

Evolution of river Cauvery: A point of view

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Geomorphological studies reveal that the river Cauvery as we see it today is a composite river made up of two distinct parts which have been brought together as the result of an upwarp across the flow in comparatively recent times. The effect of the upwarp has been the rejuvenation of the river leading to its diversion southwards and linking it up with another east-flowing river at a lower elevation, through a series of narrow step-wise diversion channels.

River Cauvery is the river *par excellence* which has contributed in no small measure to the well-being and prosperity of a large section of our country. It has helped to cover the land over which it flows, a magnificent spread of lovely green carpet. Water of no other river in India has been used so completely and effectively for the benefit of mankind as the waters of the river Cauvery.

A consideration of the river's geological past, extending backwards in time for millions of years, to a time when man had not entered the world scene would prove helpful in understanding our present-day problems better.

Youth, maturity and old age of landforms

In tracing the development of a person we recognize three different stages—the stages of youth, maturity and old age. Similar stages in the development of landforms can also be recognized (Figure 1). Initially, rain falling on a mountain slope gathers itself into a stream and flows down the hill slope as a torrent. In this initial course, it has all the characteristics of youth—it jumps over precipices, it cuts through its way carving out steep valleys, it foams and bubbles and rushes onward in gay abandon. The valley through which the young river flows has steep sides and there are quite often rapids, cascades and waterfalls. This is the *youthful stage* of a river.

This stage is succeeded gradually by a *mature stage* where hills have lost their rugged character. They have become mellowed. All angularities have been almost removed presenting smooth round shapes. Valleys are broad and the velocity of the river is considerably reduced. There is very little down-cutting of the valley.

Going further down along the river, the mature stage passes on to the *stage of senility* or old age. All unevenness is removed and the land is reduced to a featureless plain in which the river moves gracefully in broad meanders. It

has now lost all its power of erosion and whatever load it had carried is deposited as alluvium over a flood plain on both sides of the channel. This is the last stage of its journey before it merges with the sea.

All landforms, therefore, pass through these three principal stages of development—youth, maturity and old age. This process of levelling through erosion may take thousands of years. One such full cycle is called an '*erosional cycle*'. The life cycle of a human being is reckoned as one hundred years. In the case of landforms, however, the duration of an erosion cycle can be many many times more than that of the human cycle.

One other major difference between human life cycle and erosional cycle as applicable to land surfaces is worth noting. In the case of human beings, there is a regular transition from one stage to another and the process is irreversible. For example, it is impossible for an old person to revert back to a youthful stage. Such limitations, however, do not exist in respect of landforms. The duration of an erosion cycle is so vast that during its full course, many things can happen interrupting the even course of the life cycle, imposing new sets of conditions. A senile river can thus become youthful and start its life all over again. It is possible for an ancient river to get rejuvenated. In such an event, the land that had got reduced to a featureless plain during the course of its erosional history gets uplifted and is once again exposed to erosion. The cycle starts afresh on the uplifted segment and the river which had previously lost much of its erosive power becomes

