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Rb-Sr Dating of the Gundlupet gneiss around Gundlupet, Southern Karnataka

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Introduction

The tract around Gundlupet and Terakanambi is mostly a gneissic terrain, constituting the southern part of the Sargur high grade belt. The gneisses of this area are components of the Archaean polyphase Peninsular Gneiss Complex. They contain innumerable large (ranging from a few metres to a km in length) curvilinear enclaves of Sargur supracrustals. viz: quartzites, pelites, marbles, calc-silicates, Mn-rich calc-silicates, banded magnetite quartzites and amphibolites (Janardhan *et al*, 1979, 1981). The gneisses discussed in this note engulf the supracrustals and also the layered meta ultramafic complex, and thus represent a major phase of igneous activity.

Twelve samples of the gneisses, each weighing 15 kg were collected from three different widely separated active gneissic quarries. (Fig. 1) Great care was taken to

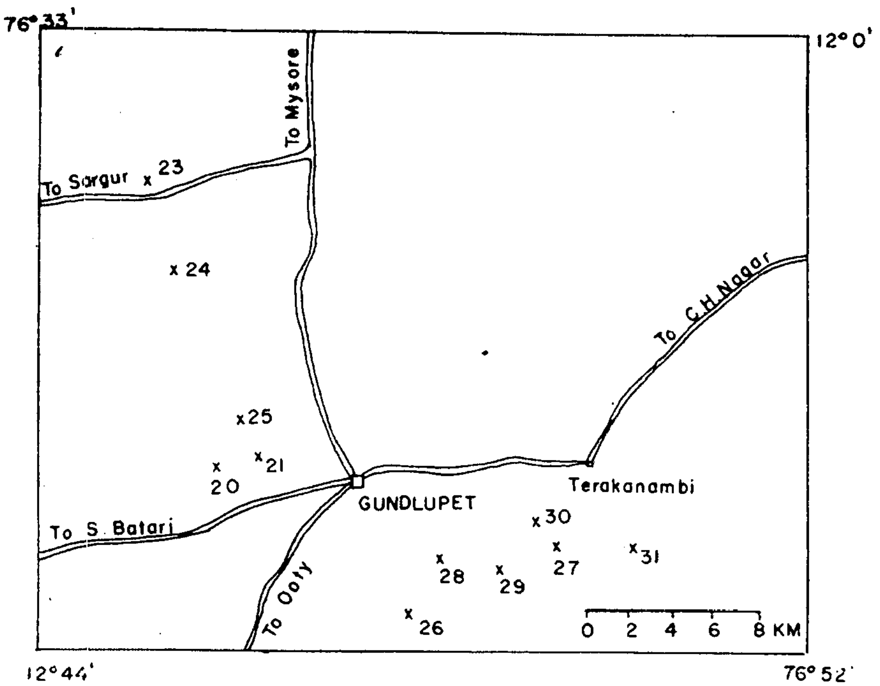

Figure 1. Sample locality map

collect fresh, homogeneous samples, avoiding the pink pegmatites traversing the gneisses. The coarse pink pegmatites vary from a few cm to a metre in thickness. The collected gneisses are whitish gray, medium grained rocks with a faint foliation defined by biotite layers. The gneisses are dominantly trondhjemites, and form part of a tonalite-granodiorite suite.

Rb-Sr study

The analytical results are reported in Table I and plotted in Fig. 2.

TABLE I. Rb-Sr data for Gundlupet samples

Sample No.	Rb	Sr.	$^{87}Rb/^{86}Sr$	$^{87}Sr/^{86}Sr$
20	22.7	325	0.202	0.71463
21	93.9	430	0.631	0.72968
22	45.1	411	0.317	0.71627
23	74.0	274	0.780	0.73069
24	123	208	1.708	0.77402
25	144	216	1.928	0.78318
26	114	322	1.03	0.74460
27	59.2	506	0.339	0.71705
28	56.3	498	0.327	0.71698
29	67.4	343	0.569	0.72653
30	39.5	464	0.246	0.71371
31	89.2	428	0.604	0.72799

