

ROCK MELT EXTRUSION AT ABISHEKAPATTI, TIRUNELVELI DISTRICT, TAMIL NADU

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Villagers of Abishekapatti (E 77°39' 18" and 8°45'58"), 10 km NW of Tirunelveli town, Tamil Nadu, reported seeing fire and smoke close to a concrete electric post (11 kV) in the early hours of 6th August 1998. They noticed that the concrete post had sunk up to a depth of 4 m. They also found the effects of burning in the soil and vegetation along cracks developed in a particular direction near the electric post. Similar such occurrences were reported

from Anikulam (E 77°45'8" and N 8°26'11") during the first week of September 1998, and from Pondicheri village (E 77°45'58" and N 8°24'32") both from Tirunelveli District. On the 29th of September, 1999 another rock melt extrusion appeared at Thirupanikarisalkulam (E 77°37'30" and N 8° 45'00") near an electric post, 4 km SW of Abishekapatti (Fig.1).

To understand the real cause for the phenomenon, the

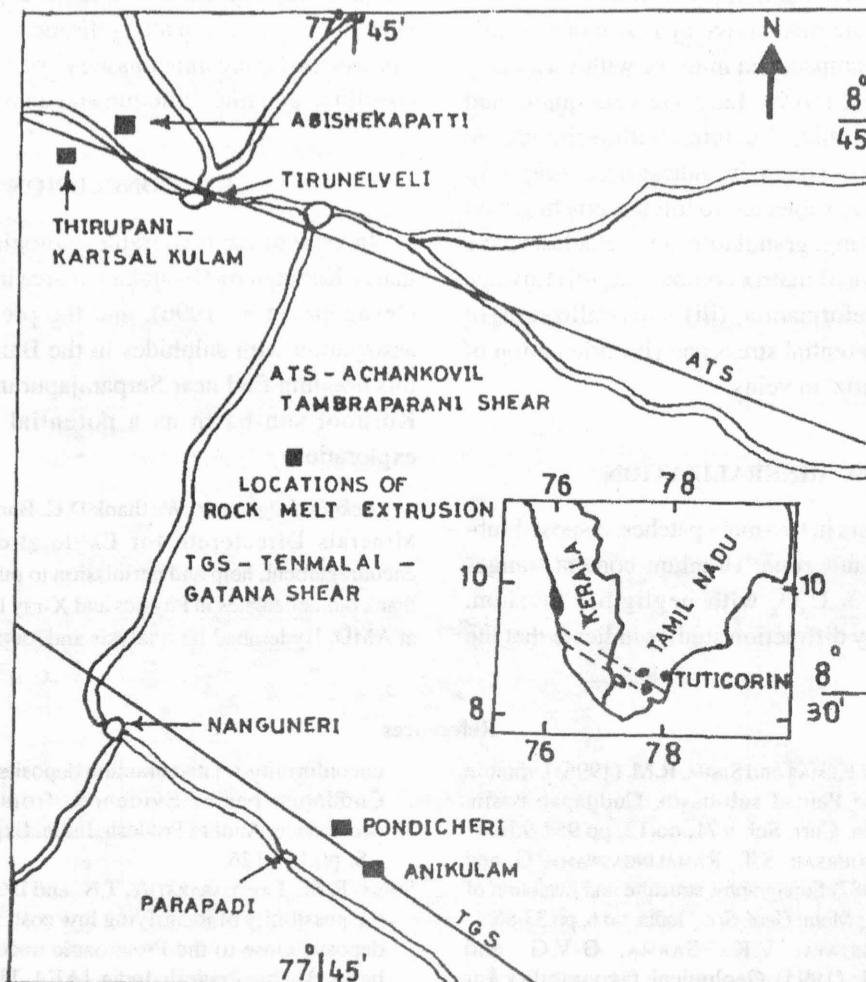


Fig.1. Map showing the sites of rock melt extrusion along Achankovil-Tambraparani shear and Tenmalai-Gatana shear of south India

following possibilities are suggested (Jayakaran, 1998; Rajamanickam and Chandrashekar, 2000; Ramasamy, 2000).

- 1 High-tension electrical leakage related rock melt extrusion.
- 2 Lightning strike related super heating and instantaneous melting of the soil and rock, causing fulgurite and glass formation, and
- 3 Neotectonic activity.

Observations

At Abishekapatti a detailed study was done through excavations. The country rock is quartzite with enclaves of garnet-biotite-sillimanite gneiss (khondalite) and is covered by one metre thick red soil. After removal of the topsoil, a small vent with a diameter of 25cm was seen near the electric post. When we opened the vent, it was lined with a thin layer of black glass. One metre away from the post, the vent was completely concealed by black glass. This massive, cylindrical glass is encircled by four different layers from core to rim, viz., (1) 1-3 cm thick, resinous, water-bearing, greyish green glass; (2) Green, fine grained vesicular rock, 4-10 cm thick; (3) Pyroxene-bearing calcic plagioclase 5-10 cm thick, and (4) Rim of 4 - 10 cm thickness of recrystallized quartz in contact with the outer zone of baked quartzite (Fig.2). The exposure can be traced even 7m away from the post. Clusters of golden coloured vermiculite flakes after biotite were found at the contact of khondalites and baked quartzite, possibly due to extreme heating. Apart from this main vent, upward branching tiny vents of 1-5 cm size (similar to fulgurites) were observed in the adjoining country rock.

