

Cumulate and residual wallrock major element calculation tool for Magma Chamber Simulator output

This Excel worksheet tool can be used to calculate the major element composition of the cumulate (each step and bulk) and residual wallrock, because these are not standard output in MCS. The calculator does this by calculating what is added to the cumulate pile each step (i.e. what is being lost from the M melt) and what is being removed from the residual wallrock each step (i.e. decrement of WR melt added to M from bulk residual WR each step).

The central equation behind the incremental cumulate calculations is:

$$X_{ic} = (X_p - \left(X_c \left(1 - \frac{m_s}{m_l + m_s + m_f} \right) \right)) / \left(\frac{m_s}{m_l + m_s + m_f} \right)$$

where

X_{ic} = oxide composition of incremental cumulate in the current step

X_p = oxide composition of M liquid (melt) + fluid in the previous step

X_c = oxide composition of M liquid (melt) + fluid in the current step

m_s = mass of incremental solids in the current step

m_l = mass of M liquid (melt) in the current step

m_f = mass of M cumulative fluid in the current step

The central equation behind the residual WR calculations is:

$$X_r = X_p - X_l \left(\frac{m_l}{m_l + m_r} \right)$$

where

X_r = composition of WR residual in the current step

X_p = composition of bulk WR in the previous step

X_l = composition of WR liquid in the current step

m_l = mass of WR liquid added to M in the current step

m_r = mass of residual WR in the current step

This is then further refined to also calculate out melt (below percolation threshold) and fluid from the residual WR and output solid WR residual composition.

All calculations are normalized to 100 wt.% for output. See the worksheet for more info.