

Information Circular No. 28
Idaho Bureau of Mines and Geology

Moscow, Idaho
May, 1975

Guidebook for Field Trips
Nos. 7 and 8

The Later Tertiary Stratigraphy and Paleobotany
of the
Weiser Area, Idaho

by

Charles J. Smiley, S.M.I. Shah, and Robert W. Jones

The Geology and Scenery of the Snake River
on the Idaho-Oregon Border
from Brownlee Dam to Hells Canyon Dam

Compiled by

Patsy J. B. Miller

28th Annual Meeting
The Geological Society of America
Rocky Mountain Section
Boise, Idaho

Prepared in cooperation with the
Idaho Bureau of Mines and Geology
Moscow, Idaho

Field Trip No. 7

4 May, 1975

Guidebook for the Later Tertiary Stratigraphy and Paleobotany
of the
Weiser Area, Idaho

by
Charles J. Smiley
S.M.I. Shah
Robert W. Jones

Prepared for the Annual Meeting of the
GEOLOGICAL SOCIETY OF AMERICA
Boise, Idaho
in cooperation with the
IDAHO BUREAU OF MINES AND GEOLOGY
Moscow, Idaho

TABLE OF CONTENTS

	Page
Introduction	1
Geology	2
Floral Composition	6
Floral Stages	8
Criteria for dating	10
References	11

ILLUSTRATIONS

Figure 1. Stratigraphic Chart	5
Figure 2. Geologic Map	13

INTRODUCTION

This guide book is a brief summary of the later Tertiary geology and paleontology (paleobotany) that will be observed on this one-day field trip to the Weiser area. It contains general descriptions of rock units and their field relations, their superpositional relations, and paleontology. Included are locality lists containing the most common plants that are likely to be found at collecting sites. The summary is based in large part on the results of field mapping and collecting by S.M.I. Shah (1966-1968) in the Weiser area. It should be emphasized that not all geologists agree on certain interpretations of the field data. However, there is agreement that the sequence of floras in the Weiser area is that which is presented herein. This geologic sketch will be used in conjunction with a road log supplied separately.

GEOLOGY

The Weiser area is an area of hilly terrane on the north side of the Snake River Plains. North and west of the Weiser area the exposed rocks are mostly basalt of Miocene age. On the northeast are the Idaho batholithic complex of late Mesozoic and early Cenozoic age, and the early Tertiary Challis Volcanics Group marginal to the batholith. On the south are Quaternary basalts of the Snake River Plains, and relatively unconsolidated sands and gravels of Pliocene-Pleistocene age are present in places.

The rock sequence of the Weiser area consists of possibly two volcanic units (the "Lower" and the "Upper" Columbia River Basalts), and four sedimentary units, in part interbedded with the basalts (the Succor Creek, Payette, "Poison Creek", and Idaho Formations).

The "Lower" Columbia River Basalts underlie, perhaps unconformably, all other rock units in the western part of the area. They are recognized by the presence of large phenocrysts of plagioclase in hand specimens. The uppermost 90 feet of this unit have been mapped in the Olds Ferry area west of Weiser.

The "Upper" Columbia River Basalts are hard, dense basalt lacking the plagioclase phenocrysts of the older unit. In the Weiser area these younger basalts are interbedded with the Payette-Succor Creek sediments and with at least the lower part of the "Poison Creek" Formation. They underlie the Idaho Formation with an apparent angular unconformity.

The Succor Creek Formation is exposed in the Olds Ferry area to the west of Weiser, where it is interbedded with flows apparently of the "Upper" Columbia River Basalts. A 1200-foot thick section measured by Shah (1966) contains a total of about 800 feet of basalt flows and about 400 feet of sedimentary interbeds. The sediments are mostly well-indurated, lithic shales of pale yellowish pink to light gray color. Plant fossils occur in some beds, and florules from three levels were collected (Locs. 14, 15, 16).