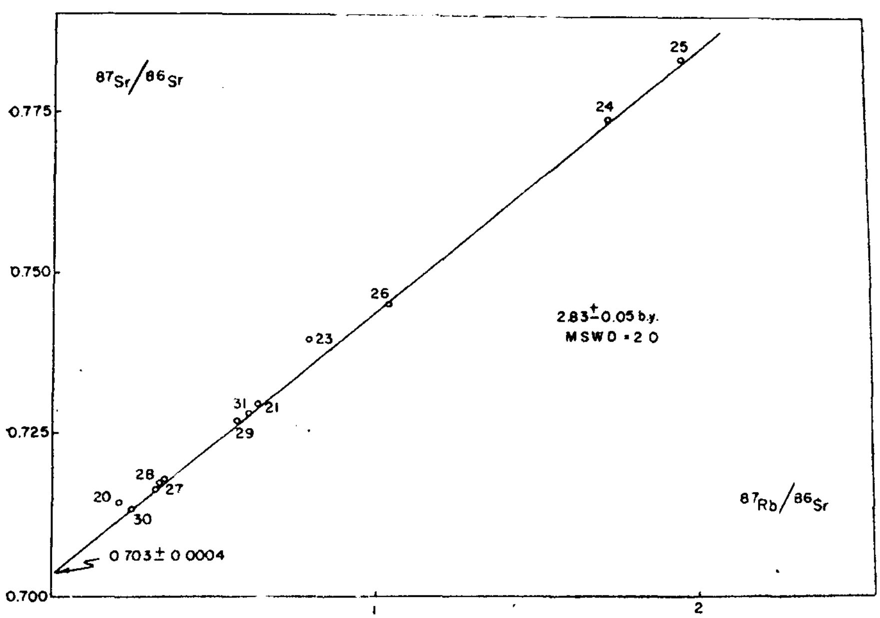

Figure 2. $^{87}Sr/^{86}Sr$ *vs* $^{87}Rb/^{86}Sr$ whole rock diagram for Gundlupet Gneisses.

The Rb-Sr techniques in use at the Rennes laboratory have been recently described (Vidal *et al*, 1980). The precision on the $^{87}Rb/^{86}Sr$ ratio, which is determined by isotopic dilution, is 2%. The precision (2 cm) on the $^{87}Sr/^{86}Sr$ ratio is always better than 10^{-4}.

The age has been calculated using the constant $\lambda^{87}Rb = 1.42.10^{-11}y^{-1}$.

From Fig. 2, it is seen that 10 of the samples lie on a straight line. The age given by their isochron is 2.83 ± 0.05 b.y. The low MSWD (2.0) indicates the good quality of this isochron. The initial $^{87}Sr/^{86}Sr$ ratio is 0.7034 ± 0004.

Two types of information can be obtained from these data:

(1) *Age of the precursor:* There is no particular reason on this medium-grained type of rock and also due to the medium grade of metamorphism that the isochron may correspond to a metamorphic reequilibration (rehomogenisation). Therefore, the best interpretation is that this age of 2.83 ± 0.05 b.y., means the age of crystallisation of the igneous precursor of these gneisses.

(2) *Source region of the protolith:* The initial $^{87}Sr/^{86}Sr$ ratio of 0.7034 is somewhat high in comparison with the mantle ratios 2.8 b.y. ago, which ranged between 0.700 to 0.702 (Jahn *et al*, 1980). In consequence, the protolith cannot be the direct melting product of the mantle or of a part of oceanic crust. It must contain a component which had a not negligible crustal history before being incorporated into the protolith.

Was the protolith totally derived from the continental crust or was it mantle (or oceanic crust) derived and then contaminated? This problem cannot be solved with Sr isotopes only. Pb isotopes are more informative in this respect (Moorbath *et al*, 1981).

As far as the two points above the isochron (samples 20 and 23) are concerned, no unequivocal explanation can be offered. Their location on the diagram is probably due to an open-system behaviour regarding the Rb-Sr systematics during (1) a subsequent metamorphic event, for example by Rb loss, (2) the intrusion of the numerous dykes or veinlets of granite pegmatites which are never very far (a few decimeters) from the samples analyzed.

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