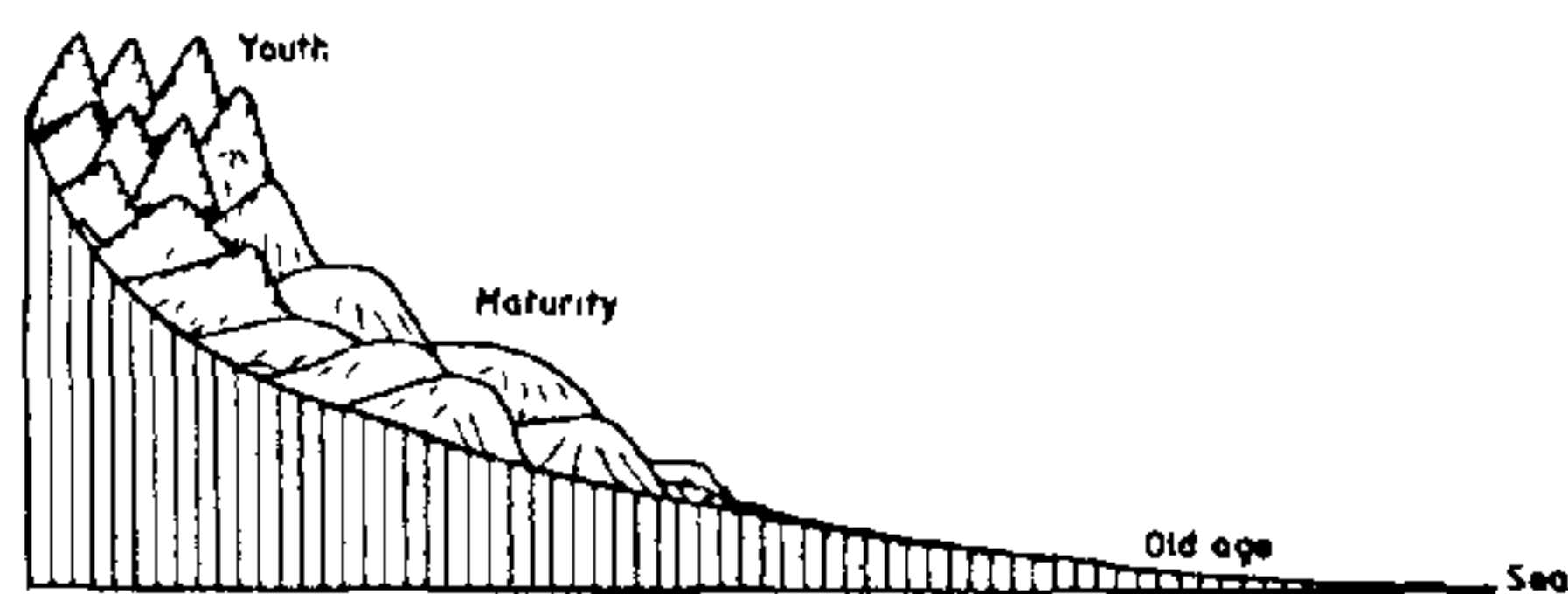


Figure 1. Cartoon showing the stages of youth, maturity and old age in landscape evolution.

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active once again. There is every possibility of the youthful river capturing the drainage of neighbouring rivers and enlarging its own drainage network. Such evidences of river capture or river piracy are common in regions which have got rejuvenated through recent uplift.

The Cauvery

Let us now take a look at the Cauvery and see how far we can recognize in its course, the stages of youth, maturity and old age. We shall try and gather whatever other significant information it can furnish on its evolution (Figure 2).

The basin of the river Cauvery is large covering an area of 87,900 km² spread over Kerala (2930 km²), Karnataka (36,240 km²) and Tamil Nadu (48,730 km²). The river takes its birth at Talakaveri in the Brahmagiri range of the Western Ghats almost within sight of the Arabian sea to the west, but takes an easterly course over the Mysore plateau and Tamil Nadu plains before joining the Bay of Bengal. The total length of the river is approximately 800 km. The course of the river can be split up into four stages.

Initial course in the mountainous region of Coorg

The traditional source of the river is at Talakaveri in

the Brahmagiri ranges of Western Ghats at an elevation of 1341 m above MSL. The river loses height rapidly and from Bhagamandala at the foot of the hills it flows eastwards. The terrain over which it flows is hilly and has a youthful aspect, while the river itself is in an advanced stage of maturity.

Meandering course over the Mysore plateau

Leaving the mountainous region of Coorg, the river enters the fertile fields of Mysore. These plains have a distinct character. They are not like the plains close to sea level, but represent an old surface subsequently elevated to form a plateau at a height of nearly 1000 m¹. Many flourishing townships can be seen on the banks of the river. The country over which the river flows is gently undulating and the river flows majestically in sweeping meanders. Numerous *anecuts* (barrages) constructed across the river have helped in irrigating land on either side of the river. A major dam has been constructed a little north of Mysore at Krishnarajasagar. The sweeping, meandering course of the river is maintained up to Shivasamudram, at which point, the river's flow is obstructed by a mountain wall, the northern extension of the Biligirirangan hills.

