

Field trip guides to the geology of the northern half of Lower Crooked Basin, Crook, Deschutes, and Jefferson Counties, Oregon — Overview

The north half of the of the Lower Crooked Basin resides at the intersection of the High Lava Plains and Blue Mountains physiographic provinces and encompasses approximately 2,338 km² (903 mi²) of the Crooked River drainage in central Oregon (Overview Figure 2). This part of the basin extends from Ochoco Divide on the east to Redmond on the west and from Prineville Reservoir on the south to Lake Billy Chinook on the north (see Overview Figure 2). The area is drained by the northwest-flowing Crooked River and its major tributaries: McKay Creek, Mill Creek, Marks Creek, and Ochoco Creek. Topographic relief in the north half of the basin ranges from 1,779 m (5841 ft) along Ochoco Divide on the northeast to 610 m (2,000 ft) at Lake Billy Chinook in the northwest corner of the basin. The city of Prineville, which encompasses a population of greater than 10,000 people within its urban growth boundary lies near the geographic center of the basin.

The Lower Crooked Basin has been the locus of episodic volcanic eruptions for much of the past 45 million years (see Overview Figure 1), including the formation of two large-scale rhyolite calderas during the Paleogene and eruption of numerous lavas from local small vents during the Neogene. Four distinct geologic domains composed of volcanic and sedimentary rocks spanning most of the Cenozoic Era are preserved within the north half of the of the Lower Crooked Basin. The Ochoco Mountains, which form the upland topography of the eastern half of the basin, are composed of Eocene andesite and dacite domes and flows and silicic volcanic and intrusive rocks that are part of the Clarno Formation. These rocks make part of the Ochoco volcanic field, which culminated with the eruption of the Tuff of Steins Pillar and formation of the Wildcat Mountain caldera around 40 Ma. The topographically low western part of the basin is underlain by Oligocene basalt lavas, rhyolite domes, and rhyolite ash-flow tuff that make up the Lower Crooked volcanic field and that are correlative with the John Day Formation. The main vent feature of the Lower Crooked volcanic field is the

large Crooked River caldera, which erupted the voluminous Tuff of Smith Rock at 29.56 Ma. Paleogene rocks in the west part of the basin are overlain by a cover of middle Miocene, Pliocene, and Quaternary basalt lavas and interbedded sedimentary rocks. These units include the Simtustus Formation, Prineville Basalt, Deschutes Formation, and basalts erupted from Newberry Volcano.

The following three field trip guides summarize geologic mapping in the Lower Crooked Basin that was partially funded by the U.S. Geological Survey National Cooperative Geologic Mapping program during 2005 and 2006. The field trips are organized chronologically, beginning with guides to two previously unrecognized Paleogene calderas and ending with a guide to overlying Neogene basalt stratigraphy exposed along the meandering course of the Wild and Scenic Crooked River south of Prineville.

Phanerozoic							EONOTHEM / EON
Cenozoic							ERATHEM / ERA
Tertiary					Quaternary		SYSTEM, SUBSYSTEM / PERIOD, SUBPERIOD
Paleogene			Neogene		Pleistocene	Holocene	
Paleocene	Eocene	Oligocene	Miocene	Pliocene			SERIES / EPOCH
65.5 ± 0.3	55.8 ± 0.2	33.9 ± 0.1	23.03 ± 0.05	5.332 ± 0.005	1,806 ± 0.005	11,477 ± 85 Yr	Age estimates of boundaries in mega-annum (Ma) unless otherwise noted

