



Simplified Stratigraphic Cross Sections of the Eocene Green River Formation in the Piceance Basin, Northwestern Colorado

By John D. Dietrich and Ronald C. Johnson

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Conversion Factors

Inch/Pound to SI

Multiply	By	To obtain
Length		
inch (in.)	2.54	centimeter (cm)
inch (in.)	25.4	millimeter (mm)
foot (ft)	0.3048	meter (m)
mile (mi)	1.609	kilometer (km)
Volume		
gallon (gal)	3.785	liter (L)
gallon (gal)	0.003785	cubic meter (m ³)
gallon (gal)	3.785	cubic decimeter (dm ³)

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Introduction

Thirteen stratigraphic cross sections of the Eocene Green River Formation in the Piceance Basin of northwestern Colorado are presented in this report. Originally published in a much larger and more detailed form by Self and others (2010), they are shown here in simplified, page-size versions that are easily accessed and used for presentation purposes. Modifications to the original versions include the elimination of the detailed lithologic columns and oil-yield histograms from Fischer assay data and the addition of ground-surface lines to give the depth of the various oil shale units shown on the cross section.

Stratigraphy of the Green River Formation, Colorado and Utah

The Green River Formation of the Piceance Basin was deposited in the Eocene Lake Uinta, a long-lived lake that covered much of the Piceance Basin, the Uinta Basin to the west in eastern Utah and westernmost Colorado, and the intervening Douglas Creek arch (fig. 1). Lake Uinta remained a single continuous lake across both basins and the Douglas Creek arch throughout most of its history, and most stratigraphic units can be recognized in both basins (fig. 2). The early stages of the lake are marked by deposition of clay-rich oil shale referred to as the Garden Gulch Member (figs. 2, 3). Oil-shale zones deposited later in the lake's history are carbonate-rich and referred to as the Parachute Creek Member. These oil shale units grade marginward into marginal lacustrine rocks of the Douglas Creek and Anvil Points Members. The names "Garden Gulch," "Parachute Creek," and "Douglas Creek Members" of the Green River Formation were first used by Bradley (1931). The name "Anvil Points Member" of the Green River Formation was first used by Donnell (1953). Sandstones and siltstones containing abundant volcanic debris intertongue with the upper part of the Green River Formation and form units within the Eocene Uinta Formation (Cashion and Donnell, 1974) in the northern part of the basin.

Cashion and Donnell (1972) recognized that the Parachute Creek and Garden Gulch Members could be subdivided into a sequence of oil-rich zones (R-zones) and oil-lean zones (L-zones) that could be recognized throughout much of the central part of the Piceance Basin and eastern part of the Uinta Basin (fig. 2). These zones appear to form approximate time-stratigraphic units representing changing rates of organic matter production and preservation that occurred simultaneously throughout Lake Uinta. The rich and lean-zone stratigraphy formed the basis of the recent assessments of in-place oil shale resources in the Piceance and Uinta Basins by the U.S. Geological Survey (Johnson and others, 2010a, 2010b). The lower zones, from the

L-0 zone through the L-1 zone, are rich in clay and contain little carbonate; these form the Garden Gulch Member (fig. 2). All zones above the L-1 zone composing Parachute Creek Member (fig. 2) are dolomitic. Units above the R-6 zone are, (in ascending order); the B-groove, a lean zone; the Mahogany ledge, the richest oil shale zone in the basin; and the A-groove, another lean zone. The 13 cross sections (locations shown in fig. 4–17) show the distribution of the Green River Formation and the rich and lean zones within them.

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Figures

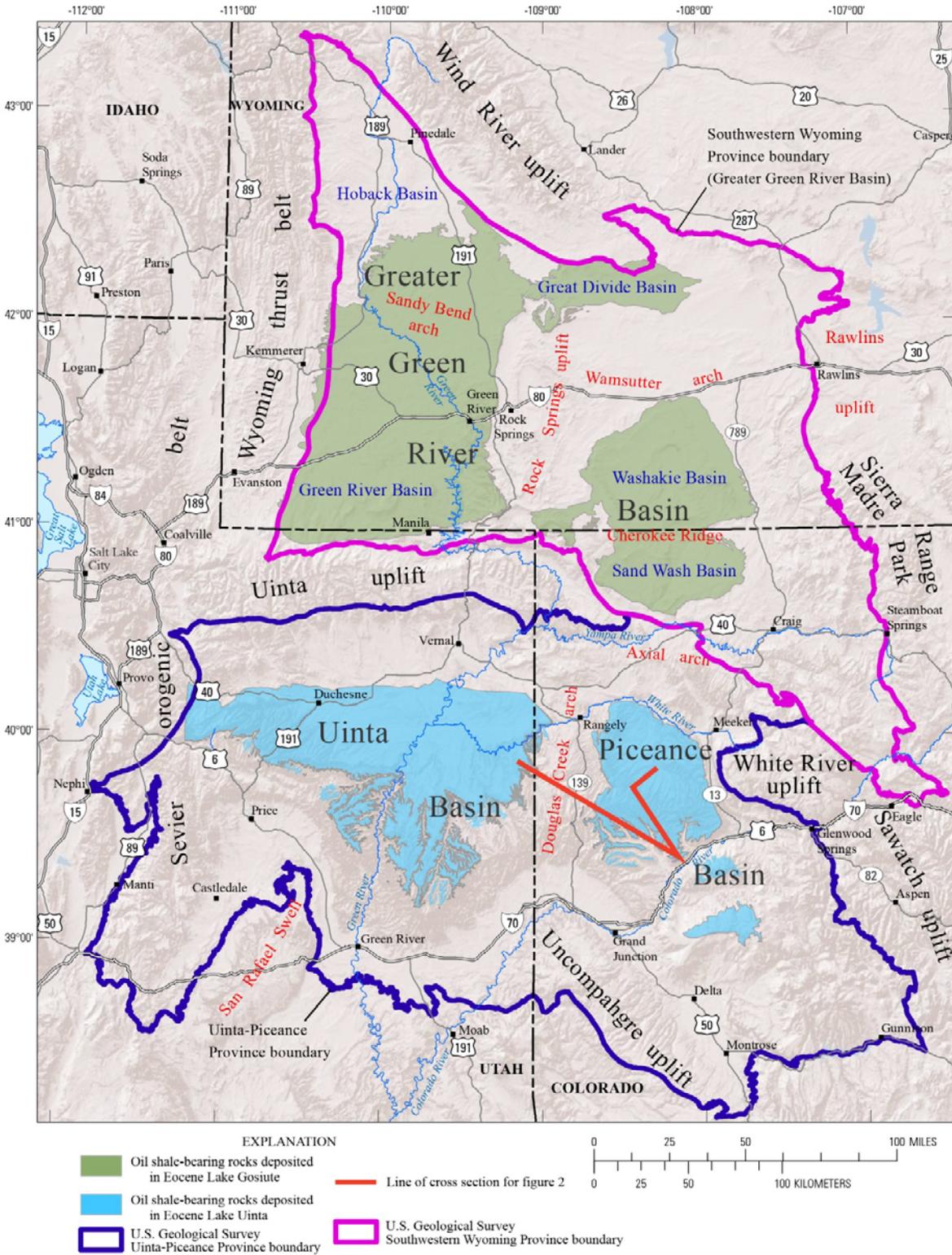


Figure 1. Map showing the extents of Uinta, Piceance, and Greater Green River Basins and approximate extent of oil shale in the Eocene Green River Formation. Modified from Mercier and Johnson (2012).

