Southern India develops a hunch back

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According to plate tectonic concepts, Earth's landmasses form a mosaic of more than a dozen major and several smaller plates (e.g. Indo-Australian Plate, African Plate, Pacific Plate, etc.) all floating over the mantle on a plastic or semi-soft layer of rock. The margins or the boundaries along which two or three major plates meet are usually the sites of tectonic activity, i.e. they are the zones of deformation like faulting; or, regions where ocean floors spread and oceanic ridges rise; or, they may be zones of convergence where one plate subducts and another overrides. While the plate boundaries are thus active, the main oceanic or continental crust, away from the boundaries and capping the plates, are usually passive. However, observations over the last two decades arising out of oceanographic expeditions, appear to belie some of these ideas about plate boundaries being exclusive sites of tectonic activity. Studies[1–3] of the Indian Ocean floor, south of the Indian Peninsula have revealed deformation and faulting in a region far from plate boundary and well within the Indo-Australian Plate. A 900 km long split has been created in this once united plate with the resultant two halves now moving in different directions[4]. Similarly, the Tien-Shan region in central Asia, far away from the collision zone, between India and Eurasia is undergoing deformation, currently[5].

Yet another instance of tectonic activity in a region far from plate boundaries has now been reported by Subrahmanya[6,7]. The area described by him is well within the continental plate making up the crust of southern Indian peninsula close to 13°N. Stretching east–west from Mulki on the west coast to Pulicat Lake, a little to the north of Madras, on the east coast, this Mulki–Pulicat Lake Axis (MPA) (Figure 1), marks a region of uplift due to sea-floor spreading along the Indian Ocean Ridge system. He has cited a number of evidences pointing to this uplift.

Uplift of continental land segments produce many geomorphological changes. The most noticeable ones are their effects on the drainage pattern. Rivers in the area may gradually change their courses or even get dismembered. If turbulent enough, the rivers can cut through the strata keeping pace with the uplift of land and develop, as a result, deep valleys or gorges while retaining their original courses unchanged. Also, changes in sea level take place, leading to emergence of land and accretion to the coastline. Besides, the neighbourhood of uplifted regions may experience seismic shocks of varying intensity.

Subrahmanya has recognized all these changes along MPA, commencing from the west coast, passing through the Mysore Plateau to Pulicat Lake on the east. He has observed that the ridge making up the MPA is virtually the water divide and eastward flowing rivers on either side of this line have shifted in conformity with the new slope developed as a result of the uplift, leaving what are termed palaeochannels (ancient channels, now defunct), marking their trends during various stages of the uplift. Noteworthy examples are the easterly flowing Pennar and Palar (Figure 2), which according to palaeochannel evidences, have shifted northeast and southeast respectively as the land between these two rivers gradually lifted up to form the MPA ridge. The author has observed similar river shifts at the western end of the axis also, where the rivers drain into the Arabian Sea. Here, the westerly flowing Swarna, Netravathi and Gurupur, on either side of the MPA, have taken to northwesterly and southwesterly courses depending upon whether they are to the north or south of this axis.

There is also the view that this uplift was responsible for the dismemberment of South India's major river, Cauvery, which once was flowing closer to the MPA, but which subsequent to the uplift, split, leaving the dismembered segments – the Palar and Ponnaiyar rivers, and shifted to the present trend further south, before joining the Bay of Bengal[8,9]. Moreover, there is deepening of the river valleys, and development of river terraces at the western end of the MPA, along the Netravathi River drain-

