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A Contribution to the Latah Flora of Idaho

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Reprinted from Northwest Science, 6-69-82, June, 1932

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During the last five or six years there has been discovered and described a very interesting and extensive fossil flora in the Latah formation in Idaho and in eastern Washington. The Latah formation is contemporaneous with and is intercalated in the Columbia lavas. It is, therefore, for the most part probably of Upper Miocene age. This flora is, therefore, of more than ordinary value, not only as an indicator of the general climatic conditions of the Pacific Northwest during the middle Tertiary time, but also as an evidence of the nature of the last well established mixed forest flora before the advent of Pleistocene time.

The Latah formation is made up of clastic materials, sands, silts, clays with varying amounts of diatomaceous earth and fine volcanic ash which were deposited in lakes and ponds formed by blocking of the established drainage by the great Columbia basalt flows. The general period of eruption consisted of some two or three shorter periods of intense activity separated by periods of quiescence during which soil formed and plants re-established themselves. Because of the intermittent nature of the volcanism, the Latah flora is not strictly of one and the same age. It probably ranges from Middle Miocene to the beginning of Pliocene time.

So far as the writer has been able to determine, the discoverers of this most interesting flora are Messrs. I. A. Bonser, C. O. Fernquist and E. E. Alexander of Spokane, Washington, who made a comprehensive collection

of the materials for the Eastern Washington Historical Society of Spokane. The pioneer students of the geology of the Latah Formation were Pardee and Bryan, who also made extensive collections of the plant remains in the vicinity of Spokane and of Coeur d'Alene, Idaho. These collections were described by Knowlton² and his descriptions were included in their report.

Some two or three years later V. R. D. Kirkham, who at that time was an instructor in the University of Idaho, became interested in the stratigraphic position of the Latah formation in Idaho. In connection with his stratigraphic and lithologic studies he made collections of fossil plants from a number of localities, extensively from Whitbird, Idaho, and in a smaller way from several others. These collections were studied by Berry and his descriptions were incorporated in an article which Kirkham published in the *Journal of Geology*.³

In 1928, while carrying on graduate study in paleobotany in the University of Idaho under direction of Dr. F. B. Laney, Head of the Department of Geology, the writer became convinced that the Latah flora merited more extensive study than it had received. He and Dr. Laney visited all the known localities in northern Idaho, except those near Coeur d'Alene and St. Maries, and made large collections from each of them. To the material

¹Presented at the annual meeting of the Northwest Scientific Association, December 29-30, 1930, Spokane, Washington.

²U. S. Geol. Survey, Professional Paper No. 140, 1925, pp. 1-55.

³*Journal of Geology*, vol. 37, 1929, pp.

thus obtained were added smaller collections made by Gerhard Kempff formerly of the School of Forestry of the University of Idaho, and by Earl Monnett of the Lewiston High School. This collection, by far the largest and most comprehensive thus far made, has been studied systematically from the fall of 1928 until 1932.

No startling new discoveries have been made. The results of studies have, however, rounded out the data obtained by Knowlton and Berry and have for the first time made it possible for the student to successfully see the Latah plants as a true flora which was in mid-Tertiary time apparently characteristic of that part of the northern Rocky Mountain region known as the Inland Empire. These studies have also made it possible to understand the general ecological conditions under which this unusual flora, cosmopolitan mesophytic in aspect, lived and flourished. Much light has been thrown upon the former habitat of plants which at present are found only in widely scattered and entirely disconnected places. They have also added many data to the increasing knowledge of the climate of this region during the Tertiary period. A number of new species of plants were found, described and photographed.

The work of Knowlton and Berry is so comprehensive and of such a high standard of excellence that it would be presumptuous on the part of

the writer to attempt a revision or to try to devise a different form of presenting data. The tabular method used by Kirkham in stating the taxonomic-locality data supplied by Knowlton and Berry has been adopted and the table has been extended and somewhat rearranged, so as to save space in presenting the new data. The following explanations should make everything clearly understandable.

