar

**Joël Brugger,[1,2,*] Barbara E. Etschmann,[1,2] Pascal V. Grundler,[1,3] Weihua Liu,[4] Denis Testemale,[5] and Allan Pring[2,*]**

[1]School of Earth and Environmental Sciences, The University of Adelaide, 5000 Adelaide, South Australia, Australia
[2]Division of Mineralogy, South Australian Museum, North Terrace, 5000 Adelaide, South Australia, Australia
[3]Laboratory for Nuclear Materials, Paul Scherrer Institute, OHSA/B07, CH-5232 Villingen, Switzerland
[4]CSIRO Earth Science and Resource Engineering, Clayton, 3168 Victoria, Australia
[5]Institut Néel, Département MCMF, 25 Avenue des Martyrs, 38042 Grenoble, France
and FAME beamline, ESRF, 6 rue Jules Horowitz, 38043 Grenoble, France

## Abstract

Although the crustal abundance of tellurium (Te) is about half of that of gold (Au), several classes of Au deposits are highly enriched in Te. Our understanding of the nature of this Au-Te association is hampered by the lack of experimental studies of Te geochemistry at elevated temperature. We characterized the structure of polytelluride solutions from room temperature to 599 °C at 800 bar using in situ X-ray absorption spectroscopy. Both ab-initio XANES and EXAFS fits show that polytellurides are stable up to the highest temperature, with planar structures (four- or threefold coordination of Te) giving way to linear chains (e.g., $Te_2^{2-}$ ion) at temperatures above ~200 °C. This is the first experimental confirmation of the thermal stability of polytelluride species. The data show that polytellurides play an important role in Te transport in reduced S-rich or $CO_2$-rich solutions and vapors.

**Keywords:** Tellurium, polytellurides, aqueous speciation, X-ray absorption spectroscopy, hydrothermal ore deposits