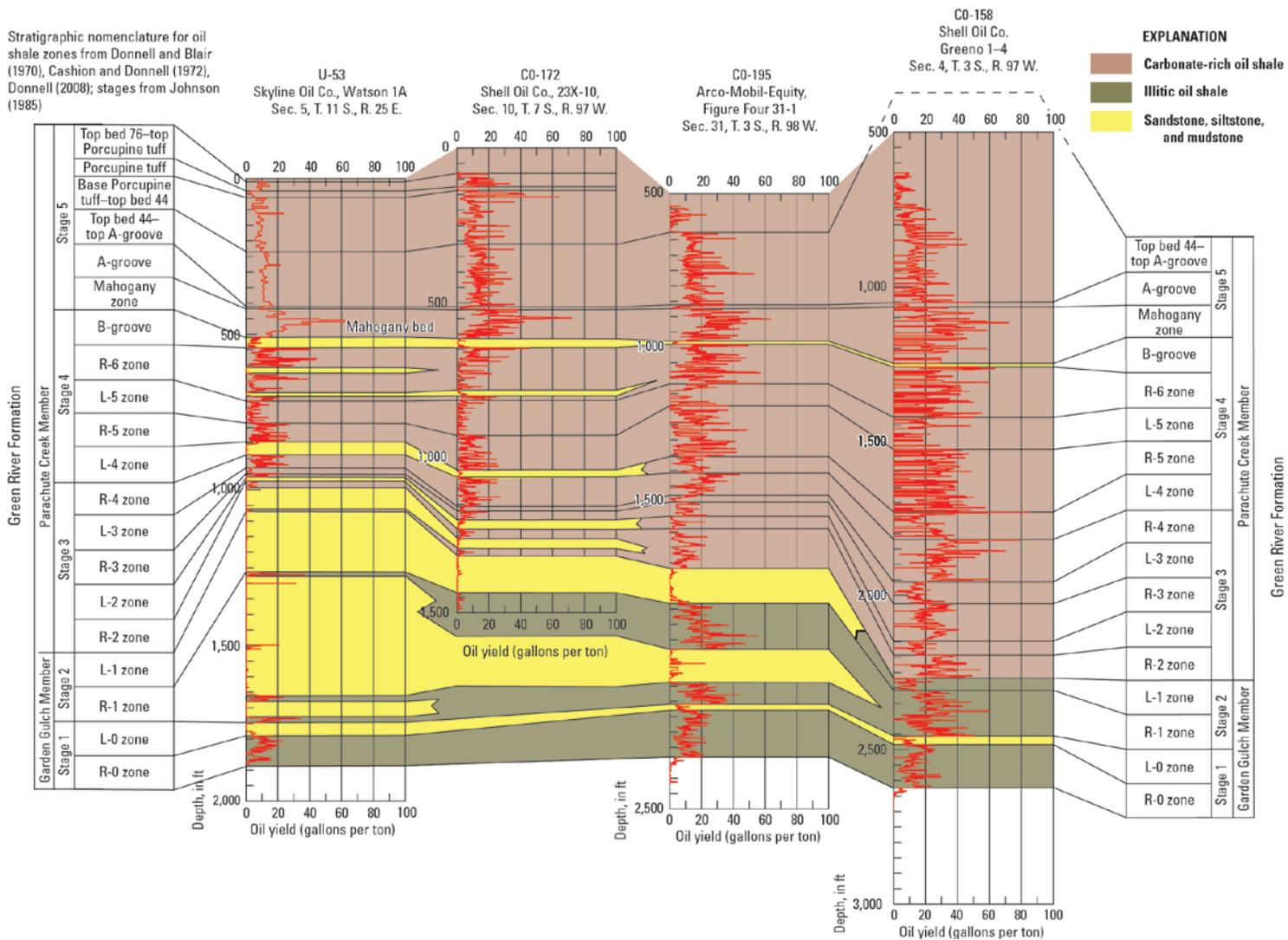


Figure 2. Cross section showing members of the Eocene Green River Formation, stages in the evolution of Lake Uinta, correlation of rich (R) and lean (L) oil shale zones of Cashion and Donnell (1972), and oil-yield histograms. Line of cross section is indicated on figure 1. Modified from Mercier and Johnson (2012). (ft, feet)

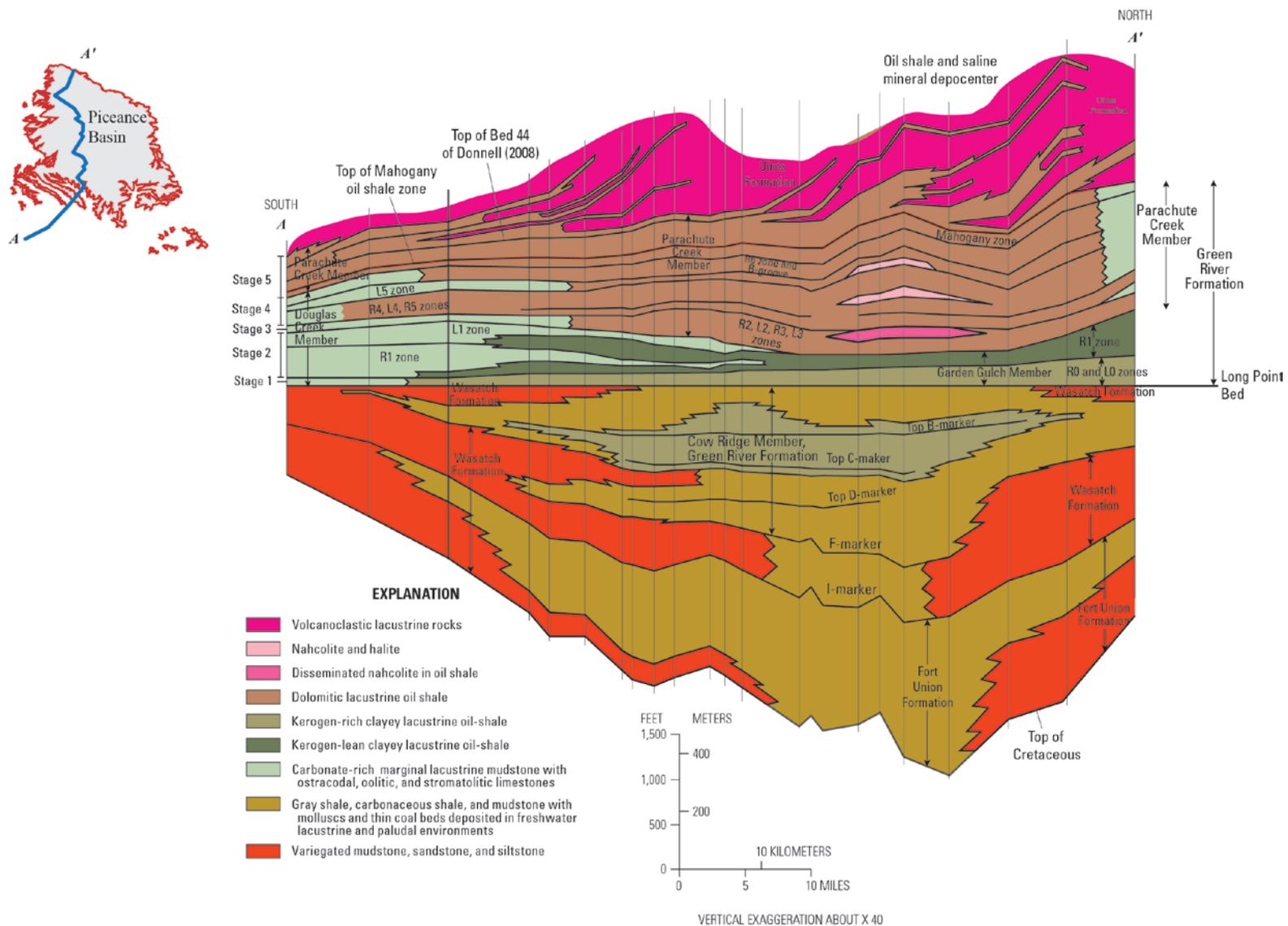


Figure 3. North-south cross section through the Piceance Basin, northwestern Colorado, showing stratigraphic subdivisions, stages of Lake Uinta as defined by Johnson (1985), and some of the rich and lean zones defined by Cashion and Donnell (1972). Modified from Johnson (2012).

