Quantifying Mass Change Associated with an Imbricate of the Copper Basin fault, SE California

By

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The northern imbricate of the Copper Basin reverse fault is located south of Picacho State Recreation Area and west of Little Picacho Wash. It generally strikes EW and dips 52° S, and places within the hanging wall Quechan volcanics over Quechan volcanics within the footwall. The footwall is converted to a chlorite+epidote hydrothermal assemblage and was not studied during this investigation. In contrast, 5 samples from the fault core, 5 samples from the inner damage zone, and 4 samples from the least altered outer damage zone were analyzed for major element chemistry. The results of applying non-central principal component analysis to the chemical data revealed a compositional linear trend extending from the geometric mean of samples from the outer damage zone through samples from the inner damage zone and fault core and terminated at the p(CN) apex. Principal component 1 explained 99.7% of the scatter of samples about the compositional linear trend. The fact that calcite plots at the p(CN) apex, suggests that the calculated linear trend may be a simple reflection of the addition of this mineral. Utilizing statistical tests provided in the software program Assessing Element Immobility written by T. Carrasco and G.H. Girty, revealed that SiO_2, Fe_2O_3, Al_2O_3, and MgO are good candidates for an immobile reference frame. Significantly, Only SiO_2 and Fe_2O_3 yield a statistically significant change in elemental mass. This change involved a loss of 11-15% phosphorous mass. Though similar losses in phosphorous mass are indicated by an Al_2O_3 and MgO reference frame they are not statistically significant. Such results imply that fluids infiltrating the inner damage zone, likely leached P mass from apatite, but such losses are minimal and near the statistical detection limit governed by the sample size of this study. In contrast to the inner damage zone, statistically significant increases of ~208% - ~256% Ca mass, ~143% - ~182% of LOI mass, and ~17% - ~35% of bulk mass are indicated by all 4 reference frame elements for the fault core. In addition, the reference frame Fe_2O_3, Al_2O_3, and MgO indicate an increase of ~13-31% Ti mass. Though a reference frame of Fe_2O_3 and Al_2O_3 indicates that ~13-~18% of the mass of P was lost, SiO_2 and MgO indicate that such losses are not statistically significant. In short, the fault zone appears to have been invaded by fluids supersaturated with Ca and CO_2. In addition, to account for the increase in LOI mass, such fluids must have reacted with the silicate mineral framework to produce a clay mineral dominated by smectite. Of some note, though Ti is commonly regarded as an immobile element, data from this study suggests the possibility of at least limited mobility of this element. The continued loss of P mass is nominal and likely the result of minor leaching of apatite.