Bulk-Rock Major Elements

Tuolumne

Bulk-rock major element compositions for Tuolumne Intrusive Complex samples were collected by wavelength dispersive x-ray fluorescence at the Texas Tech University Geoanalytical Laboratory using a Thermo Scientific ARL Perform'X. Approximately 1 kg of sample was crushed and powdered in an alumina shatterbox then fused into glass discs using a 1:2 ratio of sample to flux (Claisse M4 Fluxer: 49.75% lithium metaborate, 49.75% lithium tetraborate, and 0.5% lithium bromide). The operating conditions for XRF analyses were 30–60 kV, 60–120 mA, and count times ranging from 10 to 40 seconds for major and minor elements. Analyses were calibrated using a suite of USGS standards.

English Peak

Bulk samples were crushed in a steel jaw crusher and splits were powdered in an alumina shatterbox. Major elements were determined on a Leeman Labs inductively-coupled plasma atomic emission spectrometry (ICP-AES). Two-sigma uncertainties were <1% for SiO_2 and Al_2O_3; <3% for TiO_2, Fe_2O_3, MnO, CaO, and Na_2O; <5% for K_2O, and MgO; and <10% for P_2O_5. A detailed description of methodologies is presented in Berry, 2015.

Tenpeak, Mt Stuart, and Black Peak

Bulk-rock major element data were analyzed by Activation Laboratories Ltd, Ancaster, Canada on a combination simultaneous / sequential Thermo Jarrell-Ash ENVIRO II inductively coupled plasma or a Varian Vista 735 ICP system. A detailed description of the methods is available from Ratschbacher, 2017 and Ratschbacher et al., 2018.

Amphibole Major Elements

Wooley Creek, English Peak, and Ashland amphibole analyses collected before 2000.

Amphibole major elements were analyzed on an automated four-spectrometer JEOL JXA-733 microprobe at Southern Methodist University. Accelerating voltage was 15 kV, beam current was 20 nA, and beam diameter varied from 2–10 microns. Standards consisted of a suite of natural and synthetic minerals and data reduction was done according to a modified Bence and Albee (1968) scheme. A detailed description of the methodologies for these samples can be found in Barnes, 1983; Barnes, 1987; and Gribble et al., 1990.

Tuolumne, Wooley Creek, English Peak, and Ashland amphibole analyses collected after 2000

Amphibole major element compositions were collected by electron microprobe at the University of Oklahoma using a Cameca SX-100. Operating conditions were a beam energy of 20 keV, beam current of 20 nA, and beam diameter of 2 μm. The counting times for all elements (Si, Ti, Al, Fe, Mg, Mn, Ca, Na, K, and Cl) was 30 seconds. Both natural and synthetic standards were used. The percent relative standard deviation is < 2% for all elements. A detailed description of the methodologies for these samples is presented by Berry, 2015 and Barnes et al., 2016b.

Tenpeak, Mt Stuart, and Black Peak

Amphibole major element compositions were collected using a JEOL JXA 8200 electron microprobe at the University of California, Los Angeles in wavelength-dispersive mode with an acceleration voltage of 15 kV, beam current of 20 nA, and a beam diameter of 5 μm. Counting times on peak varied from 20 seconds for most elements and 10 seconds for Na and K. A description of methodologies is presented by Ratschbacher, 2017 and Ratschbacher et al., 2018.