1. Spokane-Coeur d'Alene, Flora by Knowlton & Berry in U.S.G.S. Prof. Paper 140. U.S.G.S. Prof Paper 154-H.
2. Whitebird, 1/2 to 2 miles east of Whitebird, Idaho, and includes Kirkham's localities 8, 9, 12, 14.
3. Arrow Junction, Idaho=Kirkham's localities 16, 17, 24, 25, 26.
4. Juliaetta, Idaho=Kirkham's locality 27.
5. Lewiston, 11 miles east of Lewiston, Kirkham's localities 1, 2, 3, 4, 5.
6. St. Maries. The writer was unable to visit the St. Maries deposits.
7. Grangeville Mountain.
8. Oviat Creek, five miles west of Elk River, R. 1 E., T. 39 N., S. 1.
9. Elk River, 3 miles west of Elk River, R. 2 E., T. 40 N., S. 33.
10. Clearwater Lumber Camp 2, four miles southeast Elk River, R. 2 E., T.39 N., S. 8.
11. Payette flora.
12. Florissant flora.

Note: The x in column 1 of the table=flora recorded for Spokane-Coeur d'Alene by Berry and Knowlton. The x in columns 2, 3, 4, 5, 6=Kirkham's records. The o in any column=Ashlee-Laney records.

ALPHABETICAL LIST OF KNOWN SPECIES OF LATAH FLORA.

	Spokane-Coeur d'Alene	Whitebird	Arrow Junction	Juliaetta	Lewiston E	Saint Maries	Grangeville Mountain	Oviat Creek	Elk River	Clearwater Lumber Camp No. 2	Payette	Florissant
	1	2	3	4	5	6	7	8	9	10	11	12
Acer bendirei, Lesq.	X	O				X						
Acer chaneyi, Kn.	X	O	X									
Acer florissanti, Kirchner		X		X					O		X	X
Acer merriami, Kn.	X	X	X	X	X							
Acer minor, Kn.	X	O			X							
Acer orionianum, Kn.	X	X								O		
Acer vivarium, Kn.	X	X										
Acer sp.	X	X										
Acer sp.				O								
Acer sp.												
Acer sp.												
Acer sp. samara									O			
Acer sp. (macrophyllum, Purth?)		O							O			
Aesculus hesperia, By.	X	O										
Alnus elliptica, By.	X											
Alnus prerrhombifolia, By.	X											
Alnus sp.	X											
Alnus sp. Cones	X											
Alnus sp. Pistillate aments	X			O								
Amelanchier grayi, Chaney	X				X							
Amelanchier scudderi, Cockerell	X											
Amelanchier sp.				O			O					
Apocynophyllum latahense, By.	X			O								
Aralia whitneyi, Lesq.	X											
Archaeomnium patens, E. G. Britton	X											
Arisaema hesperia, Kn.	X											
Artostaphylos knowltoni, By.	X											
Arctostaphylos spatulata, By.	X											
Asplenium occidentale, By.	X											
Betula bryani, Kn.	X	O					O					
Betula fairii, Kn.	X	O	X	O								
Betula heteromorpha, Kn.	X	X		O		X		O				
Betula ? largei, Kn.	X			O	X	X						
Betula thor, Kn.	X	O	X									
Betula, Winged fruit	X											
Betula sp.				O								
Carpinus sp.	X											
Carpites boraginoides, Kn.	X			X								
Carpites ginkgoides, Kn.	X											
Carpites menthoides, Kn.	X	X										
Carpites paulownia, Kn.	X											
Carpites polygonoides, Kn.	X											
Carpites spokaneensis, Kn.	X											
Carpolithus sp.	X				X							
Carpolithus pteriformis, By.	X											
Castanea castaneaefolia (Unger) Kn.	X	X			X	X		O	O	O	X	
Castanea orientalis, Chaney.	X	O							O			
Castanea pulchella, Kn.		O						O	O		X	
Cassia idahoensis, Kn.	X	X										
Cassia sophoroides, (Kn.) By.	X	X		X				O	O	O		
Cassia spokaneensis, By.	X	O						O				
Celastrus confluens, Kn.		O										
Celastrus fernquisti, Kn.	X	O										
Celastrus lacosi, Lesq.	X											X
Ceratophyllum sp.		O										
Cercidium sp. Fruit									O			