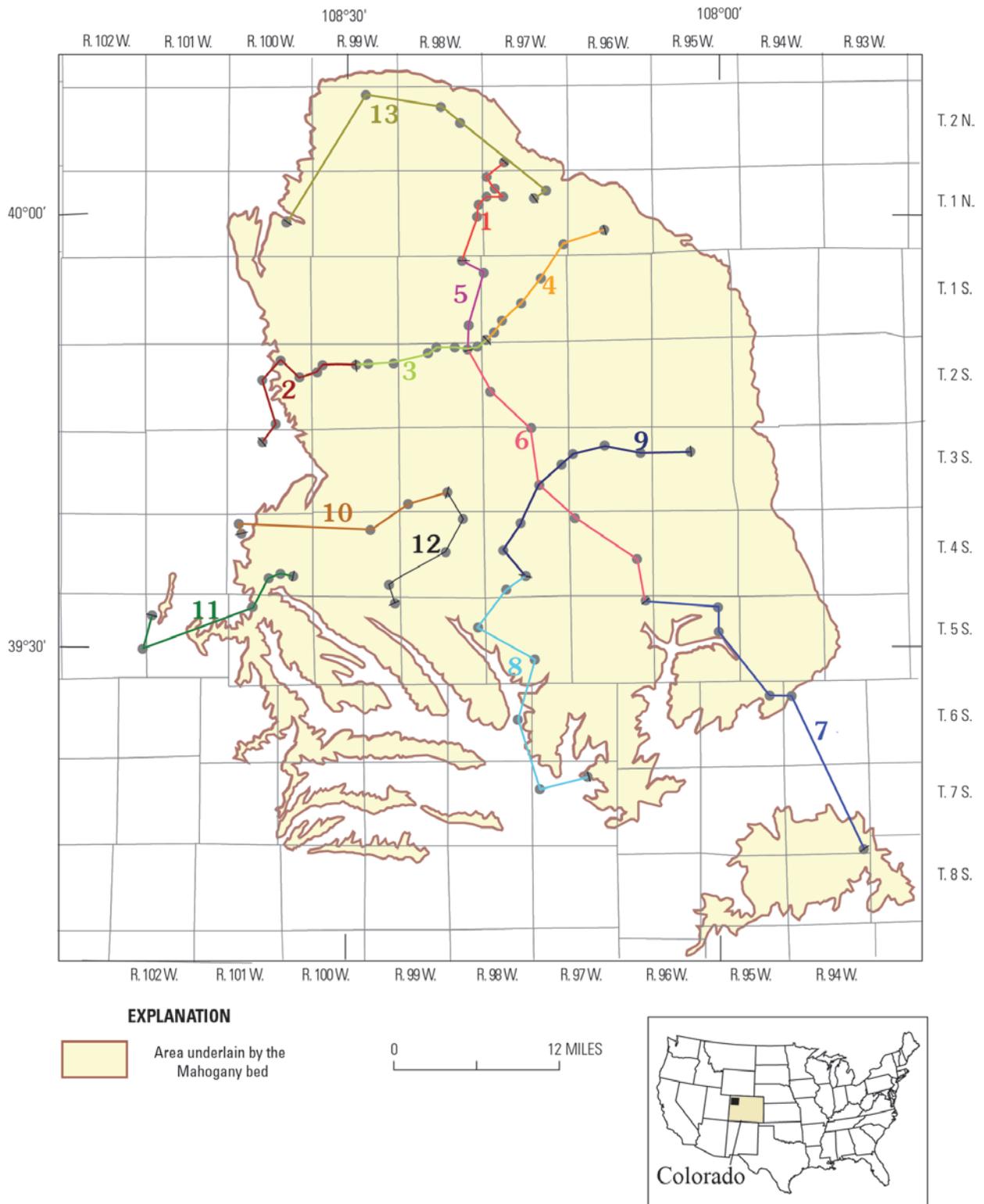


Figure 4. Map showing locations of the 13 stratigraphic cross sections in the Piceance Basin, Colorado. Modified from Self and others (2010).

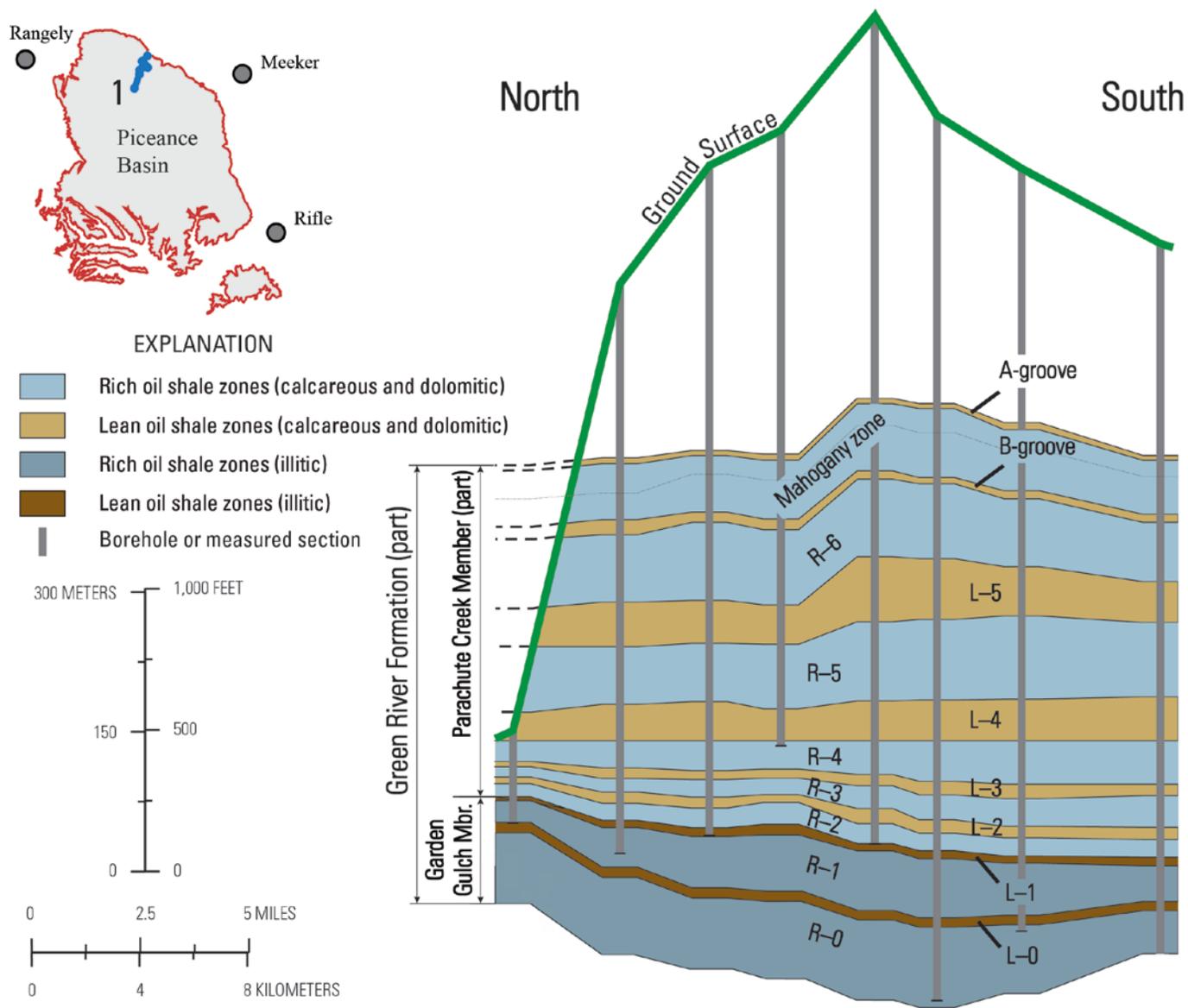


Figure 5. Cross section line 1. Modified from Self and others (2010).