Petrography and Petrochemistry

Under microscope, the black glass is brown, non-

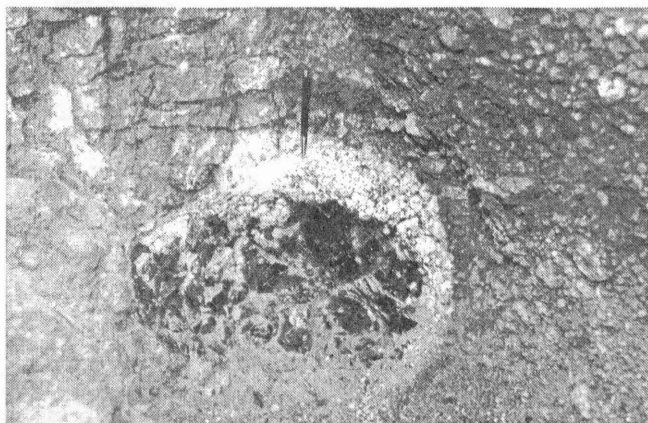


Fig.2. Photograph showing the cross sectional view of a rock melt in quartzite at Abishekapatti.

Table 1. Chemical analysis and modal analysis of quartzite (MS-1) and associated black glass (MS-2), and green coloured rock (MS-3) from Abishekapatti, Tamil Nadu (P - Phenocryst; G - Groundmass; X - Xenocryst)

Oxides (in wt %)	Green-coloured Rock MS 3	Black Glass MS 2	Quartzite MS 1
SiO ₂	51.56	56.57	95.76
TiO ₂	0.57	0.79	0.04
Al ₂ O ₃	11.10	10.29	Nd
Fe ₂ O ₃	15.50	13.20	1.00
CaO	8.30	8.60	0.56
MgO	8.06	5.03	0.90
MnO	0.18	0.14	0.01
Na ₂ O	2.98	2.85	0.17
K ₂ O	0.80	1.56	0.05
P ₂ O ₅	Trace	Trace	Trace
LOI	0.01	0.01	0.82
Elements in ppm			
Ni	370	290	75
Cr	730	660	155
Cu	50	45	15
Co	40	35	Trace
Minerals in vol. %			
Hypersthene	18.0 (P)	4.5 (P)	-
Augite	6.0 (P)	6.5 (P)	-
Augite	8.5 (G)	-	-
Anorthite	5.5 (P)	-	-
Quartz	2.5 (X)	5.5 (X)	89.0
Quartz	3.5 (G)	2.5 (G)	-
Orthoclase	1.0 (X)	-	-
Cordierite	2.0 (X)	-	-
Sillimanite	1.0 (X)	-	-
Labradorite	19.0 (G)	-	-
Serpentine	3.5 (G)	-	-
Magnetite	10.0 (G)	-	-
Chlorite	3.0 (G)	-	-
Glass	16.0 (G)	80.0 (G)	-
Rutile	0.5 (G)	1.0 (G)	0.5
Garnet	-	-	6.5
Biotite	-	-	3.0
Oligoclase	-	-	1.0

pleochroic and isotropic. At places, it is vitrophyric with augite and hypersthene phenocrysts. Xenocrysts of quartz and rutile adhering to the glass are from the country rock. The resinous, greyish green glass is identified as palagonite (H₂O-bearing tachylite). The green coloured rock shows microlites of pyroxene, euhedral magnetite, chlorite, serpentine, quartz and brown glass. Sillimanite and cordierite also occur as xenocrysts.

Representative samples of black glass, associated green coloured rock and quartzite, collected 5 m away from concrete post, were analysed at the Marine Wing Laboratory, Geological Survey of India (GSI), Mangalore. SiO₂ was estimated by standard wet chemical method. Major and minor elements were determined by Atomic Absorption Spectrometer (AAS). B2283/ In House GSI standards were used. The analytical precision is about 1 to 2 %. The data along with average modal composition are given in Table 1. The samples are basic in composition with high content of Cr and Ni. Petrochemically the green, vesicular glassy rock is compositionally similar to subalkaline tholeiitic basalt.

Microseismic activity is well known along the lineaments bounding the different tectonic units in Peninsular India. The WNW-ESE striking sinistral Achankovil-Tambraparani (ATS) lineament and NW-SE striking dextral Tenmalai-Gatana (TGS) lineament of south India extend through the Abishekapattai-Tirupanikarisalkulam and Anikulam-Pondicheri villages respectively (Drury et al. 1984; Sacks et al. 1997) (Fig. 1).

Similar extruded materials at Anikulam, Pondicheri and Tirupanikarisalkulam along with the incidence of recent mild tremor on 26th February, 2000 at Kalakad and Ervadi of

Tirunelveli District lead to the speculation of reactivation of ATS and TGS lineaments. However, the molten rock material occurs always in close proximity to the electrical installations, and since these are not traced much beyond the surface, it is difficult to be certain about the tectonic linkage to the deeper parts.

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