

## **Tetrahedral plot diagram: A geometrical solution for quaternary systems**

**TOSHIAKI SHIMURA<sup>1,\*</sup> AND ANTHONY I.S. KEMP<sup>2</sup>**

<sup>1</sup>Graduate School of Science and Engineering, Yamaguchi University, 1677-1 Yoshida, Yamaguchi 753-8512, Japan

<sup>2</sup>Centre for Exploration Targeting, University of Western Australia, 35 Stirling Highway, Perth, Western Australia 6009, Australia

### **ABSTRACT**

The transformation from a tetrahedral four-component system to an XYZ-orthogonal coordinate axis system has been solved using the geometry of a tetrahedron. If a four component mixing ratio is described as  $t$ ,  $l$ ,  $r$ , and  $f$  (here,  $t + l + r + f = 1$ ), the transforming equations can be written as

$$x = (r + 1 - l)/2$$

$$y = \frac{\sqrt{3}}{2}t + \frac{\sqrt{3}}{6}f$$

and

$$z = \frac{\sqrt{6}}{3}f$$

A tetrahedral plot diagram can be easily constructed using the algorithms described in this paper. We present an implementation of these algorithms in a custom-designed Microsoft Excel spreadsheet, including adjustable viewing angles for the tetrahedral plot. This will be of general utility for petrological or mineralogical studies of quaternary systems.

**Keywords:** Tetrahedral diagram, triangular diagram, quaternary systems, phase diagram, three-dimension, trilinear coordinates, tetrahedron