basement rocks like anorthosites), picked up by the host basalt dike magma during ascent; or they represent magma mixing, wherein a primitive liquid with plagioclases having relatively high An content mixed with the evolved phenocryst-rich dike magma.

However, petrographically the most important finding has been the presence of microscopic clusters of apatite-like crystals. These clusters are mainly found in the interstices between groundmass plagioclase grains or sometimes within these grains. Each cluster contains hundreds of such crystals (Figure 3). Interestingly, very similar clusters have been recently known from a Shirpur area basalt dike[8,10]. The crystals forming these unusual clusters in the Shirpur dike and the Dhule–Parola dike were earlier thought to be apatite[8,11] on the basis of their needle- or tubular shape, transparency, and first order gray interference colour and straight extinction between crossed polars. However, ongoing electron microprobe studies at the Consiglio Nazionale Delle Ricerche (CNR) Laboratory, Italy, indicate that these crystals are *orthopyroxenes*[12], with which identification, the above-mentioned optical characteristics are consistent. To our knowledge, occurrence of such unique orthopyroxene clusters has not been reported from anywhere else in the entire Deccan province till date.

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Mud eruption in Elagiri region, Tamil Nadu, South Indian peninsular shield

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The recently occurred mud eruption in Elagiri region, Tamil Nadu appreciably signifies the active tectonic movements along N-S trending lineament systems in South Indian peninsular shield. Such mud eruption warrants further detailed studies in the context of active tectonics and mid-plate seismicities in this area.

On 28 January 1997, Attanavur village (lat. 12°35′N, long. 78°36′E) located in the close proximity of the Elagiri plateau Tamil Nadu, South Indian peninsular shield was affected by thundering noise and fracture development for nearly 50–60 min in North–South direction (Figure 1). This activity was associated with an eruption of brownish mud. After three days of such activity, Ambur, Vaniyambadi and Tiruppatur (Figure 1) area felt mild earth tremors. The National Geophysical Research Institute, Hyderabad recorded earth tremors ($M = 3$) on 31 January 1997 in the above areas[1].

A field visit was undertaken by us nearly one month after the event. Most of the fracture length was filled, but a fracture length of 15–20 m in N–S direction with a number of branches (Figure 2 *e*) remained open. In and around the crack, mud-eruptive craters of varying dimensions (radius of 20–70 cm and a depth of 30 cm to 3 m) were present (Figure 2 *a–d*). In and around the craters, the mud was usually soft and loose and on applying pressure over the dry skin of the erupted mud with hands in one crater, the pressure was released with a bubble in the other nearby craters, which indicates their interconnections. In addition to the brown mud, there was a coating of blackish material, giving expression of burnt appearance (Figure 2 *c*), and also the mud had white clay particles.

The fissuring and eruption was located at the western fringe of the Elagiri Syenite plug (750 Ma), which stands raised as a plateau to an elevation of 1121 m above MSL. The slopes were filled with colluvial fill and debris wash material derived from the above syenite plug. As the source for the colluvial fill has been the Syenite, which is rich in feldspar, obviously such colluvial fill contains mostly whitish and brownish clay with pebbles and boulders. Further, the occurrence of a number of springs indicates the shallow water table conditions or the aquiclude behaviour of the groundwater.

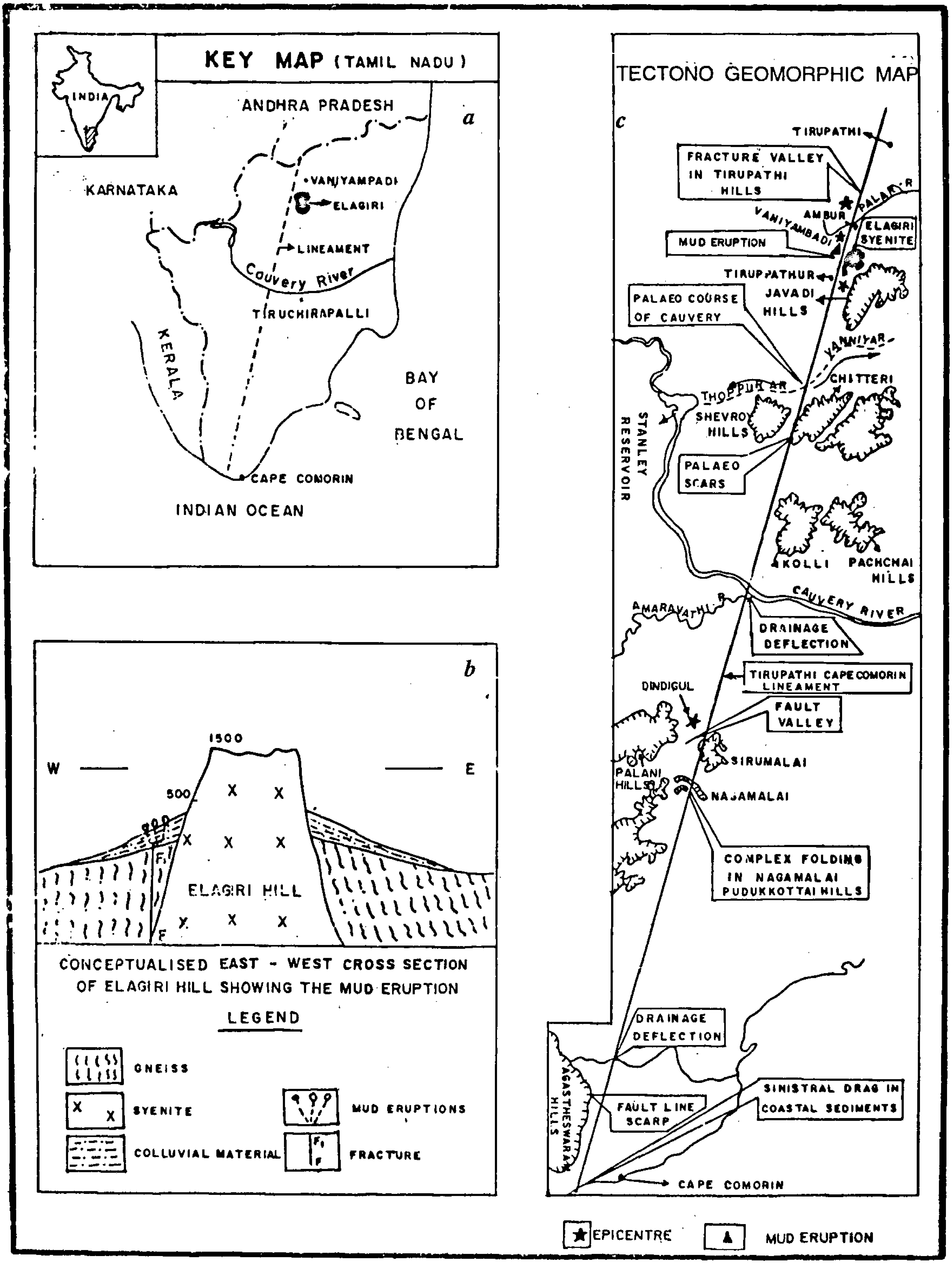

Figure 1. Location and key map of Elagiri region, Tamil Nadu.

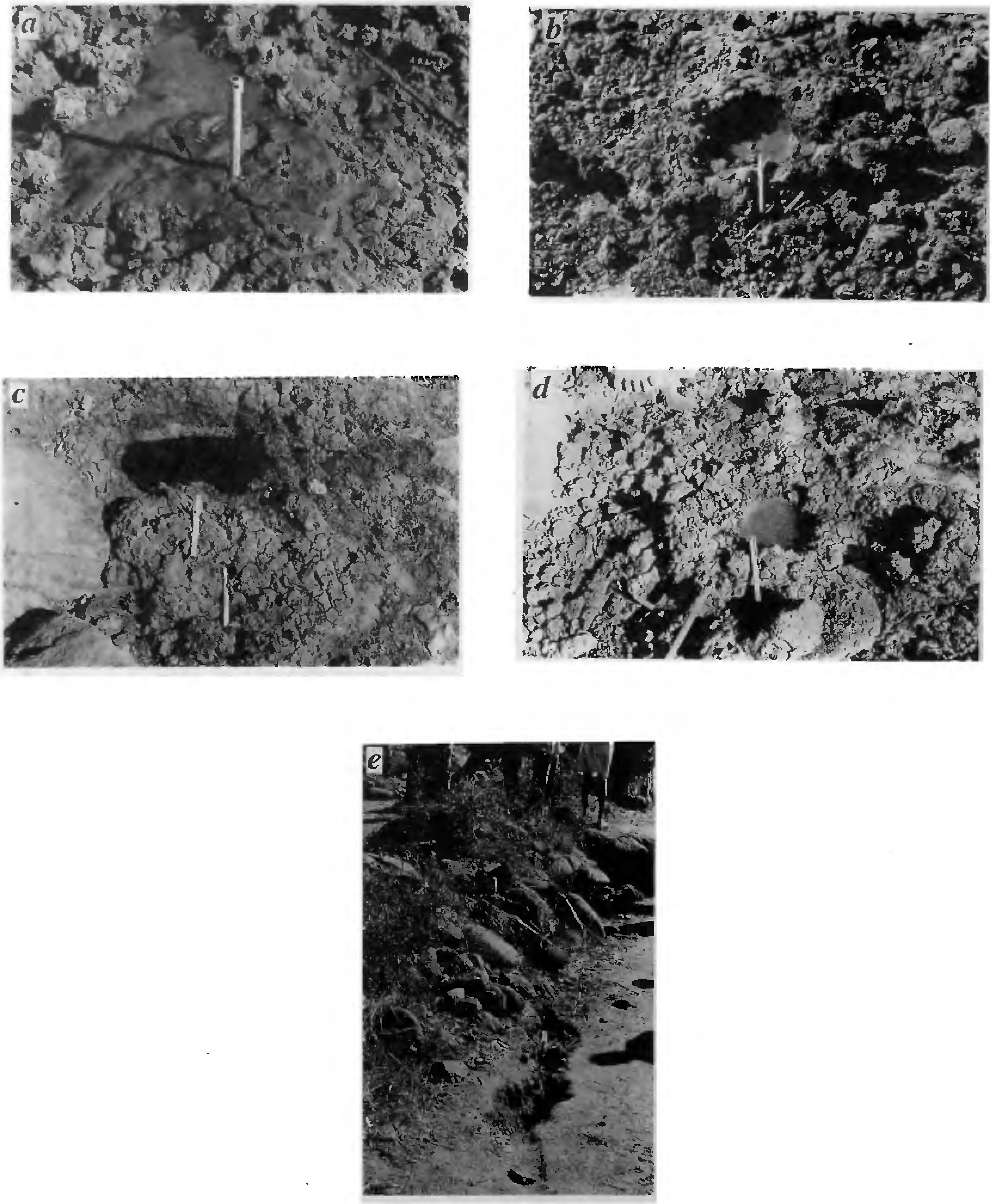

Figure 2. ***a***, Mud under eruption; ***b*** and ***d***, Micro mud-eruptive craters with encircled erupted dry mud; ***c***, Mud-eruptive crater showing black coating; ***e***, The remnant of crack along which mud has erupted.

The occurrence of such mud eruption in the present peninsular shield area is unusual and has been reported here for the first time. These are more usually observed in regions of recent geological intense orogeny as in Andaman–Nicobar, Trinidad, Java, Burma, Rumania, Colombia, along the coast of north Africa and intermontane basins of many parts of the world[2]. But interestingly, this mud eruption is found only along a very major lineament which is observed from Tirupathi in the north to Cape Comorin in the south (Figure 1 *c*). Ramasamy and Balaji[3] observed that all the N–S trending lineaments were active in Holocene times and are Pleistocene extensional fractures in nature and caused due to the northerly directed compressive force related to post-collision tectonics of peninsular India.

Between Tirupathi and Palar river, Tirupathi–Cape Comorin lineament forms a very conspicuous fracture valley (Figure 1 *c*), whereas it forms a very deep and narrow gorge separating the Shevroy and Chitteri hills. Just north of Shevroy and Chitteri hills where this lineament cuts across the major palaeo channel of Cauvery[4], there was observed a drainage reversal (Figure 1 *c*). That is, while the palaeochannel indicates the north-easterly palaeo flow of Cauvery from Stanley reservoir in the west towards Sathanur dam in the east, the misfit Thoppur Ar is flowing westerly and the misfit Vaniyar is flowing easterly from this lineament which indicates the phenomenon of probable land wedging along this lineament. Between Shevroy and Chitteri hills, where this lineament forms a narrow valley, all along the western slope of the Chitteri hills, which is rimmed by this lineament, land slides and palaeoscars are observed. Further south, where this lineament crosses the Cauvery river, there is an appreciable drainage deflection. The Sirumalai hills get abruptly chopped off on the west by this lineament and thus a huge valley is observed between Palani and Sirumalai hills. Further down south, the Nagamalai–Pudukottai hill ranges are intensely folded along this lineament. Again down south, this lineament has not only truncated the Western Ghats of Agastheeswaram area, the lineament also seems to show a sinistral strike slip of coastal land forms in Cape Comorin. The earthquake epicentre data show that in close proximity of the lineament there occurred repetitive tremors in Vaniyambadi, Salem and Tirupattur areas.

Thus all the above morphotectonic signatures like deep gorging, landslides, drainage reversals, drainage deflections, acute folding, faulting and sinistral drag of pleistocene sediments and the earthquake episodes show that this N–S trending lineament is dynamically active in the Pleistocene–Holocene times.

The present mud eruption in close proximity to the above discussed N–S major lineament is yet another confirmation of the activeness of this lineament. The post-eruptive seismic shocks reported by NGRI further suggest that this lineament/fault had reactivated during the last week of January and first week of February 1997. Hence, due to such reactivation the colluvial fills which comprise highly plastic water-bearing clay derived obviously from feldspar-rich Elagiri Syenite got compressed and squeezed due to such tremor/reactivation and poured out as eruption. The N–S trend of the above recent fissure confirms its tectonic linkage with the above mentioned Tirupathi–Cape Comorin lineament. Though the occurrence of white material in the brownish oxidized mud while endorses its kaolinite nature, the black coating in the erupted mud probably indicates the presence of minor organic matter generated from the trapped plants in the colluvial fill. As the presently developed cracks have some branches and sympathetic subparallel cracks, it can be presumed that it might be a graben-in-graben structure caused during the recent reactivation of the above major lineament similar to the one reported from Bada earthquake province of northeast Africa[5].

Further, Ramasamy and Balaji[3] and Ramasamy *et al.*[6] have observed that all the N–S trending lineaments of Tamil Nadu and adjacent states are active and opening up like lenses due to northerly compression. So such compression would have reactivated the above N–S trending Tirupathi–Cape Comorin lineament during January–February 1997 and caused fracturing/micro fracturing and subsequent mud flow.

Hence these aspects need detailed studies in unfurling knots pertaining to midplate seismicities.

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