Lecture Note

Sem. - VI

Paper: DSE – 3 (FLUVIAL GEOMORPHOLOGY)

Unit 2; Section - 3

Fluvial Landforms: River Terraces

By –

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1. Introduction:

The form of a channel is largely a function of the water and sediment supplied to it. Adjustments to channel form occur as a result of process feedbacks that exist between channel form, flow and sediment transport. At the reach scale, the type of adjustment that can take place is constrained by the valley setting, the nature of bed and bank materials, and bank vegetation.

Rivers may deposit material anywhere along their courses, but they mainly deposit material in valley bottoms where gradients are low, at places where gradients change suddenly, of where channelled flow diverges, with a reduction in depth and velocity.

Four types of fluvial deposit are recognized: **channel deposits**, **channel margin deposits**, **overbank deposits**, and **valley margin deposits.**

River terraces

A **terrace** is a roughly flat area that is limited by sloping surfaces on the upslope and downslope sides.

River terraces are the remains of old valley floors that are left sitting on valley sides after river downcutting. Flat areas on valley sides ‑ **structural benches** ‑ may be produced by resistant beds in horizontally lying strata, so the recognition of terraces requires that structural controls have been ruled out. River terraces slope downstream but not necessarily at the same grade as the active floodplain. **Paired terraces** form where the vertical downcutting by the river is faster than the lateral migration of the river channel. **Unpaired terraces** form where the channel shifts laterally faster than it cuts down, so terraces are formed by being cut in turn on each side of the valley. The floor of a river valley is a precondition for river terrace formation. Two main types of river terrace exist that correspond to two types of valley floor: bedrock terraces and alluvial terraces.

Bedrock terraces

Bedrock or **strath** terraces start in valleys where a river cuts down through bedrock to produce a Vshaped valley, the floor of which then widens by lateral erosion. The flat, laterally eroded surface is often covered by a thin layer of gravel. Renewed downcutting into this valley floor then leaves remnants of the former valley floor on the slopes of the deepened valley as rock-floored terraces.

Rock-floored terraces are pointers to prolonged downcutting, often resulting from tectonic uplift. The rock floors are cut by lateral erosion during intermissions in uplift.

Alluvial terraces

Alluvial or **accumulation** terraces are relicts of alluvial valley floors. Once a valley is formed by vertical erosion, it may fill with alluvium to create a floodplain. Recommenced vertical erosion then cuts through the alluvium, sometimes leaving accumulation terraces stranded on the valley sides.

The suites of alluvial terraces in particular valleys have often had complicated histories, with several phases of accumulation and downcutting that are interrupted by phases of lateral erosion. They often form a **staircase**, with each tread (a terrace) being separated by risers.

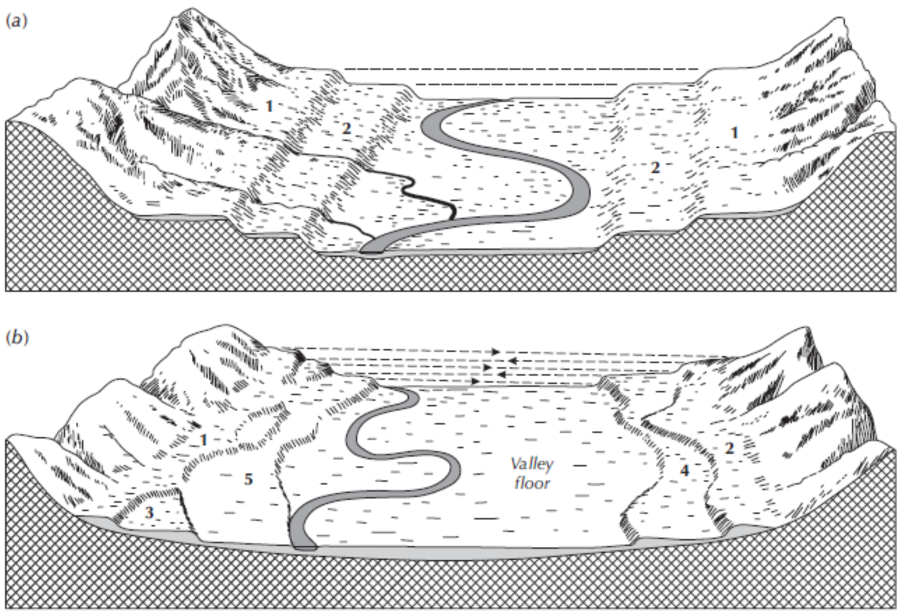

Figure 1: Paired and unpaired terraces. (a) Paired, polycyclic terraces. (b) Unpaired, noncyclic terraces. The terraces are numbered 1, 2, 3, and so on.