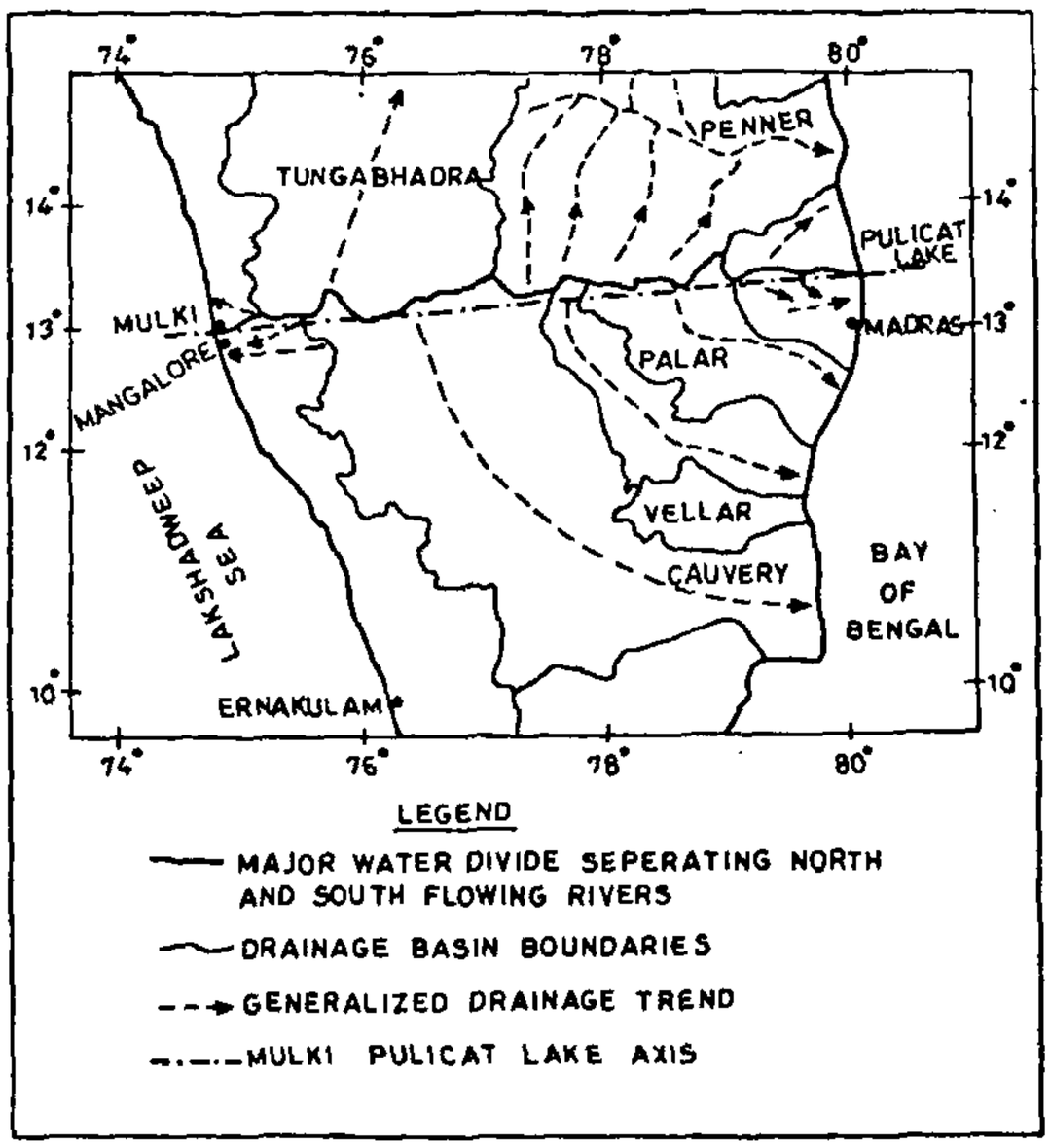

Figure 1. Generalized map of southern India, showing the Mulki–Pulicat Lake Axis (MPA), and the drainage pattern. The MPA is a zone of active uplift and marks a major water divide (after Subrahmanya[6]).

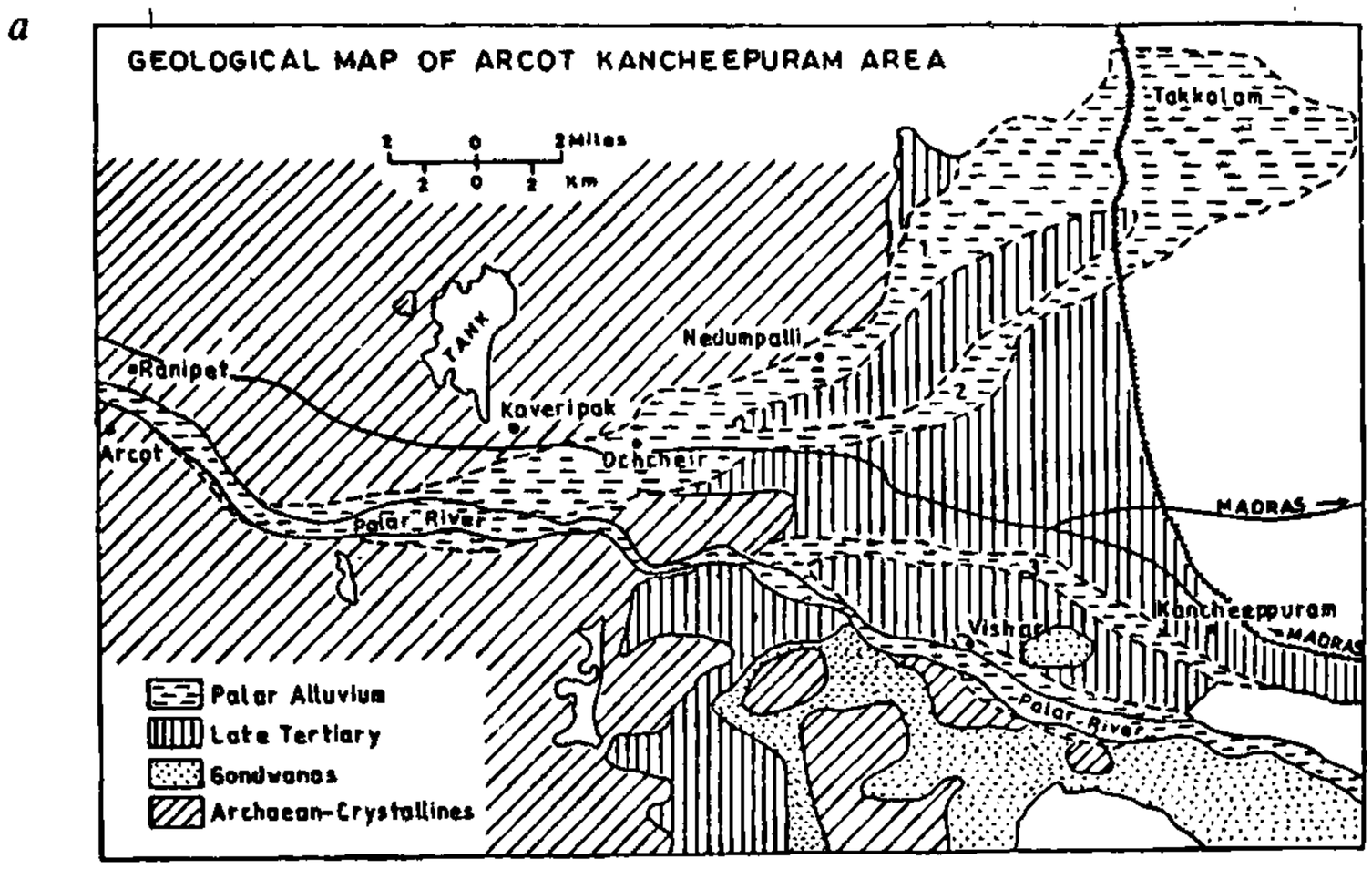

Figure 2. ***a***, Three palaeochannels (1,2, 3) showing the shifts of Palar flowing on the southern side of the MPA; ***b***, five palaeochannels 1–5 of Pennar flowing on the northern side of MPA (after Subrahmanya[6]).

ing into the Arabian sea. Marine shells and sands, pockets of saline waters[10] well inside both west and east coasts, apart from wave-cut platforms at different elevations (seen very well in St. Marys Islands off the west coast), have been noted. These are features arising out of falling sea level. The region close to 13°N has also recorded several seismic events[11] due to 'compression and uplift, related to the north–south oriented regional stress field'; and the Killari and Latur earthquake of 1993, in the adjoining State of Maharashtra, are believed by Subrahmanya to be related to this. Further, he feels that the 'region is likely to experience further upwarp and result in micro-seismicity to meso-seismicity to the south and mega-seismicity to the north of the MPA', thus dispelling the established notions that South India is seismically quiet and stable.

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