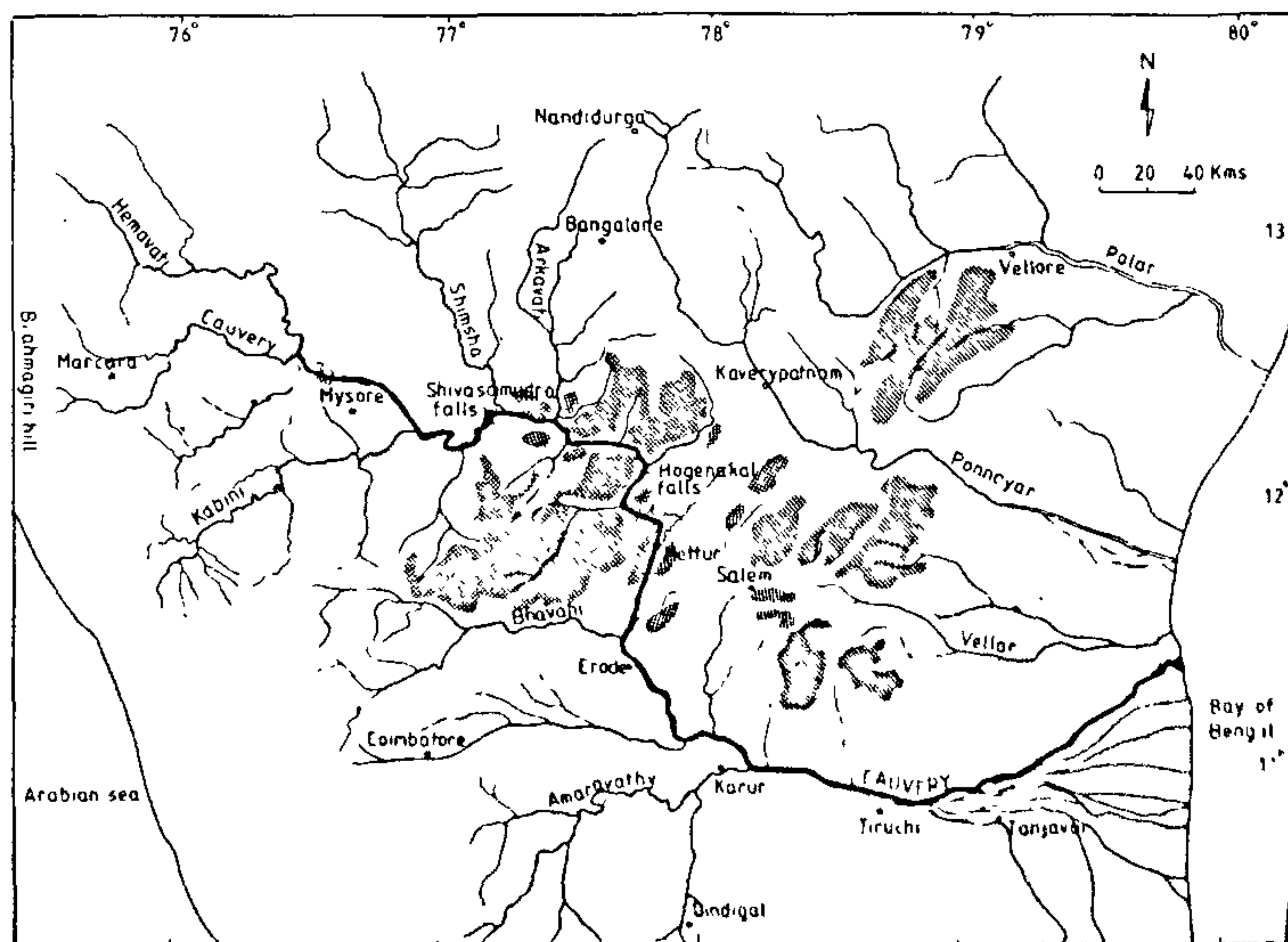


Figure 2. The Cauvery basin—the region between Shivasamudram and Erode is in a stage of youth, while the Upper and Lower reaches are in a state of senility. Shaded portion indicates mountains.

