

PILLOWED SPILITIC BASALTS FROM THE TADPATRI FORMATION OF CUDDAPAH BASIN

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Abstract

Pillow structures are noticed in the spilitised basalts occurring within the shales of Tadpatri Formation indicating subaqueous eruption as against the traditional notion of subaerial volcanism in Cuddapah basin. The basalt is enriched in alkalis and silica and depleted in calcium and magnesium. The pillows are separated by a black siliceous inter-pillow material. The pillowed basalt is underlain by a massive lava with a thin intervening bed of aphanitic rock and nodular limestone. This pillowed and massive lava flow appears to extend for long distances in the Cuddapah basin.

Introduction

Basic sills and flows occur extensively in the upper and lower stratigraphic units of Vempalle and Tadpatri Formations respectively in the Cuddapah Basin (King, 1872). Most basaltic flows are amygdaloidal and are interpreted as subaerial to shallow water in origin. Sen and Narasimha Rao (1967) were the first to report spilitic pillow lavas from Vempalle Formation in the Velidendla area, but the occurrence of pillows could not be confirmed by subsequent work (Satyanarayana Rao, 1972).

Field occurrence

During a recent study of basic rocks of the Cuddapah basin, the author came across well-preserved ellipsoidal pillows (Fig. 1) in a basaltic flow which is underlain and overlain by shales of the Tadpatri Formation, as exposed in a newly dug well about 0.5 km south of Kondapuram (14°43' : 78°02'). These basalts appear to extend for long distances up to Racherla and beyond. The pillows vary in size and shape ranging from 0.5 to 1.5 m across and are piled up in a 6m thick vertical section. The pillows have a dark fine-grained rim, with elongated radial vesicles near the outer margins and variolites inside. Dark, fine-grained inter-pillow material is conspicuous in the exposure. The pillowed flow is underlain by a metre thick bed of fine-grained rock which resembles the inter-pillow material, along with nodular carbonate rock. This bed is underlain by a massive basalt similar in composition to the pillow lava.

Petrography and Geochemistry

The pillowed basalt is fine-grained, fresh and unaltered. It consists of plagioclase, clinopyroxene, chlorite and quartz. Epidote, sphene and zeolite are also present. Plagioclase and clinopyroxene show symplectic growth and have acicular and lath shape. Plagioclase shows simple twins and low extinction angle of 8–10° (oligoclase). It occurs as quench crystals with skeletal form and swallow tail terminations as seen in other submarine basalts (Bryan, 1972). Pyroxene is mostly a brownish augite. Modal percentage of pillowed basalt is: clinopyroxene (45), Plagioclase (31), chlorite (20), quartz (1) and calcite (1). The vesicular and amygdaloidal flow contains plagioclase and clinopyroxene having indistinct margins,



Figure 1. Pillow structure in spilitic basalt, Kondapuram.

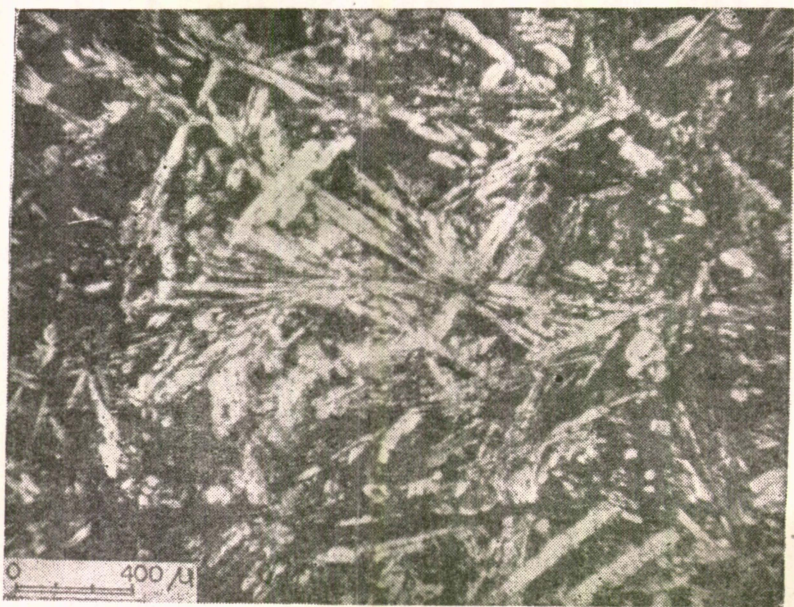


Figure 2. Variolitic texture in spilitic basalt, Centre of pillow

and the minerals are charged with dusty particles. Opaques altering to sphene, chlorite and zeolite as vesicle fillings are the other minerals present. Chlorite and quartz occur in interstitial spaces. The variolitic portions of the flow are made up of varioles containing radial aggregates of pyroxene and plagioclase (Fig. 2)

Major element composition of the pillowed basalt (Table I) shows that it is spilitic in nature with the alkali and alkali-lime ratios as per Hughes (1972). Vallance

(1974) and Graham (1976). Extensive spilitisation has shifted the composition of lava from basaltic to andesitic field. The high LOI (>4%) of the sample is due to the high incidence of chloritic alteration. The inter-pillow material is enriched in CaO, Al₂O₃ and SiO₂.

TABLE I.

	Pillowed Basalt 6-205	Inter-pillow material 6-209
SiO ₂	52.83	61.99
TiO ₂	0.93	0.53
Al ₂ O ₃	13.78	13.04
Fe ₂ O ₃	0.57	1.12
FeO	9.80	2.80
MnO	0.17	0.06
MgO	3.90	1.01
CaO	6.34	14.21
Na ₂ O	3.89	—
K ₂ O	1.40	0.15
P ₂ O ₅	0.09	0.11
H ₂ O+	2.54	1.80
LOI	4.15	4.89

Discussion

Tadpatri Formation is reported to contain siliceous ash tuffs, lapilli tuffs and ignimbrites besides a small volume of basic rocks. The discovery of spilitised basaltic pillow lavas in Tadpatri shales is very significant for the studies of palaeovolcanism in the Cuddapah basin.

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