	1	2	3	4	5	6	7	8	9	10	11	12
Salix perplexa, Kn.	X											X
Salix remotidens, Kn.	X											
Salix sp.	X											
Salix sp.				O								
Salix, Pistillate flower	X											
Sapindus armstrongi, By.	X							O				
Sapindus spokaneensis, By.	X											
Sassafras hesperia, By.	X	O							O			
Sequoia conttslae, Heer.										O		
Sequoia lanksdorai, (Brongt.) Heer.	X	X	X	X	X					O	O	X
Sequoia lanksdorai, Pistillate cone		O										
Sequoia sp., Staminate cone												
Sequoia ? sp.		X										
Sequoia sp. Cone		O									X	
Smilax lamarensis, Kn.	X	X										
Smilax sp.										O		
Sophora alexanderi, Kn.	X	X							O			
Sophora spokaneensis, Kn.	X	X	X				O	O		O		
Sopora sp.		O										
Taxodium dubium, (Stnbg.) Heer.	X	X	X	X		X	O	O		O		
Taxodium Staminate aments.	X	X		O			O	O	O	O		
Taxodium, Cone		O										
Taxodium, Seed	X	X										
Taxodium sp.												
Ternstroemites idahoensis, (Kn.) By.	X			X								
Tilia hesperia, By.	X	O										
Tsuga latahensis, By.	X	O										
Tumium bonseri, Kn.	X											
Typha lasquereuxii, Cockerell	X											X
Typha sp.	X			O					O			
Ulmus bdownelli, Lesq.	X			X								
Ulmus fernquisti, Kn.	X								O			
Ulmus speciosa, Newberry	X	O	X							O	X	
Ulmus, Fruit	X	O										
Umbelliferospermum latahense, By.	X											
Umbellularia dayana, (Kn.) By.	X	O	X						O			
Umbellularia lanceolata, By.	X	X		O			O	O				
Umbellularia oregonensis, Chaney				O								
Vaccinium americanum, (Lesq.) By.	X											
Vaccinium bonseri, By.	X											
Vaccinium bonseri serrulatum, By.	X											
Vaccinium spokaneense, By.	X											
Viburnum fernquisti, By.	X											
Viburnum lantanafolium, By.	X											
Viburnum sp.		O										

A glance at the table shows clearly that the fossil plants of Idaho localities are so similar as to be safely considered of the same age and of ecological identity, with the exception of those from the Payette formation. This flora, however, is distinctly related to the Latah. The smaller number of records for St. Maries is due to the fact that we were unable to visit this district. The species recoded by Kirkham are a typical Latah collection

and were published by him as a list of index species.⁴

The fossiliferous beds near Whitebird were first made known to the Department of Geology, University of Idaho, through their discovery by workmen engaged in highway construction. The beds are of light-colored sedimentary rocks composed of sand, silt, clay, volcanic ash, and diatomaceous earth. They were once covered by basalt, which has been re-

⁴Journal of Geology, vol. 38, 1930, p. 663.

moved by erosion. The formation consists of some seven non-fossiliferous strata, composed of sand, volcanic ash and small amounts of silt and clay, about eight inches thick, which occur in the fossil-bearing horizons at regular intervals of about eight feet. There is no change in the character of the fossils above or below these layers. The lowest part of the beds examined is a little above the water surface of Whitebird Creek, where the material is lignite and the fossils much inferior to those in the upper part of the area. The best fossils found in the lignite were Liquidambar fruits.

In the column giving the Spokane-Coeur d'Alene flora it will be noticed that 178 species are recorded, 24 in excess of the number recorded by Berry.⁵ This apparent discrepancy is caused by the inclusion of 24 species from this locality which were mentioned by Kirkham in his paper on the Latah Formation.⁶ Of these 176 species, 77 or 43.7 per cent are also found at Whitebird. The total record for Whitebird is 97 species, 76.85 per cent of which are common to the type Latah localities.

At Arrow Junction and the Lewiston locality Kirkham made only a sufficient collection to establish the age of the fossil beds. It will be noticed that *Populus heteromorpha*, Kn., *Acer merriami*, Kn., *Taxodium dubium* (Stenbg.) Heer., and *Sequoia lanksdorai* (Wrongt.) Heer., are common to both and to Spokane-Coeur d'Alene. The fossils recorded from St. Maries are equally typical of the Latah flora. They are *Acer benderi*, Lesq., *Betula heteromorpha*, Kn., *Betula largei*, Kn., *Laurus grandis*, Lesq., *Platanus dissecta*, Lesq., *Populus heteromorpha*, Kn., *Castanea castaneaefolia* (Unger), Kn., and *Taxodium dubium* (Stenbg.) