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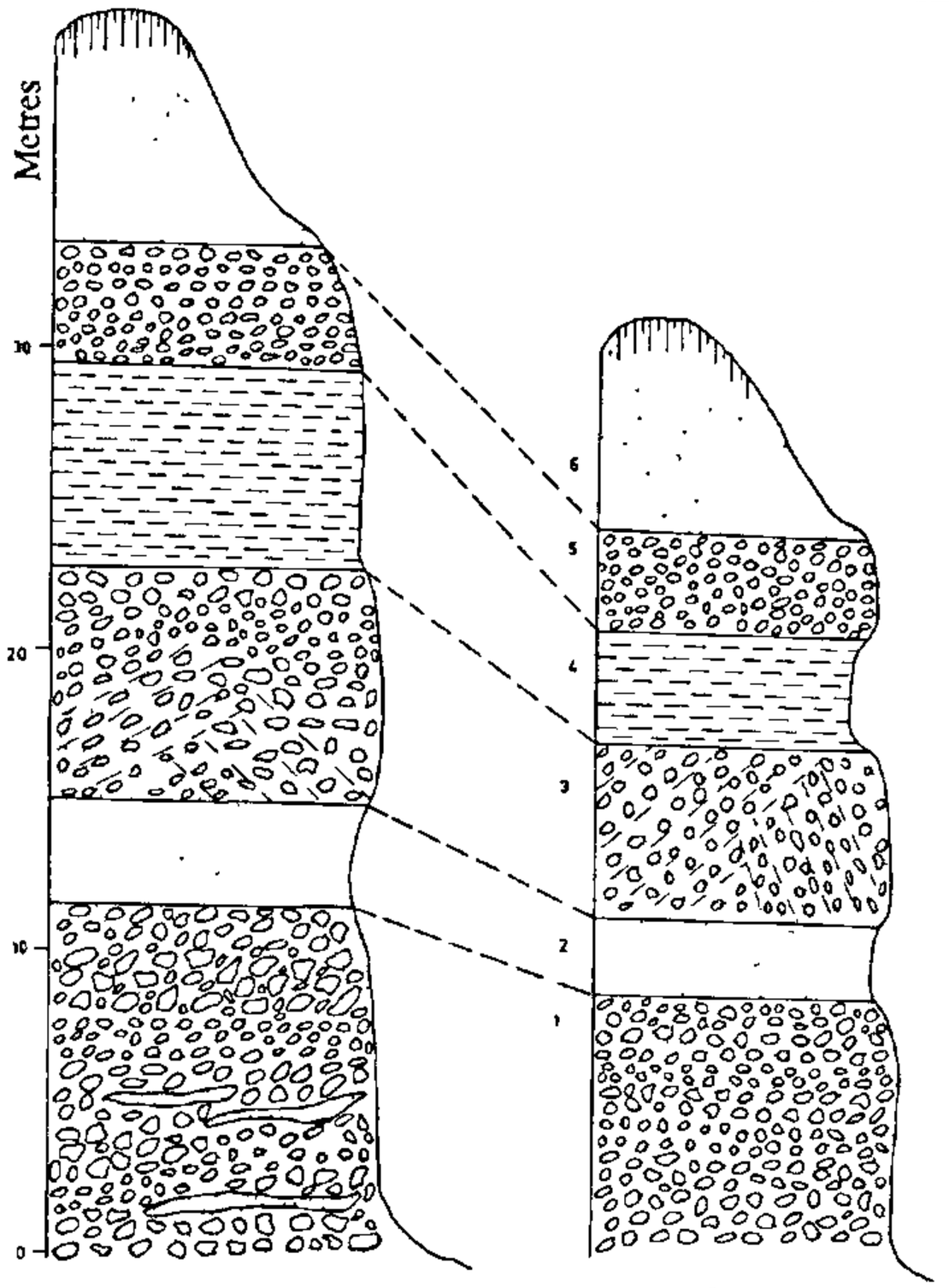

Figure 1. Quaternary sediment profile on Lower Narmada river (*a*) Tilakwada, (*b*) Maletha (after Chamyal and Merh[4]) 1 Clast to matrix supported poorly sorted coarse gravel, 2, stratified sand, 3, stratified medium to fine gravel, 4, laminated mud/sand, 5, clast supported medium to coarse unstratified gravel, 6, Dunal sands

Significance of bank material at Tilakwada in Lower Narmada Valley

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The alluvial gravels in the Lower Narmada Valley (LNV) at Tilakwada are tectonically controlled and appear to have accumulated in a graben. The three horizons of gravels distinguishable on the basis of their lithofacies point to their formation by the processes of debris and stream flows.

AN example of fluvial sedimentation controlled primarily by tectonism is provided by the alluvial gravels in the Lower Narmada Valley (LNV) near the Tilakwada town 60 km south of Baroda. The thick gravel deposits (20 m) are exposed in the cliffs along the river channel (Figure 1 *a*). Chamyal and Merh[1] included the lower two horizons of LNV gravels in their Tilakwada Formation. However, at Tilakwada three gravel horizons are distinguishable on the basis of their lithofacies; and are separated by intervening thin horizons of sand or mud.