Rejuvenated course from Shivasamudram to Erode

Spectacular changes in the course of the river are witnessed from Shivasamudram onwards. The river which hitherto had shown signs of having reached old age, flowing gently in a slow meandering course, suddenly changes its character. It now takes a leap and flows through a wild, desolate region in which the surging waters of the mighty river are seen struggling to find a way out². The river splits into innumerable channels, falling over precipices and giving rise to picturesque water falls (Figure 3) near Shivasamudram. Thereafter, the river loses height rapidly, flowing in a wild narrow gorge of its own carving. In utter contrast to the prosperous townships on its bank in its earlier course, the land over which it now flows is wild and desolate with only occasional signs of human habitation. The enormous power of the rushing waters in this part of its course has to be seen to be believed. The realization will dawn that such a soft and pliable material like water can under certain circumstances develop the capability of breaking down the hardest rock, chiselling and carving it into fantastic shapes. The narrowest portion of the river is reached at *Mekedatu* where the river passes through a chasm so narrow, just a few yards wide, that it is said a goat could leap from one bank to the other (Figure 4), hence the name *Mekedatu* (goats leap). The erosive power is at its

maximum. The flow is in narrow straight channels marked by abrupt bends. The river in this section is seen to flow along gigantic long cracks (fractures) which developed in the rocks. The river literally leaps into Tamil Nadu at Hogenakal or the 'smoky rock', raising a cloud of spray.

The further course of the river is through a narrow gorge, most unusual for the size and volume of a river like Cauvery. It is here that a massive concrete dam has been constructed across the river, creating the Mettur reservoir.

Senile course over the Tamil Nadu plains

Leaving Mettur and still keeping a straight, narrow course it captures the waters of the river Bhavani joining it from the west. From here onwards, it once again turns eastwards. From Tiruchi onwards it flows over a very wide sandy bed with all its erosive power completely lost, depositing its sediment load over a vast flood plain. The senile river now branches into two, the northern branch Kolladam and the southern branch retaining the name of Cauvery.

Are we dealing with two rivers?

The above description of the Cauvery raises the question whether we are here dealing with two distinct



Figure 3. Cauvery falls, Shivasamudram.



Figure 4. Narrow channel of Cauvery at Makedatu—See the extent of the erosive power of the river forced into a narrow channel.

ivers which have been brought together accidentally to form a composite river as we see it today. The initial course of the river over the Mysore plateau at elevations around 900–1000 m can be designated as that of the *Upper Cauvery*. Likewise, the final course over the Tamil Nadu plains at considerably lower elevations of just 100–200 m, with a distinct character of its own, as the *Lower Cauvery*.

Evolution

The Upper Cauvery and its eastward extension

It may be conjectured that the Upper Cauvery has maintained an easterly course before its diversion southwards (Figure 5). Vaidyanadhan³ has given cogent arguments for considering the present day Palar from Vaniambadi onwards, as the original course of the Upper Cauvery. The wide river bed near Vaniambadi (Figure 6) suggests that it formed the bed of a major

river and that the present Palar is a misfit stream—a tributary which has usurped the course of a former major river.

The most unusual swinging of the river Cauvery between Shivasamudram and Erode in great right angled turns (Figure 5) is the result of the repeated capture over short distances, of several of the east-flowing rivers and their NNE and SSW-trending tributaries.

The Lower Cauvery

The former course of the Lower Cauvery is equally interesting. Lower Cauvery appears as a major east-flowing river, whose westerly extension can be picked up by the Amaravathi and Noyil flowing from near the Palghat gap⁴. The Palghat–Cauvery line is believed to be a weak zone, joining together two continental blocks, the Karnataka block to the north and the Tamil Nadu–Kerala block to the south⁵. This zone has remained a low-lying landform, highly sheared and immensely suited for the carving out of a major river valley.

Linking of the Upper and the Lower Cauvery

The circumstances under which two such distinct rivers like the Upper Cauvery and the Lower Cauvery flowing at two different latitudes and at two different elevations came to be joined together can now be considered.