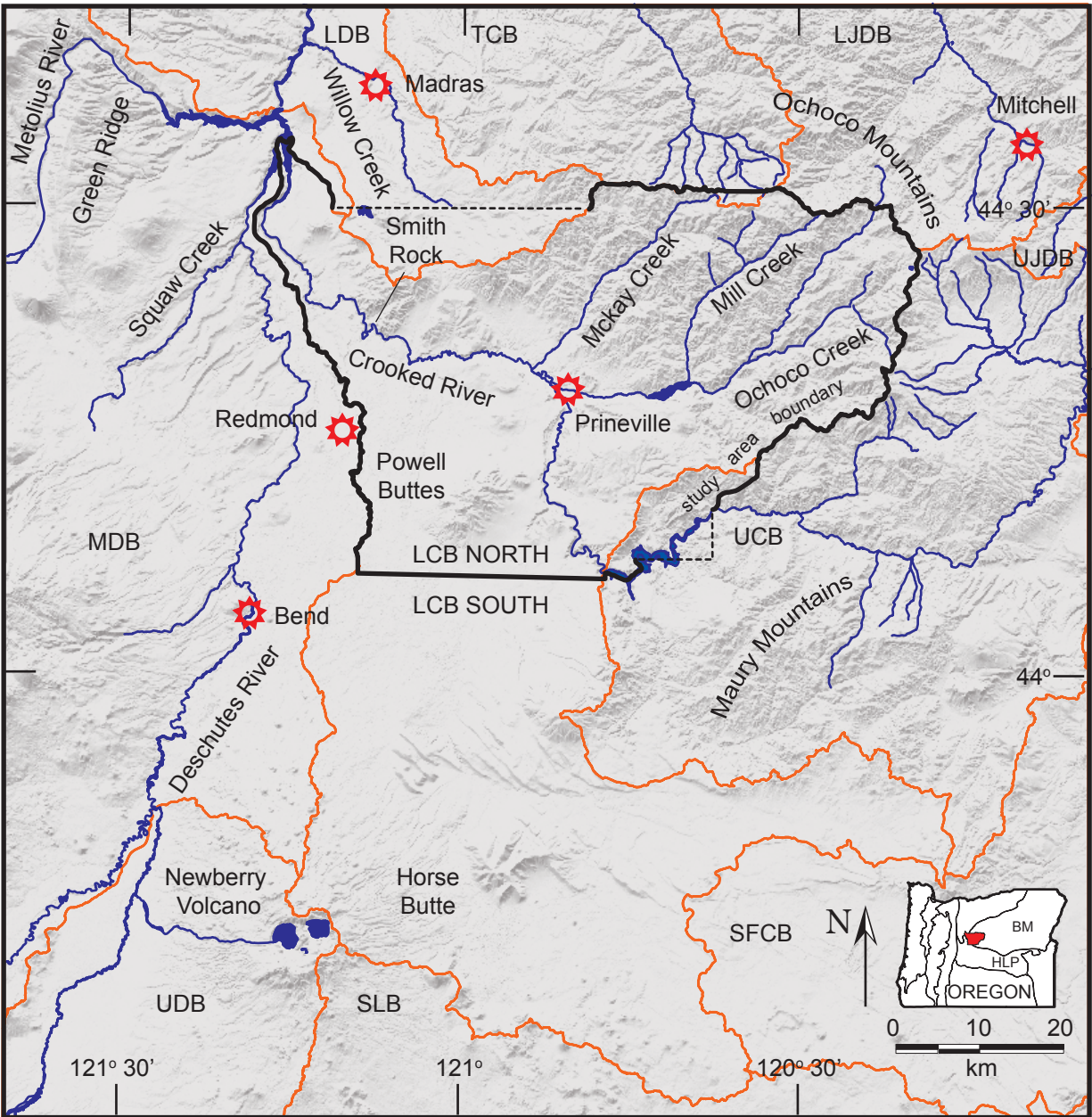
Overview Figure 1. Portion of geologic time chart (from U.S. Geological Survey, 2007) pertaining to Lower Crooked River trip guides in this issue.

CENTRAL OREGON FIELD TRIP GUIDES DEDICATION

This series of Lower Crooked Basin field trip guides is dedicated to Larry A. Chitwood (1942–2008), Deschutes National Forest Geologist, whose tremendous spirit and joy of learning, intellectual breadth, and love of geology inspired us all.

—Jason D. McClaughry, Caroline L. Gordon, and Mark L. Ferns





Overview Figure 2. Location of the north half of the Lower Crooked Basin in the state of Oregon (LCB north). Solid black line is the boundary of the geologic map compiled by Oregon Department of Geology and Mineral Industries in the Prineville area. The mapped region corresponds to the watershed hydrologic boundary of the LCB north; dashed black line indicates where the watershed boundary has been modified to incorporate relevant 1:24,000 scale geologic mapping. Orange lines demarcate the boundaries of hydrologic basins adjacent to the LCB north. South half of the Lower Crooked Basin (LCB south); Upper Crooked Basin (UCB); South Fork of the Crooked Basin (SFCB); Summer Lake Basin (SLB); Upper Deschutes Basin (UDB); Middle Deschutes Basin (MDB); Lower Deschutes Basin (LDB); Trout Basin (TB); Lower John Day Basin (LJDB); Upper John Day Basin (UJDB). Base is shaded relief 30-m DEM. Inset figure of Oregon shows physiographic provinces: BM, Blue Mountains; HLP, High Lava Plains.