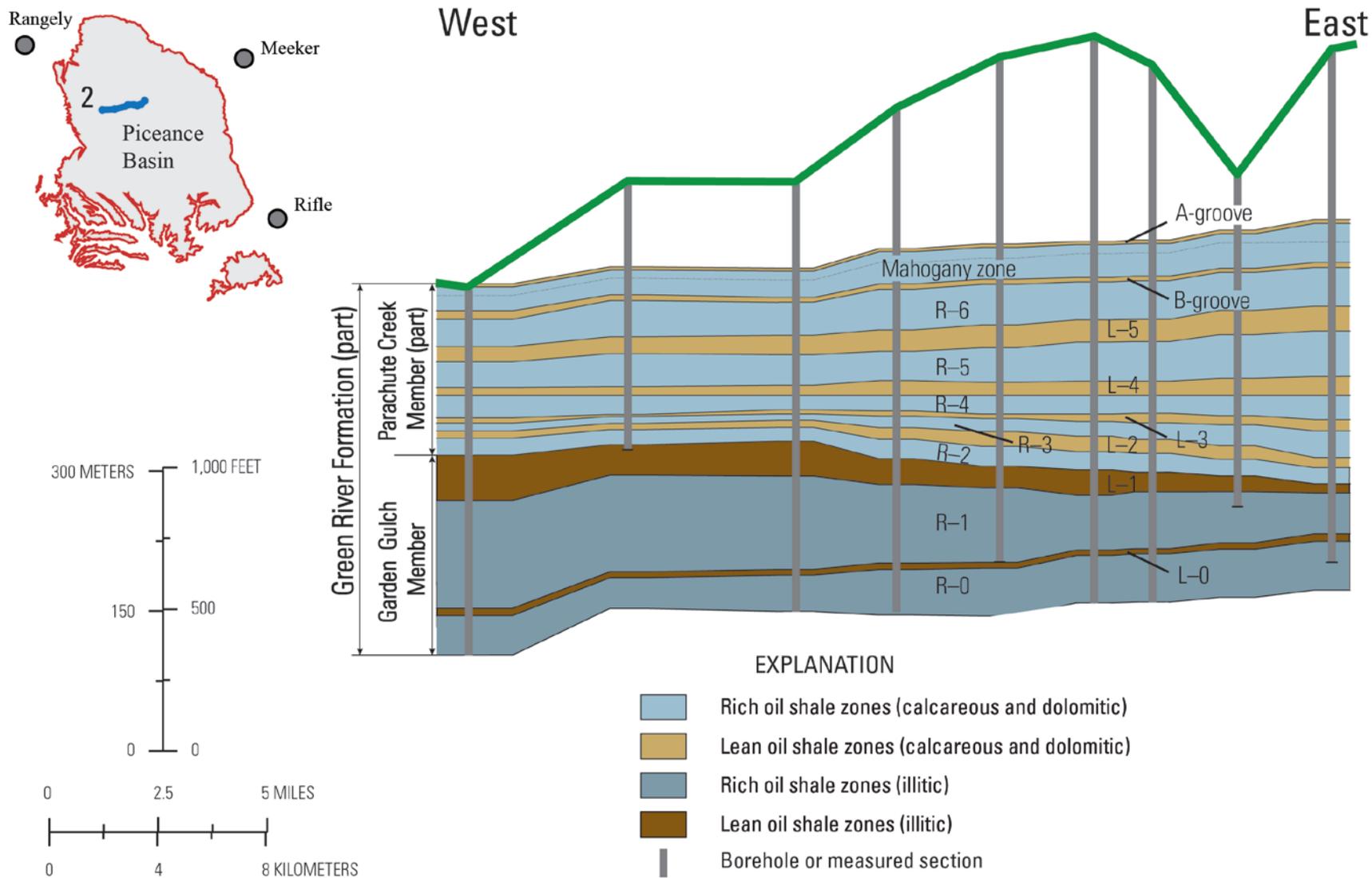


Figure 6. Cross section line 2. Modified from Self and others (2010).

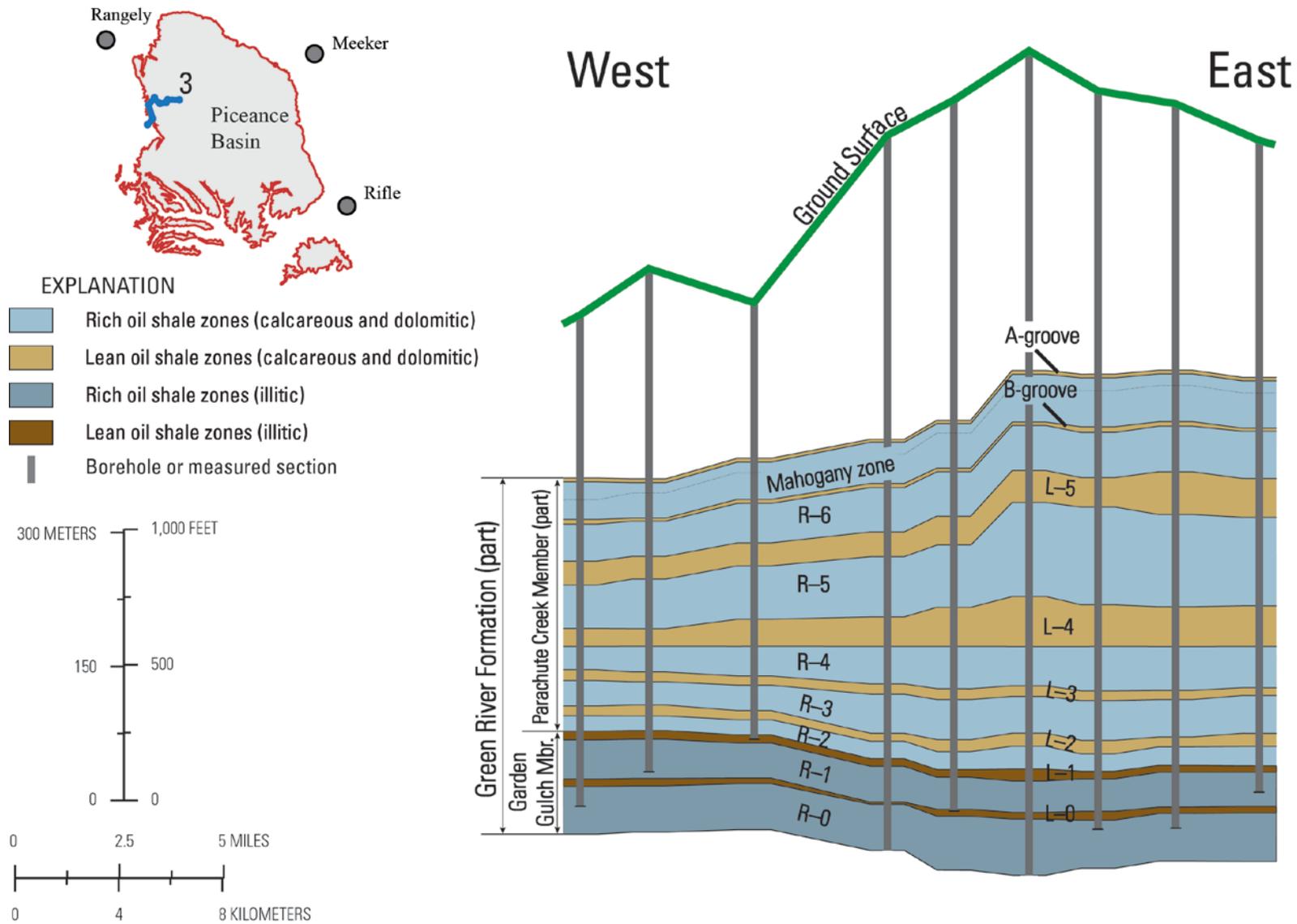


Figure 7. Cross section line 3. Modified from Self and others (2010).

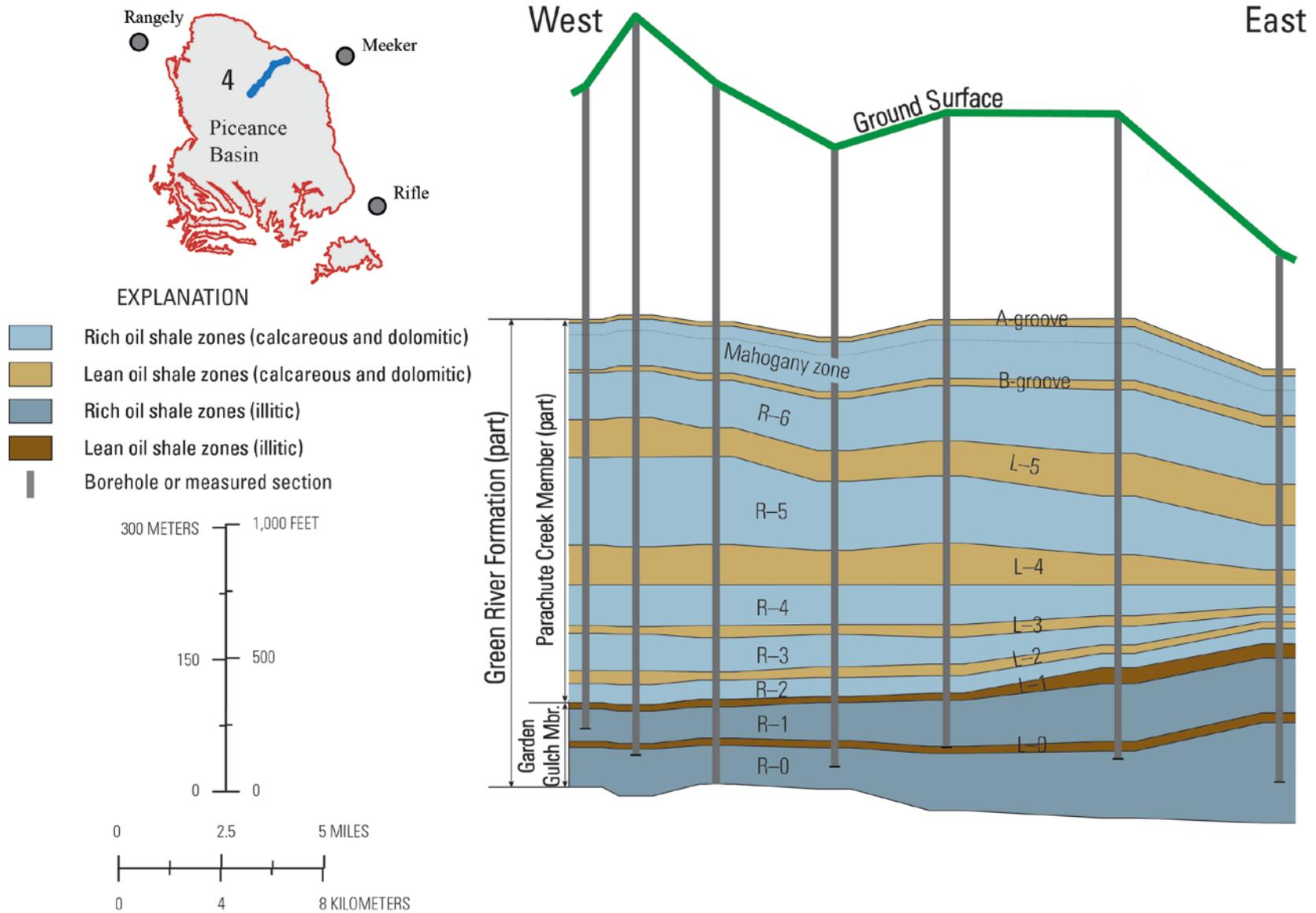


Figure 8. Cross section line 4. Modified from Self and others (2010).

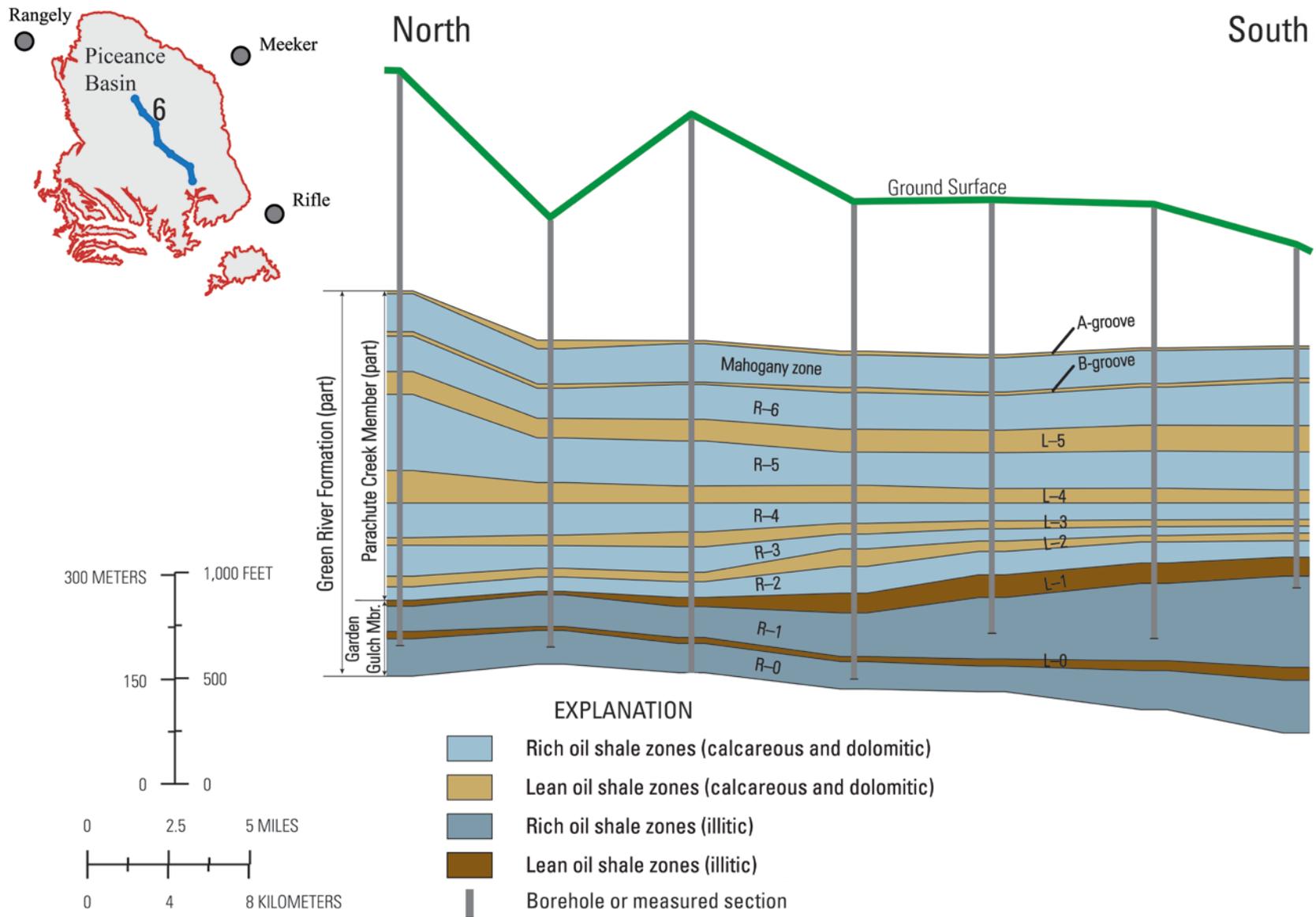


Figure 10. Cross section line 6. Modified from Self and others (2010).

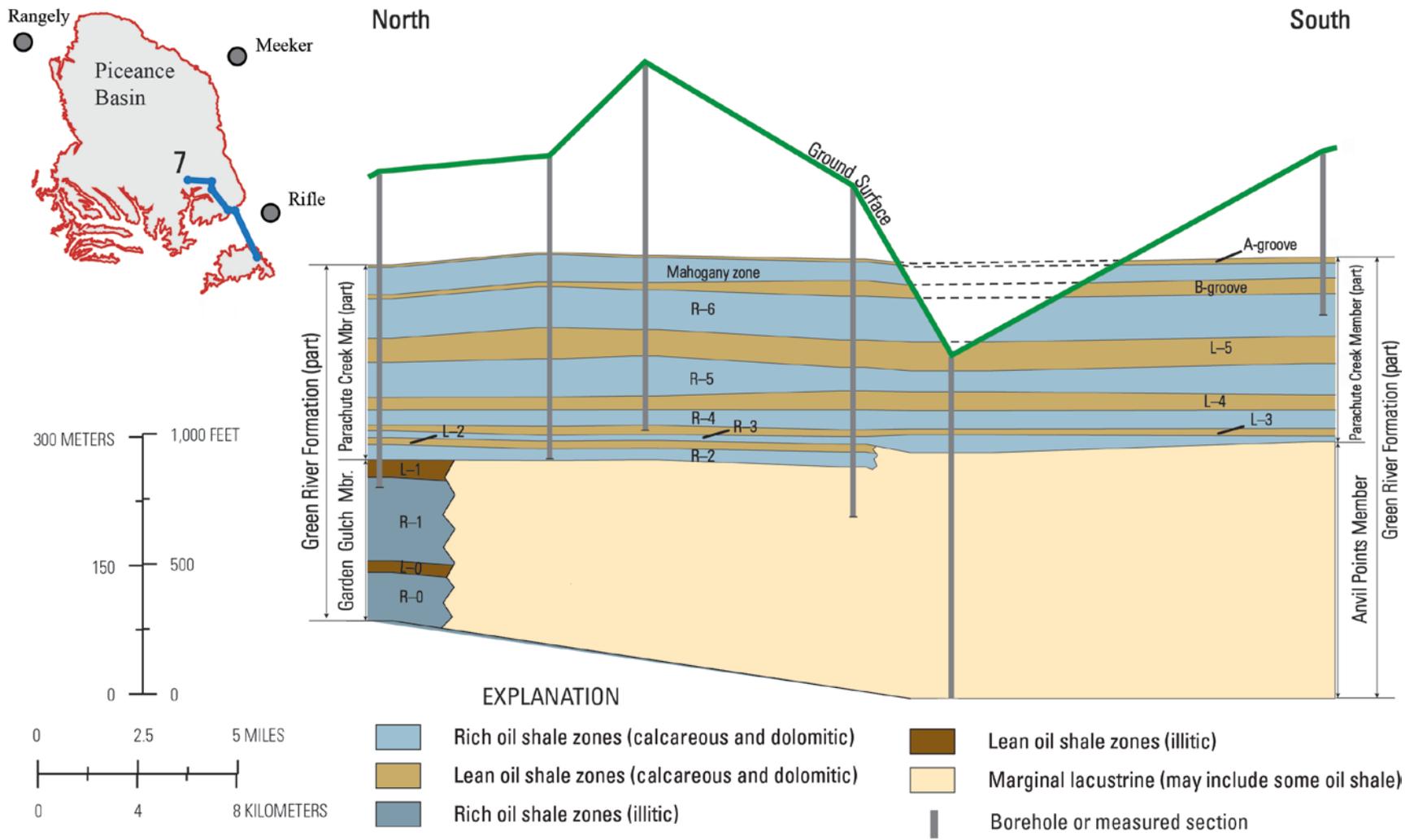
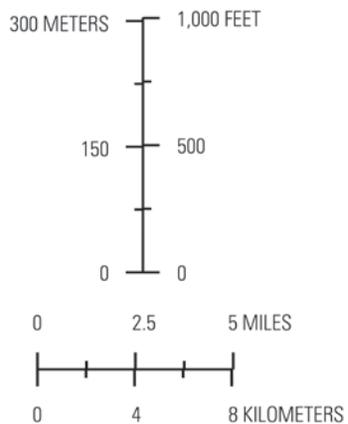
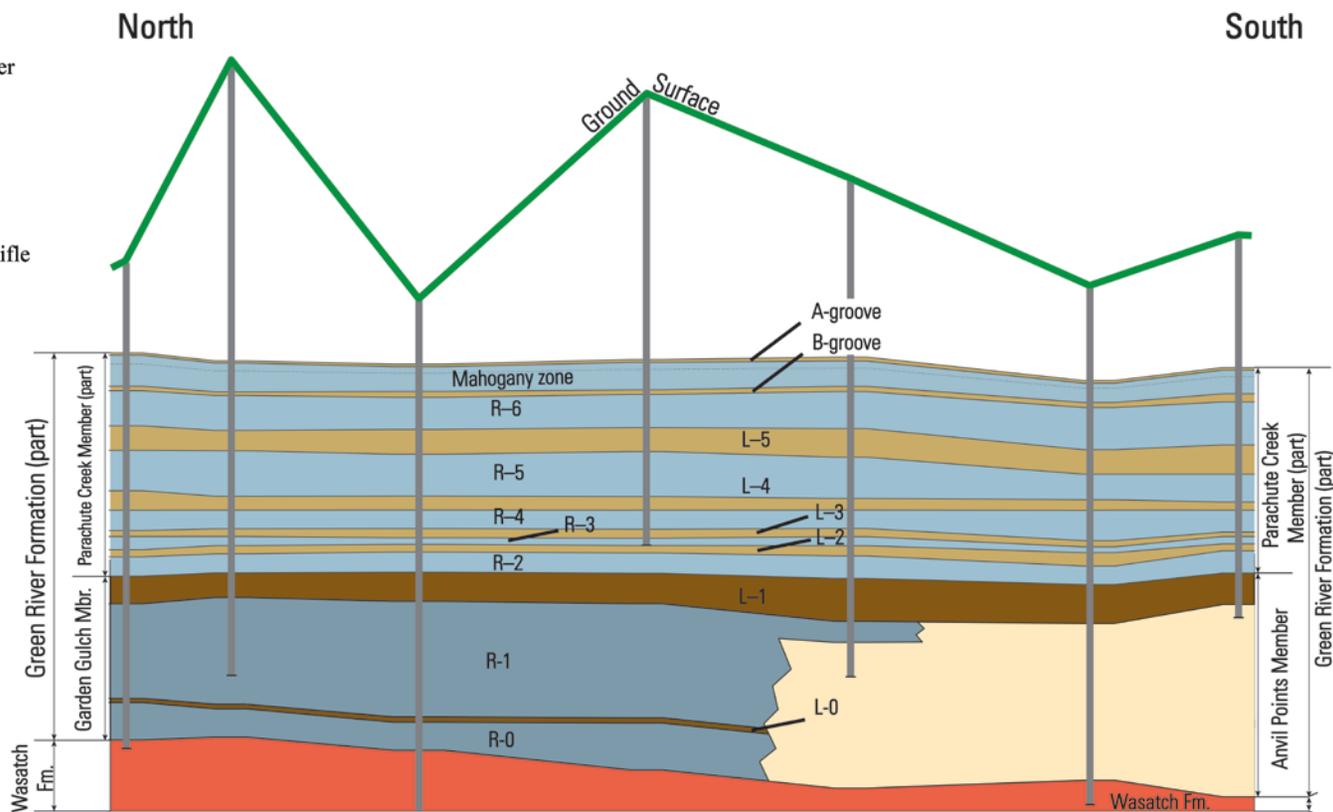
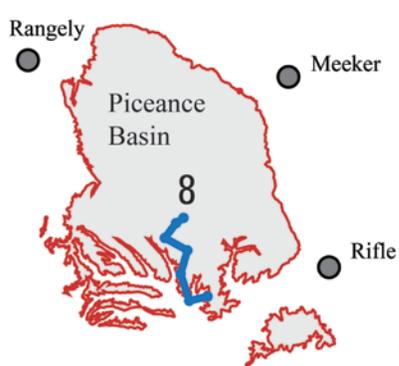


Figure 11. Cross section line 7. Modified from Self and others (2010).



EXPLANATION

- Rich oil shale zones (calcareous and dolomitic)
- Lean oil shale zones (calcareous and dolomitic)
- Rich oil shale zones (illitic)
- Lean oil shale zones (illitic)
- Variegated maroon, purple, and gray sandstone, siltstone, and mudstone
- Borehole or measured section

Figure 12. Cross section line 8. Modified from Self and others (2010).

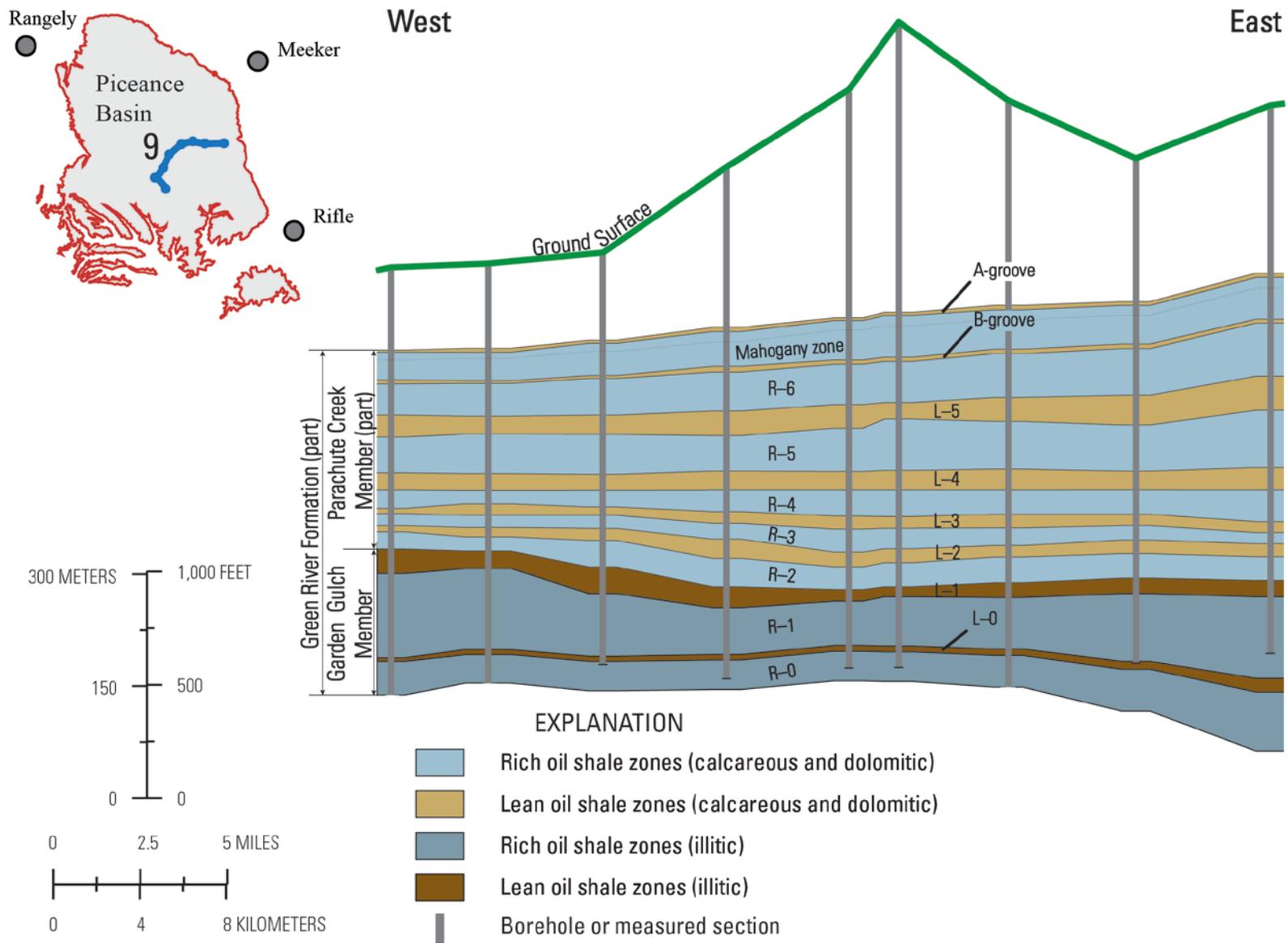


Figure 13. Cross section line 9. Modified from Self and others (2010).