The Payette Formation is exposed in the Cove Creek area to the east of Weiser where its base is not exposed; it also crops out to the south in the vicinity of Payette. This unit is reported (Kirkham, 1931) to rest unconformably on basalt flows; these probably would be the "Lower" Columbia River Basalts. In the Cove Creek area, folded beds of the Payette Formation underlie basalts with an angular discordance up to 50 degrees. A section 1032 feet thick was measured by Shah in the Cove Creek area. Fossil plants are present in some beds, but are not well preserved because of the coarseness of the sediments (Loc. P-23).

The lower part of the Cove Creek section is composed of sandstone, siltstone, and shale. The sandstone is thick-bedded, tuffaceous, and plant-bearing. Shah's field mapping shows this portion to underlie flows apparently of "Upper" Columbia Basalt, rather than to overlie these basalts as originally thought by Kirkham (1931). Field relations thus indicate that this Cove Creek section represents the Payette Formation rather than the post-basalt Idaho Formation.

The upper part of the Cove Creek section is composed of poorly consolidated arkosic sandstone and orthoquartzite and is interbedded with, and capped by, flows of the "Upper" Columbia River Basalt. The sandstone is well-sorted, with round to subangular grains ranging up to 4 mm. in size; it is porous and generally lacking in cementing material.

The coarse texture, commonly subangular grains, and presence of minerals such as feldspar, biotite and magnetite suggest a nearby granite source, most likely the Idaho batholithic complex. The Payette sandstone becomes more feldspathic in the direction of this probable source (eastward). Toward the west, in the Olds Ferry area, the stratigraphically equivalent Succor Creek Formation is a thinner bedded and compacted shale probably of lake or lake border environment. Because of their stratigraphic relations with basalt flows and with other sedimentary units, the Succor Creek and Payette Formations are considered to be probably contemporaneous facies of the same depositional event: coarser feldspathic sands nearer the granitic terrane to the north-east and east, and finer and thinner bedded shaly deposits of lowland paludal or lacustrine environments to the west and southwest.

The "Poison Creek" Formation is exposed in the Hog Creek and Scott Creek areas just west and northwest of Weiser. Here the unit is interbedded with flows of the "Upper" Columbia River Basalt, where two members were mapped and described by Shah (1966, 1968). These two members occupy approximately the same stratigraphic position as the Poison Creek Formation of Buwalda (1923) and Kirkham (1928), and together they are referred provisionally to that formation. There is some field evidence of unconformable (angular) relationships with the Payette-Succor Creek beds below and with the Idaho Formation above.

1. Hog Creek member. This lower unit is composed mainly of light gray, medium to thin bedded shale with basalt interbeds. Also present are rare thin beds of arkosic sands, medium grained tuff, and some coarser pyroclastics. Three plant localities were sampled in this member (P-17, P-18, P-19).

2. Scott Creek member. This upper unit is 1200 feet thick and is composed predominantly of quartz (80%) with lesser amounts of feldspar, biotite, and other minerals. It is apparently derived, at least in part, from a granitic source. The sandstone resembles that of the Poison Creek Formation of adjacent areas (Buwalda, 1923; Savage, 1961), and to a lesser degree the sandstones of the Payette Formation.

The Idaho Formation is exposed over a considerable area surrounding Weiser. Whereas underlying units are considerably fractured and folded, with dips ranging up to 50 degrees or more, the Idaho Formation is relatively flat-lying with dips of about 5 degrees or less. Shah (1966, 1968) mapped and described the following four subunits:

1. Blue Clay unit. This lowest subunit is mostly subsurface in the Weiser area, where it has been observed in well logs. Its greatest thickness seems to be west of Weiser, and it apparently pinches out toward the east. Exposures are small and scattered; maximum measured thickness is 251 feet. It is a uniform blue clay unit. No fossils have been found.
2. Lower Brown Sand unit. This unit is exposed on lower slopes near Weiser. Its maximum thickness of about 300 feet is in the vicinity of Weiser, and the unit thins toward the east. It is composed of grayish-brown, fine to coarse, unconsolidated sand, with thin lenticular beds of silt and claystone in the lower part. No fossils have been found in this unit.
3. Shale unit. This subunit is exposed on middle slopes near Weiser. Its maximum thickness of about 130 feet was measured along Monroe and Manns Creeks. The unit is composed predominantly of light colored, unconsolidated mudstone, stratified silty shale, montmorillonitic shale, and silt; some one- to two-foot thick medium to coarse textured sand beds are present, and some diatomite occurs in the northern part of the Weiser area. Rare fish fragments and three florules have been found in this subunit (Locs. P-20, P-21, P-22).
4. Upper Brown Sand unit. This unit is exposed on upper slopes of the Weiser area. A thickness of 237 feet was measured near Weiser, with the unit thinning toward the north and east. This uppermost subunit is similar to the brown sand unit lower in the formation. No florules were found, but the uppermost beds contain clam shells, wood and bone fragments.

AGES	Thickness	ROCK UNITS	REMARKS	PLANT COMMUNITIES
Quart		gravels; sands; etc.	Unconformity	
PLIOCENE (Lower)	235 ±	W. Sand M.	Sands and Shales (Flora)	Vegetation mainly of riparian and well-drained slope habitats; some evidence of summer aridity.
	130 ±	Sh. M.		
	250 ± 300 ±	L. Sand M.		
	250 ±	Bl. Cl. M.		
MIOCENE (Upper)	1200 ±	Scott Cr. M.	Coarse sands.	
		"Poison Creek Fm."	?Local Unconformity	
		Hog Cr. M.	Mostly sh. & silt, Basalt interbeds (Flora)	Vegetation of moist (not swampy) bottom-lands and moist slopes; some evidence of drier slopes and cooler up-lands & summer - wet.
MIOCENE (Middle)	1200 ±	Payette - Succor Creek "Upper" CRB	Unconformity	
			Succor Cr. - more shaley. (Flora) Payette - more sandy. (Flora) CRB - Basalt, fine-grained, no phenocrysts.	Mainly swamps, swamp border, and moist slope vegetation. Summer - wet.
	90 ±	"Lower" CRB	?Unconformity Basalt, labradorite phenocrysts	

Figure 1

FLORAL COMPOSITION

Preliminary taxonomic analysis of plants collected by Shah (1966, 1968) from 11 localities in the Weiser area show the presence of 145 species of plants in 73 genera and 34 families. The most commonly represented species are presented below, by localities.

Succor Creek Flora

Loc. P-14 (West Olds Ferry):

Conifers: *Sequoia affinis*; *Sequoiadendron chaneyi*; *Chamaecyparis linquaefolia*.

Oaks: *Quercus simulata*; *Q. hannibali*; *Q. dayana*.

Other: *Salix knowltoni* (willow); *Acer glabroides* (maple).

Dominants are *Sequoia* and *Quercus* spp.

Loc. P-15 (Central Olds Ferry):

Conifers: *Glyptostrobus oregonensis*; *Sequoia affinis*; *Taxodium dubium*; *Thuja dimorpha*.

Oaks: *Q. prelobata*, *Q. dayana*, *Q. hannibali*, *Q. pseudolyrata*, *Q. simulata*, *Q. payettensis*, *Q. bretzi*, *Q. merriami*, *Q. orindensis*.

Poplars: *Populus alexanderi*, *P. eotremuloides*, *P. lindgreni*, *P. voyana*.

Maples: *Acer bolanderi*, *A. columbiana*, *A. glabroides*.

Other: *Zelkova* (Asian genus); *Platanus* (sycamore); *Salix* (willow); *Liquidambar* (sweet gum); *Persea* (avocado); *Carya* (hickory); *Ulmus* (elm).

Dominants are *Taxodium*, *Sequoia*, *Glyptostrobus*, *Populus* spp. and *Quercus* spp.

Loc. P-16 (Coal Mine Gulch):

Conifers: *Glyptostrobus oregonensis*.

Oaks: *Q. hannibali*, *Q. simulata*, *Q. dayana*.

Other: *Cedrela*; *Gordonia*; *Pterocarya*; *Crataegus*; *Mahonia*; *Salix*; *Hydrangea*; *Malus*; *Prunus*; *Rhamnus*; *Robinia*.

Dominant plants are *Quercus* spp., *Cedrela*, *Gordonia*, *Glyptostrobus*, and *Pterocarya*.

Payette Flora

Loc. P-23 (Cove Creek):

Oaks: *Q. hannibali*, *Q. pseudolyrata*, *Q. simulata*, *Q. eoprinus*, *Q. winstanleyi*.

Willows: *Salix knowltoni*, *S. payettensis*, *S. truckeeana*.

Other: *Platanus* (sycamore); *Zelkova*; *Acer* (maple); *Betula* (birch); *Populus* (poplar); *Azalia*; *Persea* (avocado); *Ptelea*; *Pterocarya*; *Ribes* (currant); *Vaccinium* (huckle berry).

Dominant plants are *Platanus*, *Zelkova*, *Acer*, *Quercus* spp., and *Salix* spp.

Hog Creek Flora

Locs. P-18 and P-19 (Hog Creek):

38 species at Loc. P-18, 81 species at Loc. P-19. Dominants are:

Conifers: *Glyptostrobus oregonensis*; *Sequoia affinis*; *Picea seeds*.

Oaks: *Q. dayana*, *Q. hannibali*, *Q. simulata*.

Maples: *Acer bendirei*, *A. bolanderi*, *A. knowltoni*, *A. minor*, *A. scottiae*.

Other: *Cedrela*; *Gordonia*; *Arbutus*; *Salix*; *Zelkova*; *Garrya*; *Alnus*.

Idaho Flora

Locs. P-20 (Manns Creek Dam), P-21 (Hwy 95 north); P-22 (Williamson Ranch):

Oaks: *Quercus hannibali*, *Q. dayana*, *Q. simulata*, *Q. prelobata*.

Other: *Ailanthus*; *Cercocarpus*; *Fraxinus*; *Ilex*; *Acer (box elder)*.

Rare: *Alnus*; *Cercidiphyllum*; *Platanus*; *Salix*; *Mahonia*; *Populus*.

FLORAL STAGES

FIRST STAGE (PAYETTE-SUCCOR CREEK):

The habitats indicated by plants are (1) swampy lake borders, (2) better drained but moist lower slopes, and (3) well-drained drier slopes. The lack of evidence of upland conifers suggests the possibility that appreciable upland sites were not yet developed at this time. Judging from requirements of similar modern plant associations in North America and eastern Asia, the regional climates were moderate, winters were relatively mild (of short duration, sub-freezing temperatures uncommon), and annual precipitation was in the range of 45-55 inches evenly distributed throughout the year (no pronounced summer drought).

Swampy lake borders were occupied by *Taxodium* (swamp cypress) and the Asian lowland conifer *Glyptostrobus*, with probable associates of *Populus* (poplar), *Quercus* (swamp-border oaks), *Zelkova*, *Cedrela* and *Gordonia*. Moist lower slopes probably were occupied by *Sequoia* (California coast redwood), in association with *Acer* (maple), *Salix* (willow), *Persea* (avocado), *Ulmus* (elm), and *Quercus* spp. (Oak woodland types). Drier slopes probably were occupied by *Sequoiadendron* (Sierra big tree), in association with *Quercus* (oak woodland or savannah types), *Mahonia* (Oregon grape) and *Ptelea* (hop tree).

A comparison between assemblages of the Succor Creek beds on the west and the Payette beds on the east indicate more mesic (moist) conditions in the western part of the area. The finer textured sediments of the Succor Creek Formation, and the presence of swamp or swamp-border plants, suggest a position near a lacustrine depositional site on the west and southwest. The coarser textured sediments of the Payette Formation, and the absence of strictly swamp or swamp-border species, indicate a position farther removed from the western paludal-lacustrine conditions.

SECOND STAGE ("POISON CREEK" - HOG CREEK FLORA):

The habitats indicated by plants are (1) moist, but not swampy, bottomlands, (2) well-drained slopes, and (3) uplands. Lack of *Taxodium* and certain associates suggests that the swamp conditions of Payette-Succor Creek time were no longer extensive in the area. A more pronounced aridity on well-drained slopes is indicated by the presence of such plants as *Amelanchier*, *Amorpha*, *Arbutus*, *Arctostaphylos*, *Mahonia*, *Quercus* spp., *Robinia*, *Rosa*, *Spiraea*, *Symphoricarpos* and *Vaccinium*. Presence of cooler uplands in the region is indicated by the presence of seeds of *Picea* (spruce), *Abies* (fir) and *Pinus* (upland pines).

Regional climates were still moderate with mild winters, not greatly different from that of Payette-Succor Creek time. This probably reflects the absence of any appreciable climatic barrier between this inland region and the Pacific Ocean. Some evidence of developing summer aridity is shown by the number of Madro-Tertiary (drier) plants, and by the absence of a truly swamp component in the Hog Creek flora. The earliest fossil evidence of cooler uplands in the region occurs at this horizon.

THIRD STAGE (IDAHO FLORA):

The habitats indicated by plants are (1) mesic riparian, (2) drier slopes, and (3) cooler uplands. The floral assemblages in the Idaho Formation are considerably more "modern" in character, in that most of the exotic (eastern United States, eastern Asia) taxa of older stages are no longer represented. The flora is more western American in composition, having more the character of stream and lake border forests and oak woodlands of the West. On the other hand, presence of about one-third of the species whose modern affinities are with plants of eastern North America and eastern Asia indicates that summers were considerably moister than now prevails in the region. Cooler upland habitats are indicated by seeds of *Abies*, *Pinus*, and *Tsuga* (hemlock).

GENERAL TRENDS

The most mesic Succor Creek flora contains a *Taxodium* swamp component that is not found in the less mesic Payette flora toward the east nor in the younger floras of the area. The predominance of humid east American and east Asian taxa that are characteristic of the Payette, Succor Creek and Hog Creek floras are lacking in the overlying Idaho Formation. The drier climate plants of Madro-Tertiary affinity increase upward both in numbers of species and in proportion to more mesic plant indicators. Thus it seems apparent that climate was becoming more continental (winters more severe, summers drier) as world climates slowly deteriorated and as climatic barriers were becoming more pronounced in western North America. The regional vegetation was changing in response to this trend toward more continental conditions, as exemplified by the floral sequence in the Weiser area and adjacent regions.

CRITERIA FOR DATING

The Payette-Succor Creek floras most resemble the Succor Creek flora from the Oregon-Idaho border area (16-17 m/y), the Mascall flora of north-central Oregon (15-16 m/y), and the Vantage flora of central Washington (15-17 m/y). The Idaho flora most closely resembles that of the Ellensburg Formation of central Washington (10-12 m/y). On the basis of this floral correlation, it seems most likely that the floral sequence of the Weiser area spans the time from a maximum of about 17 m/y ago to a minimum of about 10 or 11 m/y ago - that is, from middle Miocene to early Pliocene.

Rare fossil mammals are reported from Succor Creek beds of the region (Buwalda, 1924; Scarf, 1935). These include *Merychippus*, *Dromomeryx*, and *Merycodus* that are typical of middle and upper Miocene faunas of western United States. Corcoran (1962) reported upper Miocene mammals from the Deer Butte Formation (=Poison Creek Formation, Hog Creek flora). Kirkham (1931) reported vertebrate fossils from the Idaho Formation that suggested a Pliocene or Pleistocene age.

Thus, on the basis of (1) superpositional relations from field mapping, (2) radiometric dates on floras from contiguous regions, (3) vertebrate fossils, (4) regional floral comparisons, and (5) evidence for tying into known regional climatic trends, it would seem that the Payette and Succor Creek floras are late middle Miocene (Hemingfordian), the Hog Creek flora is upper Miocene (Barstovian), and the Weiser flora from the Idaho Formation is probably late Miocene-early Pliocene (Clarendonian). As yet, no radiometric dates are available from volcanic rocks in close proximity to the plant beds. Radiometric dates may ultimately verify or modify these present age determinations; but a question of the reliability of such dates is posed by the widespread evidence of apparent hydrothermal alteration of rocks in the Weiser area (Dave McIntyre, personal communication, February, 1975).

REFERENCES

- Axelrod, D. I., 1964, The Miocene Trapper Creek flora of southern Idaho: Univ. Calif. Publ. Geol. Sci., v. 51, 148 p.
- Chaney, R. W. and D. I. Axelrod, 1959, Miocene floras of the Columbia Plateau; Carnegie Inst. Washington Pub. 617, 237 p.
- Corcoran, R. E., et al, 1962, Geology of the Mitchell Butte quadrangle, Oregon: Oregon Dept. Geol. and Mineral Industries, Geol. Map Ser. No. 2, 1:125,000
- Dorf. E., 1936, A late Tertiary flora from southwestern Idaho: Carnegie Inst. Washington Pub. 476, Pt. II, p. 73-124.
- Evernden, J. F. and G. T. James, 1964, Potassium-Argon dates and the Tertiary floras of North America: Amer. Jour. Sci., v. 262, p. 945-974.
- Gilmour, E. H. and D. Stradling, (co-editors), 1969, Proceedings of the Second Columbia River Basalt Symposium: Eastern Wash. State College Press, 333 p.
- Graham, A., 1965, The Sucker Creek and Trout Creek Miocene floras of southeastern Oregon: Kent State Univ. Bull., Kent, Ohio, p. 1-147.
- Kirkham, V. R. D., 1928, Brief papers on geologic field work in Idaho during 1927: Idaho Bur. Mines and Geol. Pamphlet 29, p. 1-3.
- , 1930, Old erosion surfaces in southwestern Idaho: Jour. Geol., v. 38, no. 7, p. 652-663.
- , 1931, Revision of the Payette and Idaho Formations: Jour. Geol., v. 39, no. 3, p. 195-239.
- Knowlton, 1898, The fossil plants of the Payette formation: U. S. Geol. Surv. 18th Ann. Rept., pt. 3, p. 721-744.
- Merrim, J. C., 1918, Fauna of the Idaho formation (abstract): Geol. Soc. Amer. Bull., v. 29, no. 1. p. 162.
- Savage, C. N., 1958, Geology and mineral resources of Ada and Canyon Counties Idaho Bur. Mines and Geol., County Report No. 3, 94 p.
- , 1961, Geology and mineral resources of Gem and Payette Counties: Idaho Bur. Mines and Geol., County Report No. 4, 50 p.
- Scarf, D. W., 1935, A Miocene mammalian fauna from Sucker Creek, Oregon: Carnegie Inst. Washington Publ. 453, p. 97-118.
- Shah, S. M. I., 1966, Stratigraphy and paleobotany of the Weiser area: Univ. Idaho, MS Thesis, 191 p.
- , 1968, Stratigraphic paleobotany of the Weiser area, Idaho: Univ. Idaho, Ph.D. Dissertation, 166 p.

Smiley, C. J., 1963, The Ellensburg flora of Washington: Univ. Calif. Publ. Geol. Sci., v. 35, no. 3, p. 159-276.

Smith, H. V., 1938, Some new and interesting late Tertiary plants from Sucker Creek, Idaho-Oregon boundary: Torrey Bot. Club Bull., v. 65, p. 557-564.

-----, 1941, A Miocene flora from Thorn Creek, Idaho: Amer. Midland Naturalist, v. 25, no. 3, p. 473-522.