Sources: Adapted from Sparks (1960, 221‑23) and Thornbury (1954, 158)

Terrace formation and survival

Four groups of processes promote river terrace formation: (1) crustal movement, especially tectonic and isostatic movements; (2) eustatic sea-level changes; (3) climatic changes; and (4) stream capture.

In many cases, these factors work in combination.

River terraces formed by stream capture are a special case. If a stream with a high base level is captured by the upper reach of a lower-lying stream, the captured stream suddenly has a new and lower base level and cuts down into its former valley floor. This is a one off process and creates just one terrace level.

Crustal movements may trigger bouts of downcutting. Eustatic falls of sea level may lead to headward erosion from the coast inland if the sea-floor is less steep than the river. Static sea levels favour lateral erosion and valley widening. Rising sea levels cause a different set of processes. The sea level rose and fell by over 100 m during the Pleistocene glacial‑ interglacial cycles, stimulating the formation of suites of terraces in many coastal European river valleys, for instance.

Climatic changes affect stream discharge and the grain size and volume of the transported load (Figure 7.18). The classic terrace sequence on Rivers Iller and Lech, in the Swabian‑Bavarian Alpine foreland, are climatically controlled terraces produced as the climate swung from glacial to interglacial states and back again. The rivers deposited large tracts of gravel during glacial stages, and then cut into them during interglacial stages. Semi-arid regions are very susceptible to climatic changes because moderate changes in annual precipitation may produce material changes in vegetation cover and thus a big change in the sediment supply to streams. In the south-west USA, arroyos (ephemeral stream channels) show phases of aggradation and entrenchment over the last few hundred years, with the most recent phase of entrenchment and terrace formation lasting from the 1860s to about 1915.

Terraces tend to survive in parts of a valley that escape erosion. The slip-off slopes of meanders are such a place. The stream is directed away from the slip-slope while it cuts down and is not undercut by th stream. Spurs at the confluence of tributary valleys also tend to avoid being eroded. Some of the mediaeval castles of the middle Rhine, Germany ‑ the castles of Gutenfels and Maus, for example ‑ stand on small rock-floored terraces protected by confluence spurs on the upstream side of tributary valleys.

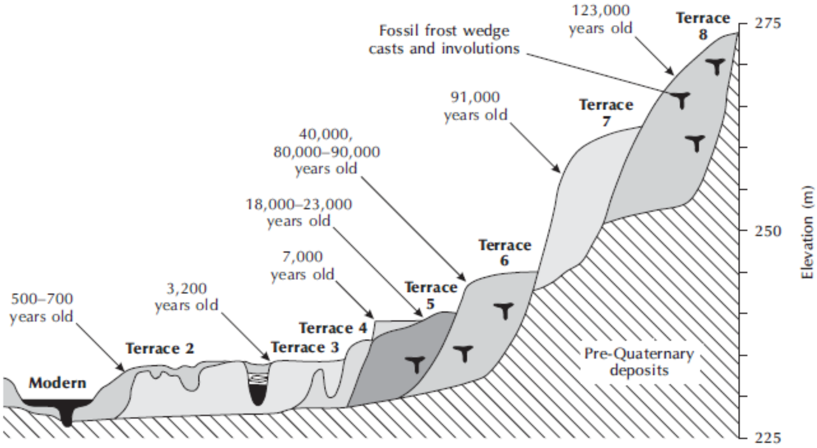

Figure 2: Terraces on the upper Loire River, France (diagrammatic).

Source: Adapted from Colls *et al*. (2001)

Disclosure: *This note has been prepared from the compilation of different works. This is not my original work.*

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