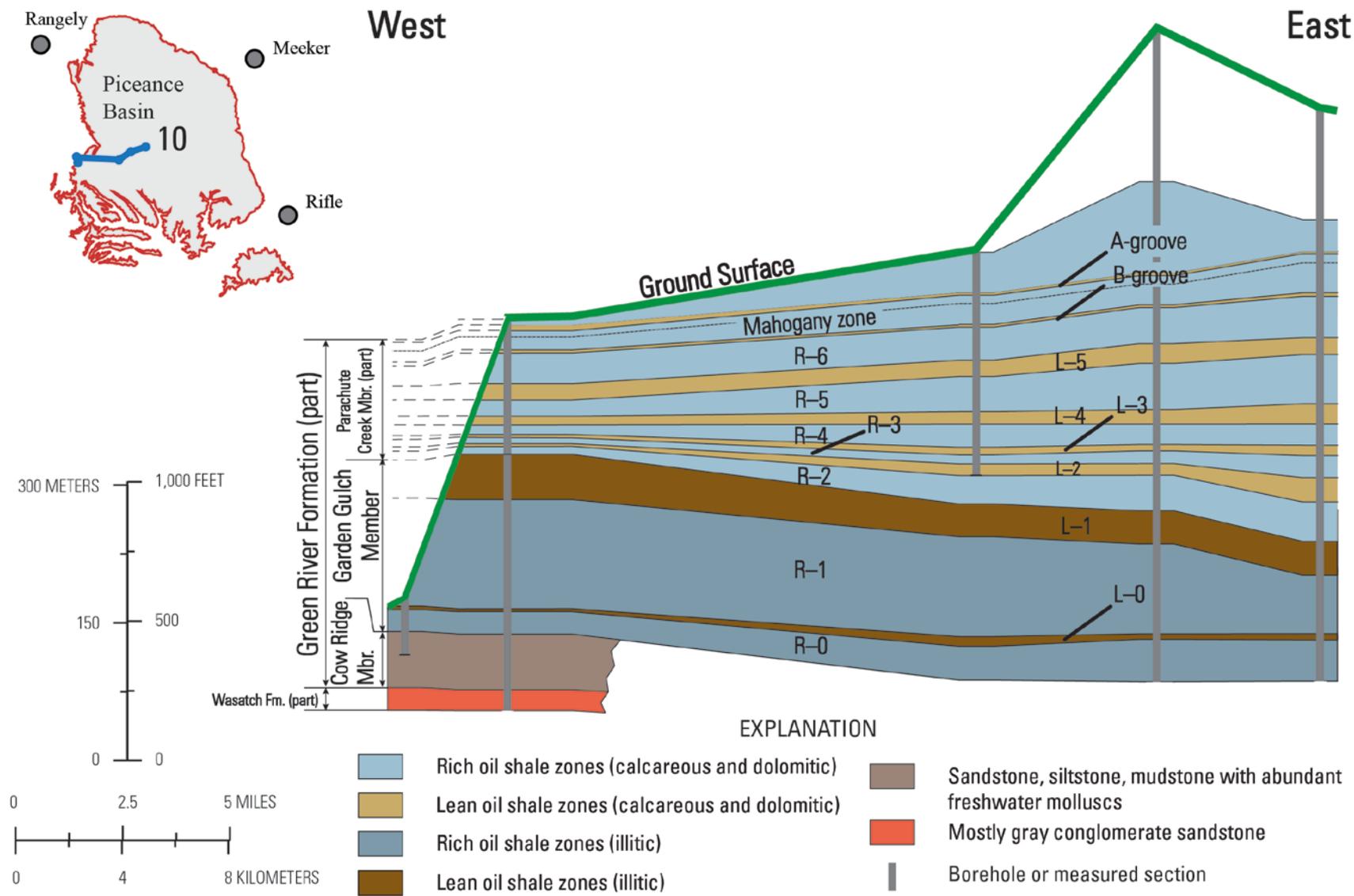


Figure 14. Cross section line 10. Modified from Self and others (2010).

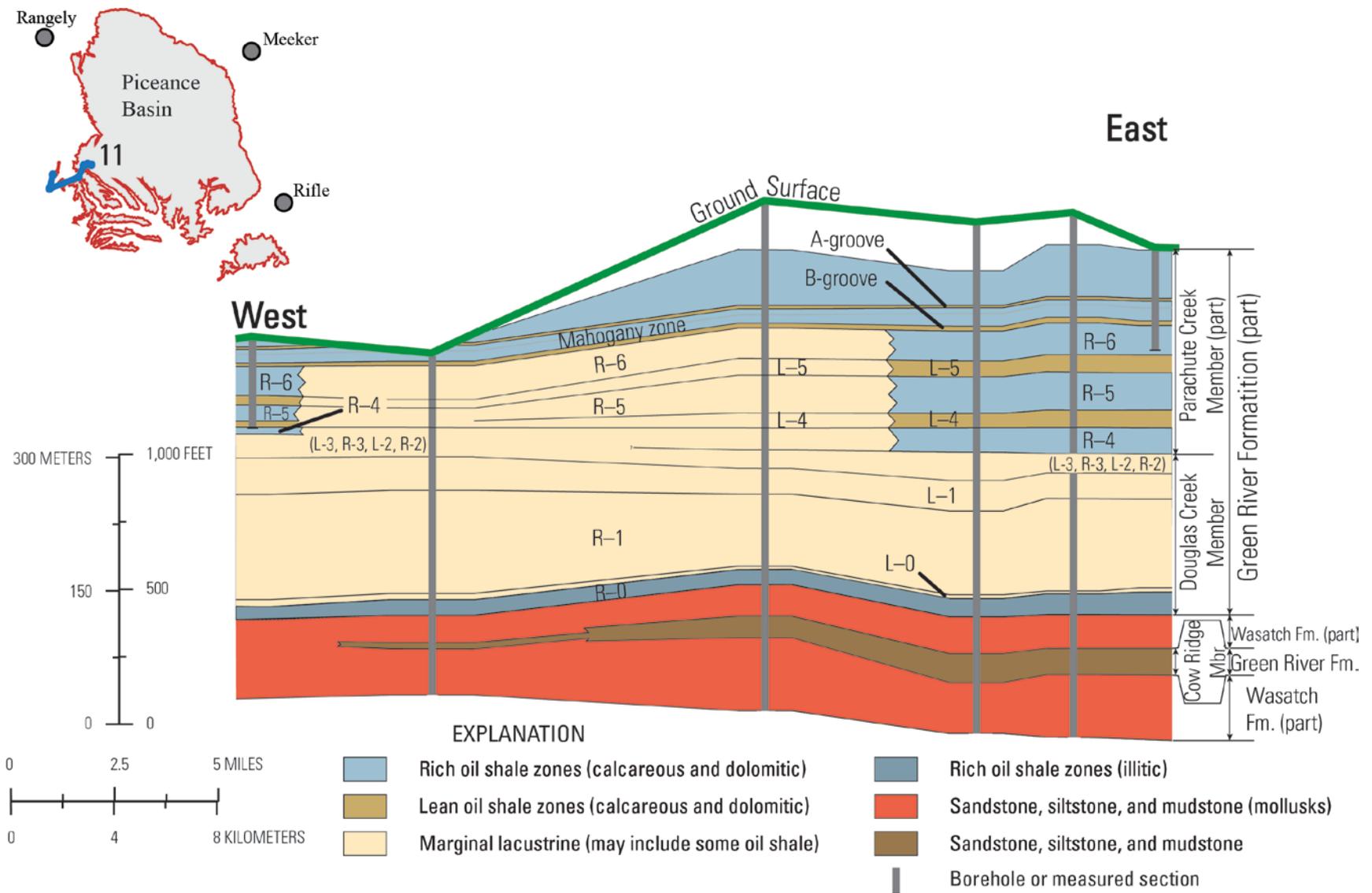


Figure 15. Cross section line 11. Modified from Self and others (2010).