The distinctly eastward drainage is the most characteristic feature of the drainage pattern of the Indian peninsula. Almost all rivers take their origin at the very edge of the peninsula within site of the Arabian sea and flow right across the full width of the continent before joining the Bay of Bengal. This predominantly easterly drainage is believed to be the result of the easterly tilt given to the peninsula as a result of the uplift of the western margin. The present day Western Ghats represent the precipitous edge of an uplifted plateau¹.

A study of Landsat imagery, aerial photographs and topographic maps brings out the additional fact that the region between Shivasamudram and Vellore, partly in Karnataka and partly in Tamil Nadu, is a region of special elevation. Numerous rugged mountain ranges guided by N–S and NE–SW shears characterize the region. These mountains are not just residual stumps of an older plateau but represent segments which have been restored to topographic youth through recent uplift. The Biligirirangan, Mahadeshwaramalai, Javadi, Shevaroy, Chitteri and the Kalroyan hill ranges are the present day representatives of this uplifted segment (Figure 7). This uplift which affected the peninsula several million years ago, i.e. long after the easterly

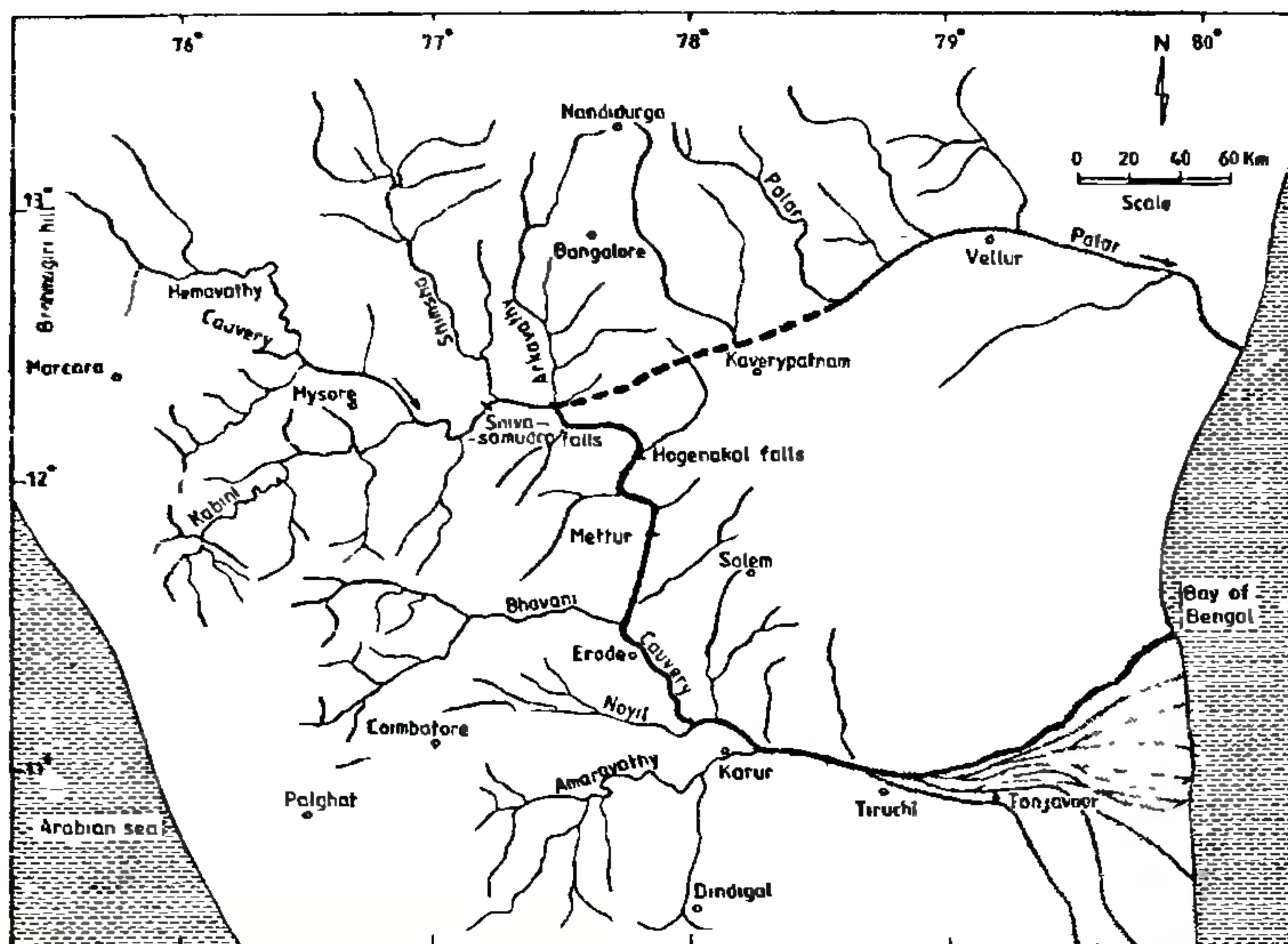


Figure 5. Projected easterly extension of the Upper Cauvery joining up with Palar



Figure 6. The large dry bed of Palar near Vaniambadi — pointing to the former existence of a channel of a major river like the Cauvery

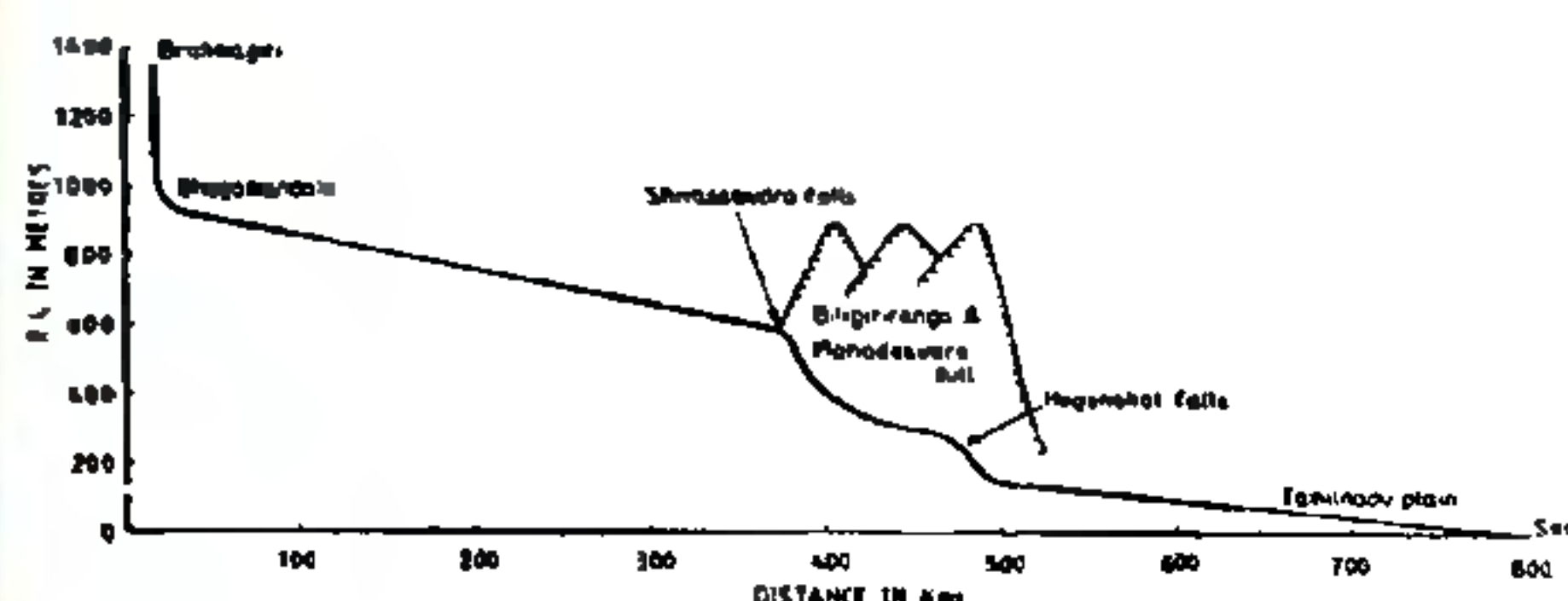


Figure 7. Linking up of the Upper and Lower Cauvery with an intervening region of structural disturbance, causing abrupt changes in the river course.

