Rb-Sr Isochron Ages of Gneisses in the Western Region of the Dharwar Craton

P. T. RAJAGOPALAN, S. JAYARAM AND V. S. VENKATASUBRAMANIAN

Introduction

The Dharwar craton of Karnataka, like the Archean cratons in other continents, is composed of granite-greenstone complexes and the relationship between the granites and greenstones has not been correctly delineated. Rb-Sr and other age data are relevant to the problem and these are sparse especially for gneisses adjoining the greenstone belts. Geochronological data coupled with the study of field relationships are particularly useful in resolving the problem. In this note we present whole rock Rb-Sr isochron age for a suite of granitic gneisses adjoining the Bababudan and Shimoga belts in the western part of the Dharwar craton.

General Geology

The area studied is situated around Balehonnur town in Chikmagalur district and forms a well-exposed granite-greenstone section. The granitic gneisses are flanked on either side by two greenstone belts, the Bababudan belt on the east and the Shimoga-Koppa belts on the west. The geology of this area and adjoining parts of the Western Ghats has been described by Sampat Iyengar (1908, 1912). The gneisses vary in character from streaky to well-banded types, while homogeneous phases are also present. Coarse varieties with porphyritic texture also occur as local variants east of Balehonnur. These too are also intruded by pegmatites.

The general geological map and sample locations are given in Fig. 1.

Experimental

The measurements of \( \frac{^{87}\text{Sr}}{^{86}\text{Sr}} \) ratios, and of \( ^{87}\text{Rb} \) and \( ^{86}\text{Sr} \) by isotope dilution were carried out using the MS702 fitted with a thermal ion source, as described in a previous paper (Venkatasubramanian, 1974).

The analytical results are given below:

<table>
<thead>
<tr>
<th>Sample</th>
<th>( ^{87}\text{Rb} ) (ppm)</th>
<th>( ^{86}\text{Sr} ) (ppm)</th>
<th>( ^{87}\text{Rb}/^{86}\text{Sr} )</th>
<th>( ^{87}\text{Sr}/^{86}\text{Sr} )</th>
</tr>
</thead>
<tbody>
<tr>
<td>(K₂)</td>
<td>8.29</td>
<td>38.38</td>
<td>0.216</td>
<td>0.7118</td>
</tr>
<tr>
<td>(K₃)</td>
<td>22.91</td>
<td>39.91</td>
<td>0.574</td>
<td>0.7290</td>
</tr>
<tr>
<td>(K₆)</td>
<td>67.05</td>
<td>27.8</td>
<td>2.41</td>
<td>0.8032</td>
</tr>
<tr>
<td>(K₁)</td>
<td>52.55</td>
<td>13.55</td>
<td>3.88</td>
<td>0.8680</td>
</tr>
</tbody>
</table>

As seen in Fig. 2, these results fall on an isochron of age \( 3025 \pm 60 \) m.y., and an initial \( \frac{^{87}\text{Sr}}{^{86}\text{Sr}} \) value = \( 0.7025 \pm 0.001 \).

The 3000 m.y. (older) event in the Dharwar craton has already been indicated in an earlier work of this group on the granites of north Mysore (Venkatasubramanian and Narayanaswamy, 1974) and in the cordierite gneisses associated with the Sargur supra crustal belt (Jayaram, Venkatasubramanian and Radhakrishna,
Figure 1. Location map.

Figure 2. Isochron for the gneisses adjoining Bababudan and Shimoga belts.
The low initial ($^{87}\text{Sr}/^{86}\text{Sr}$) ratio is consistent with a mantle origin (Juvenile nature) of these Archean rocks (O'Nions and Pankhurst, 1978). While the gneisses were regarded by Sampat Iyengar as intrusive into the schists, field studies by one of the authors (Jayaram) on a portion of the contact section between the Shimoga-Koppa belt and the gneisses has not shown any definite evidence of intrusion.

The samples selected by Rb-Sr isotope analysis and gneissic rocks from the adjoining regions (around Sringeri town, and east of Kuduremukh) have been analysed for their major element composition. The $\text{K}_2\text{O}$ content ranges from 1.1% to 4%, but most of the values are between 1.1% and 2.6%. $\text{Na}_2\text{O}$ is generally higher, ranging in abundance from 3.8% to 5.2%. The abundance of $\text{CaO}$ is variable. The average $\text{Na}_2\text{O}/\text{K}_2\text{O}$ ratio is 2.4%. On the $\text{K}_2\text{O}-\text{Na}_2\text{O}-\text{CaO}$ diagram most of the analysed samples plot in the tonalite field. A calc-alkaline differentiation trend is indicated on the Alk-F-M diagram. An orthonature is indicated on Niggli (al-alk)-c diagram.

References


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