LNV lies within the Cambay graben structure and the channel as well as its neighbourhood, especially the trap highlands to the south point to the existence of two sets of fractures N–S and E–W, related to the Cambay and Narmada basin tectonics[2, 3]. Bedi and Vaidyanadhan[4] have shown an identical lineament pattern in LNV. The graben at Tilakwada is located quite close to the intersection of the eastern boundary of the Cambay basin and Narmada fault and has provided an appropriate depression in which the gravels got accumulated.

The gravels exposed on the right bank of the Narmada river around Tilakwada form a distinct 40 m high cliff (Figure 1 *a*). Sequence of the gravels as given by Chamyal and Merh[1] along Narmada at Maletha is also taken into account (Figure 1 *b*). The lithofacies type of lowermost gravel forms an accumulation of subangular to subrounded boulders, cobbles, pebbles and smaller clasts of volcanics, quartzites and sandstone and is either matrix or clast-supported. The entire thickness is rather unstratified and the mean dip of the longest axes of the gravels is in the upstream direction. Texturally, the lithofacies comprises gravel about 75%, sand 15%, silt 7% and clay 3%. The mean size (phi) and the

inclusive graphic standard deviation (s_I) vary from 4.2 to 6.4 and 3.1 to 4.2 respectively. The logarithmic plots of the coarsest one percentile versus median particle size make a distinct rectilinear pattern. Taking into account the overall lithological and textural features, this gravelly horizon appears to have formed by the process of debris flow[5]. The gravel has several sand lenses and is overlain by a 3 m thick coarse to medium stratified sand layer.

The gravel that overlies the sand is characterized by subangular to rounded clasts (cobble to sand size). Well-defined stratification, interbeds of fine gravel or sand, graded bedding (both normal and inverse) imbrication and carbonate cement, points to its being a stream flow sheet deposit[6]. The uppermost gravel again shows features of debris flow. Grading is not visible, stratification is very poor and the clasts are mainly cobbles and pebbles. A distinct laminated mud and or sand horizon separates it from the underlying gravel.

The categorization of the three gravelly horizons into debris flow and stream flow lithofacies types has considerable significance from the point of view of the mechanism and the process of deposition in LNV, which, in turn, reflect the variations in the climate. During wet spells the Narmada river and its tributaries have carried the clasts and deposited them in the graben. The clasts are dominantly locally derived from nearby areas. The alluvial deposits in LNV vary greatly in lithology and show a decrease in clast size and progressive change in internal sedimentary structures in the downstream direction. Further, they are formed by more than one process and the proportions of different types of deposits vary both vertically and downslope.

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Stable isotopic evidence for the pedogenic origin of calcitic rocks of Andaman–Nicobar Islands, Bay of Bengal, India

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Carbon and oxygen isotopes and electron microprobe analyses were carried out in some calcitic outcrops of the Andaman–Nicobar group of islands. Isotopic results in these rocks indicate significant depletion in $\delta^{13}C$ (–12.0 to –15.02‰ vs PDB) and low $\delta^{18}O$ values (18.42 to 23.32‰ vs SMOW). The presence of chromite, magnetite, quartz and chlorite relicts in the microprobe analyses and other geological features suggest that they were formed by the alteration of ultramafic rocks. Brecciation and cementation of the ultramafics under the influence of meteoric water are attributed to the formation of these calcitic lenses.

THE Andaman–Nicobar group of islands constitute an island arc connecting the Arakan-Yoma range of western Burma to the festoons of islands south and west of Sumatra. These islands were uplifted during collisional events associated with the subduction of Indian plate under the Eurasian plate[1, 2]. The arc system is composed of an inner volcanic arc and an outer sedimentary arc. The ophiolitic suite of these islands consists of Plutonic igneous rocks, ultrabasics and volcanics[3]. The sedimentary rocks which occur in the south Andaman island are mainly composed of radiolarian cherts, conglomerates and grit, and turbidites[3, 4]. The radiolarian cherts which occur as thin bands consist of radiolarian tests set in the fine-grained clay matrix[4]. Mineralogical studies carried out in these clays showed that they are mainly made up of montmorillonite and chlorite minerals[4]. Conglomerates and grit unit include interbedded calcareous shales and sandstones[3]. Turbidites cover most part of the south Andaman island and comprise alternate greywackes, siltstones and shales. They have well-developed sedimentary structures like graded bedding, flow casts, load casts, convolutes, etc.[3]. Geological and geochemical studies of these sediments suggest that they were deposited under different oceanic environments[4, 6]

The calcitic outcrops of the south Andaman are exposed in small lenses in association with ultramafics and serpentinous rocks. These lenses which were reported earlier as 'hard crystalline limestones' are different from other shell carbonates and limestone boulders of these islands[7, 8]. These islands are extensively covered by forests and receive a very heavy annual rainfall of about 3800 mm