APPENDIX: Petrologic crustal growth model

For our petrologic model, we use a basalt composition that typifies IBM volcanism as our differentiated basalt (DB). Compositions of the primary basalt (PM) and the fraction of cumulate materials (CM) (22%) can then be obtained by assuming a simple olivine maximum fractionation from PM to DB, and Fe-Mg exchange partitioning between magma and olivine with $\text{Fe}^{2+}/(\text{Fe}^{2+}+\text{Fe}^{3+})_{\text{magma}} = 0.9$, and $\text{Mg}/(\text{Mg}+\text{Fe})_{\text{mantle olivine}} = 0.9$. Fractionation of olivine only, and subsequent formation of dunitic cumulate is confirmed by MELTS modeling (Ghiorso and Sack, 1995) for PM and DB compositions. An andesitic melt (AM) is produced by 25-35% partial melting of a basaltic component (~DB) (Beard and Lofgren, 1991). Major-element compositions of all these magmas are shown in Table S1.

The petrologic model we use here is expressed by the formulae:

\[
V_{uc} = (1-R_{db}) \times V_b,
\]
\[
V_{mc} = R_{dm} \times (1-R_{db}) \times V_{as},
\]
\[
V_{res} = (1-R_{dm}) \times (1-R_{db}) \times V_{as},
\]
\[
V_{cm} = R_{db} \times (V_a + V_b)
\]

where $V_a$ and $V_b$ are the volume of primary basalt magmas (PM) intruded at the initial and anatexis stages; $V_{uc}$, $V_{mc}$, $V_{res}$, and $V_{cm}$ are the volumes of basaltic upper crust, andesitic
middle crust (AM), restites and cumulates (CM); and, \( R_{db} \) and \( R_{dm} \) are the fractional degree of crystallisation to produce CM (22%) and the degree of partial melting to produce AM (25-35%), respectively. Re-writing these equations in terms of the parameters \( V_{uc} \) and \( V_{mc} \) that can be obtained from our seismic profile, we obtain:

\[
V_{res} = (1 - R_{dm}) \frac{V_{mc}}{R_{dm}}
\]

and

\[
V_{cm} = \left( \frac{V_{mc}}{R_{dm}} + V_{uc} \right) \frac{R_{db}}{1 - R_{dm}}.
\]

REFERENCES CITED


Table S1 Composition of each magma, restites and cumulates

<table>
<thead>
<tr>
<th></th>
<th>PM</th>
<th>CM</th>
<th>DB</th>
<th>AM</th>
<th>Restites</th>
</tr>
</thead>
<tbody>
<tr>
<td>SiO₂</td>
<td>47.8</td>
<td>40.1</td>
<td>50.0</td>
<td>60.0</td>
<td>45.7</td>
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<tr>
<td>TiO₂</td>
<td>0.6</td>
<td>0.8</td>
<td>0.6</td>
<td>0.9</td>
<td></td>
</tr>
<tr>
<td>Al₂O₃</td>
<td>14.9</td>
<td>19.1</td>
<td>18.1</td>
<td>19.5</td>
<td></td>
</tr>
<tr>
<td>FeO</td>
<td>10.9</td>
<td>13.4</td>
<td>10.2</td>
<td>6.8</td>
<td>11.7</td>
</tr>
<tr>
<td>MgO</td>
<td>14.9</td>
<td>46.5</td>
<td>6.0</td>
<td>3.1</td>
<td>7.2</td>
</tr>
<tr>
<td>CaO</td>
<td>9.5</td>
<td>12.1</td>
<td>7.6</td>
<td>14.0</td>
<td></td>
</tr>
<tr>
<td>Na₂O</td>
<td>1.2</td>
<td>1.6</td>
<td>3.3</td>
<td>0.9</td>
<td></td>
</tr>
<tr>
<td>K₂O</td>
<td>0.2</td>
<td>0.2</td>
<td>0.5</td>
<td>0.1</td>
<td></td>
</tr>
</tbody>
</table>

PM: primary basalt; CM: cumulate materials; DB: differentiated basalt; AM: andesitic melt. We assume that olivine is the only crystallizing silicate phase during the differentiation process, based on MELTS modeling (Ghiorso and Sack, 1995) of crystallization of the inferred primary magma with 0.5 wt.% H₂O at 0.2 GPa under the QFM buffer.