Introduction to Deschutes River Geomorphology

Guide: Steve Taylor, Fluvial Geomorphologist

The Deschutes River lies on the east flanks of the Cascade Range in central Oregon (see map figure below). This northward flowing river drains 27,000 sq. km, and is bounded to the east by the Ochoco Mountains, to the west by the Cascades, and south by uplifted drainage divides of the Great Basin. The Deschutes is underlain by sedimentary, igneous, and metamorphic rocks ranging in age from 250 million to 1.3 thousand years old, but the majority of bedrock is less than 65 million years. Prominent bedrock formations in the middle Deschutes area include: (1) sedimentary and volcanic rocks of the Clarno and John Day formations (54 – 22 million years old), (2) layered basaltic lava flows of the Columbia River Basalt Group (17-14.5 million years old), and (3) volcanic mudflow deposits of the Deschutes Formation (12 – 4 million years old). These bedrock units provide the foundational resisting medium that supports the modern Deschutes landscape and supports/underlies the canyon rims, valley walls, and channel bottoms.

In the Maupin Area, and northward to the Columbia River, the dark-colored rocks that form layered outcrop patterns on the hillslopes are part of the Columbia River Basalt Group (17-14.5 million years old). The basaltic lava flows are in turn weathered at the Earth's surface and fragmented to form the loose regolith ("thin soil") that covers the canyon walls. It is the loose, fragmented regolith that is then transported by landslides and river processes to form part of the sediment load of the Deschutes River. In addition to the local basalt bedrock source, river gravel is also derived from the other aforementioned formations, upstream of Maupin. While the rock material that composes the regolith may be 10's of millions of years old, the gravel fragments themselves are being processed, transported, and deposited in the present-day river environment.

The Deschutes actively eroded a large portion of the present canyon topography over a time period ranging from approximately 4 million to 1.2 million years ago. During the past 1 million years, the Deschutes Basin has been associated with local volcanic eruptions, landslide dams, and catastrophic flooding. Multiple pulses of the world-famous Missoula Floods backed up the lower Deschutes (below Maupin) leaving a record of fine-grained (silty) slack-water deposits (i.e. "dirty bath-tub ring") ranging in age from 15,000 to 12,000 years old. Missoula Floods were derived from large-scale ice dams in northern Idaho and northwestern Montana during the last glacial climate cycle. Over a period of 3,000 years, these ice-dammed lakes periodically broke loose with surging floodwaters spreading across eastern Washington and down the Columbia Gorge. As floodwaters encountered the Deschutes River tributary near The Dalles, water backed up the channel as far south as Maupin.

Small-Group Assignment – Introduction to Deschutes River Geomorphology

Attached (on page 2) is a worksheet that introduces the group to the local Deschutes landscape in the Maupin Area. Your crack river guide has visited five different locations in the Maupin area (labeled A-E on map, p. 2). Regolith samples were collected at each location on the map, and elevations relative to present-day river level were recorded (see data table). The objective of this exercise is to gain rudimentary skills in reading the landscape and develop an understanding of Deschutes River history. It is assumed that participants can read a topographic map. In small groups of 3 to 4, use the attached worksheet and map to make observations regarding the landforms and materials in the Maupin area. Fill out the worksheet using the terms provided. We will conduct a group debriefing once you've had a chance to build awareness of the environment around you.

Landscape Observation Worksheet
Introduction to Geomorphology of the Deschutes River in the Maupin Area

Landform Observation Terms

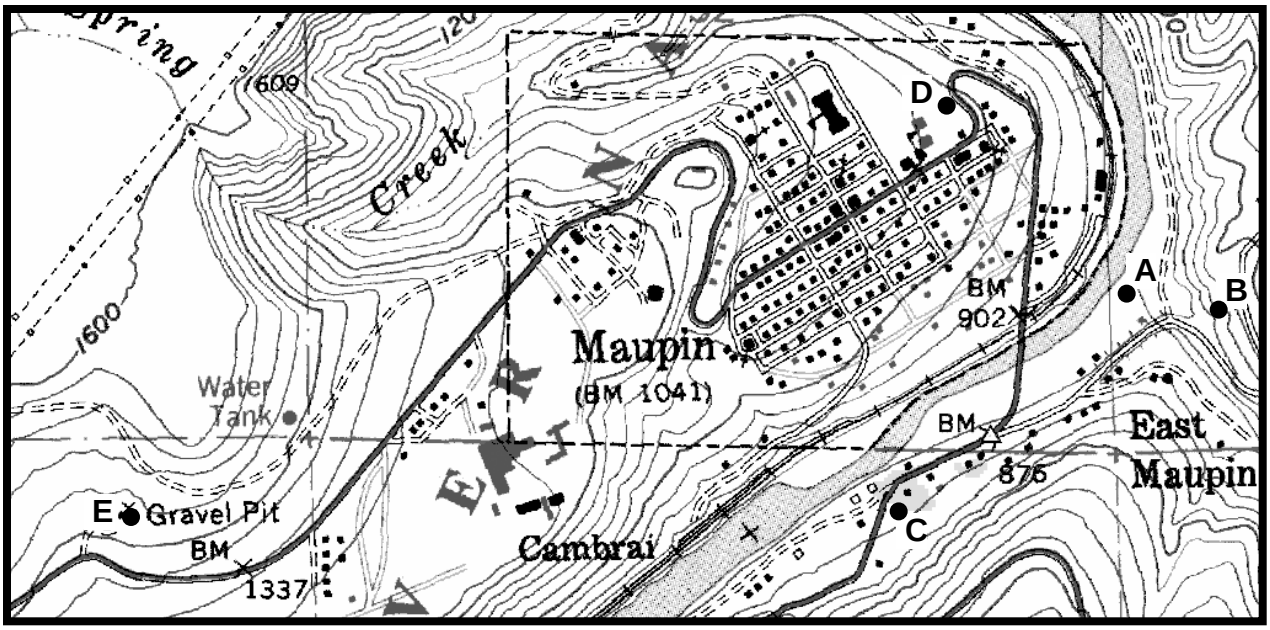
River Channel – active channel carrying water and sediment
Floodplain – low-lying area adjacent to channel that is flooded once every 1-3 years, covered with river alluvium
River Terrace – alluvium-covered flat surfaces, at elevations above floodplain
Hillslope – steeply sloping surface subject to gravity processes like rock fall, sliding, and creep

Material Observation Terms

Bedrock – hard layers of rock connected to the interior of the Earth's crust
Regolith – loose, weathered, broken rock materials, aka "sediment"
Alluvium – river deposits, clay-silt-sand-pebbles-cobbles-boulders; commonly rounded due to water tumbling
Colluvium – gravity deposits of sediment, commonly angular fragments that have not been tumbled

Other Characteristics: rounded vs. angular sediment fragments, well sorted (all sediment the same size) vs. poorly sorted (sediment mixtures of varying sizes) deposits

Sample Location	Elevation (ft)	Height Above River Level (ft)	Landform	Material	Observations
A	815	5	_____	_____	_____
B	900	90	_____	_____	_____
C	880	70	_____	_____	_____
D	1000	190	_____	_____	_____
E	1420	610	_____	_____	_____



Contour Interval = 40 ft

Deschutes River Elevation at City Park ~ 810 ft above sea level