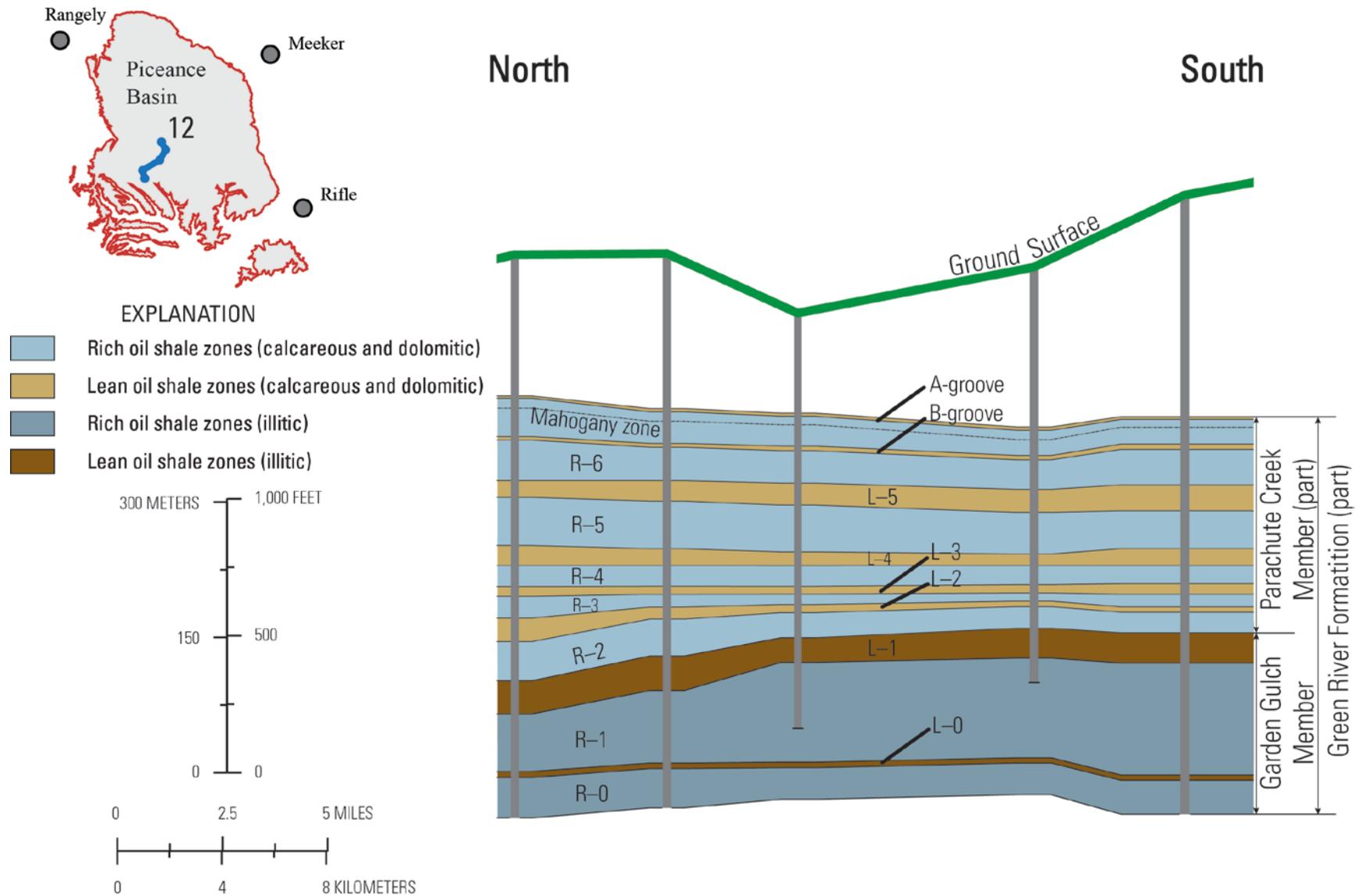


Figure 16. Cross section line 12. Modified from Self and others (2010).

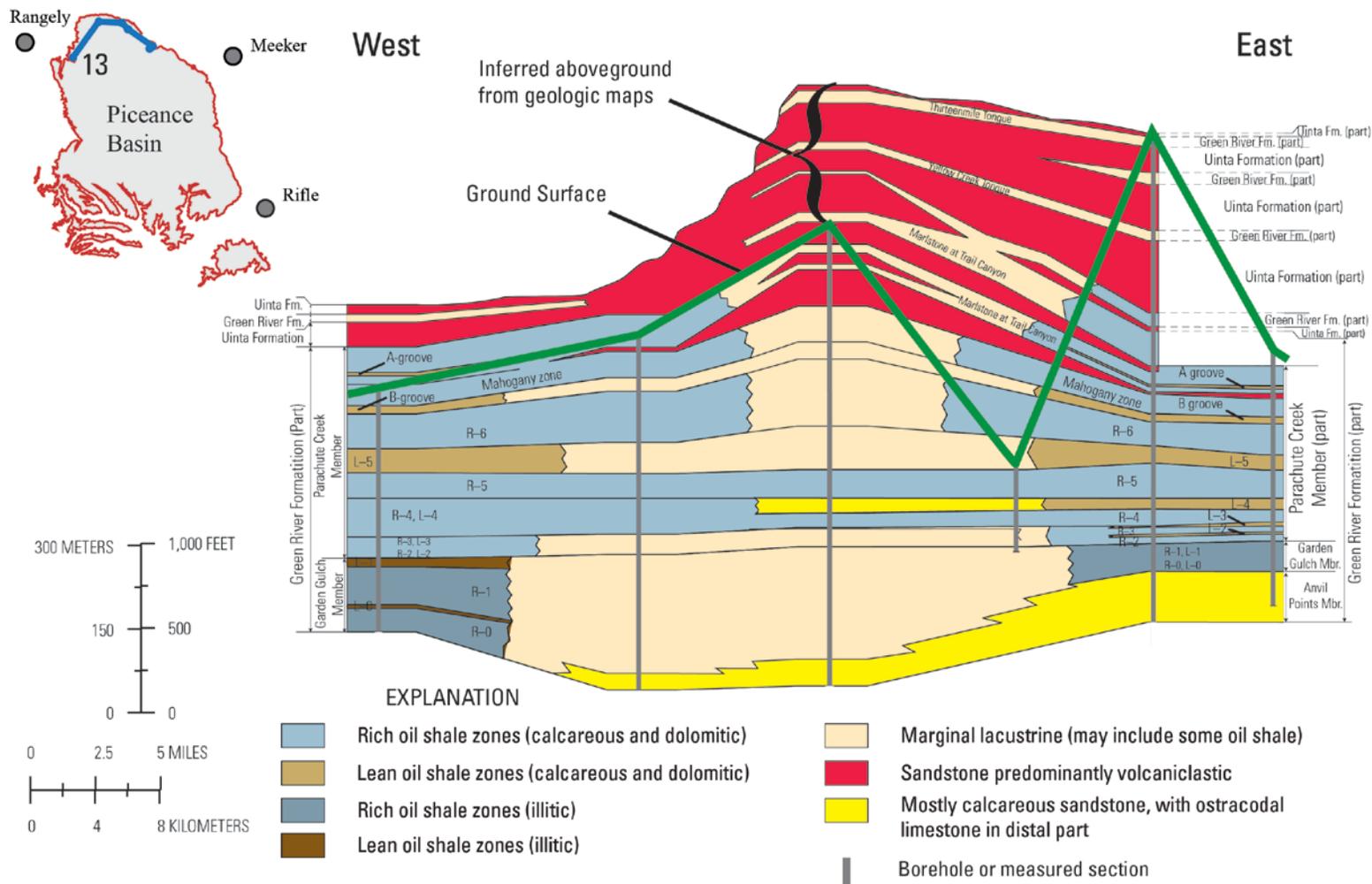


Figure 17. Cross section line 13. Modified from Self and others (2010).