Supporting Information for “Major-element composition of sediments in terms of weathering and provenance: Implications for crustal recycling”

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1. Figures S1 to S5

Figures S1 and S2 show the results of analysis which demonstrate that the weathering (\( \hat{w} \)) and protolith (\( \hat{p} \)) vectors derived in the main text are universally applicable. Figure S3 compares the predicted and observed compositions for all sedimentary rocks and all oxides for the sedimentary rock datset. Figure S4 investigates the response of the misfit magnitude when changing the \( \omega \) and \( \psi \) coefficients. Finally, Figure S5 shows the results of a sensitivity analysis for how much our estimate of the mass of subducted sediment depends on our choice of crustal model age.
Figure S1. Demonstrating universality of \( \hat{w} \). (a) \( \omega \) vs \( \psi \)-deviation for soil profiles within the compiled soil dataset. For each profile, the mean \( \psi \) for that profile is subtracted from each sample within the profile giving the ‘\( \psi \)-deviation’ value. If the \( \hat{w} \) vector derived from the Toorongo profile is universal, all points should lie closely to the \( \psi - \psi_{\text{mean}} = 0 \) line, as is observed. (b) Density distribution of \( \psi - \psi_{\text{mean}} \) values in (a). \( \psi \)-deviation values all lie close to 0. Dashed line indicates \( \pm 1\sigma \). (c) For two profiles in the dataset, which have granitic and dioritic protoliths respectively, there were enough samples from a wide enough range of weathering intensities to separately calibrate a \( \hat{w} \) vector (White et al., 2001; Turner et al., 2003). This figure compares the vectors derived from these profiles to that derived from the Toorongo profile indicating a 1:1 relationship.
Figure S2. Demonstrating the universality of the $\mathbf{p}$ vector. This figure compares the $\mathbf{p}$ vectors derived by extracting the first principal component from the Crater Lake suite on the x-axis and by extracting from the $\sim 5200$ NAVDAT igneous rocks on the y-axis (see Figure 11). The first principal component of the NAVDAT suite contains 81% of the total variance. The strong correlation between the two vectors indicates that the $\mathbf{p}$ as derived from the Crater Lake suite is likely universally applicable for igneous evolution. Straight line indicates 1:1 relationship.
Figure S3. Predicted and observed oxide concentrations for sedimentary rocks. This is an extended version of Figure 5 in the manuscript showing all oxides.
Figure S4. Magnitude of residuals plotted against model coefficients from Equation 1. (a) $\omega$ shows weak positive correlation with residual magnitude indicating miscalibration of $\hat{w}$. (b) No relationship observed between $\psi$ and residual magnitude. Blue lines indicate density contours.
Figure S5. Sensitivity analysis for calculated mass of ‘missing’ reservoir for different choices of model age. Thick black line indicates the mean value of the estimates from each individual element with the dashed grey lines indicating the 1 standard deviation bounds. The preferred model age is 1.8 Ga.
References