drainage had come to be well-established, is the main cause for seriously affecting the drainage pattern within this uplifted segment. The whole region had been rejuvenated giving rise to numerous instances of river capture, diversion of established drainage with attendant water-falls and flow through narrow gorges, accelerating vastly the rate of erosion. It is this upwarp which cut the Upper Cauvery into two, diverting the segment flowing over the Mysore plateau southwards and linking it up with the Lower Cauvery through a series of

narrow stepwise diversion channels. Cut off from the main supply, the easterly extension of the Upper Cauvery dwindled to a comparatively insignificant stream and lost its identity.

The capture of the head-waters of the Upper Cauvery and its diversion southwards subjected the triangular section between Shivasamudram, Krishnagiri and Bhavani to accelerated erosion. A crustal mass nearly 300 m thick over this ground was rapidly eroded and carried away by the raging waters of the diverted Cauvery to the sea. The rapid building of the rich Cauvery delta extending from Tiruchi eastwards via Tanjore and Kumbakonam is to be ascribed to this massive erosional influx initiated by the rejuvenated

course of the river Cauvery. The rich Cauvery delta around Tanjore could not have come into existence but for this massive contribution of weathered material from the uplifted segment across the flow of the Cauvery. The processes of erosion and sedimentation, destruction on one side and construction on the other, go hand in hand maintaining a balance, emphasizing the balance in nature.

An attempt at bold thinking

This exercise at gaining knowledge of the geological past of the river Cauvery is an attempt at 'bold thinking', covering vast tracts of space, irrespective of state boundaries and extending backwards in time to millions of years. A number of facts of observation have been focused with a view to erecting a model of drainage development which is breath-taking in its grandeur. The grand old dame Cauvery has grown young over and over again, in order to be able to

bestow her bounty on all. Truly, the epithet "*Punah Punarjāyamānā Puranee*" which was applied by the Vedic seers to *ushas* can more appropriately be applied to river Cauvery.

The physiographic incidents reviewed here hold the seed for much detailed work in the years to come. It is hoped that the preset bare outline of the evolutionary history of Cauvery will serve to generate interest in the further pursuit of geomorphological studies of this region.

Consideration of these larger issues should enable us, the inhabitants of both the segments of the Cauvery—the Upper as well as the Lower—to abandon extremist postures and strive for the good of all.

1. Radhakrishna, B. P., *Bull. Mysore Geol. Assoc.*, 1952, 3, 56.
2. Radhakrishna, B. P., *Bull. Mysore Geol. Assoc.*, 1955, 8, 1–15.
3. Vaidyanadhan, R., *J. Geol. Soc. India*, 1971, 12, 14–22.
4. Subramanian, K. S., *J. Geol. Soc. India*, 1987, 29, 362–363.
5. Radhakrishna, B. P., *J. Geol. Soc. India*, 1989, 34, 1–24.

MEETINGS/SYMPOSIA/SEMINARS

National Seminar on Applications of Personal Computers in Civil Engineering

Place: Nagpur

Date: 5–7 February 1993

The seminar is aimed at understanding application areas of civil engineering for which personal computers could be effectively used. The seminar will be dealing with aspects of: Analysis, design, estimation and optimization of civil engineering structures, including hydraulic structures and water-conveyance systems; foundations and earth-retaining structures; water resources management; project planning, project management and inventory control; detailing, drafting and drawing; soil-structure interactions; environmental engineering; surveying; computer-aided learning; knowledge-based expert systems.

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Review Meeting on 'Trends in DNA structure-function and genome organization'

Venue: Indian Institute of Science Campus, Bangalore

Date: 11–14 January 1993

Topics include: Novel DNA structures, bent DNA, Z-DNA, triplex, quadruplex, etc.; conformational analysis of sequence-dependent DNA structures; DNA structures and interaction with proteins; DNA supercoiling and transcription control; physical methods in genome analysis including novel methods for DNA sequence analysis.

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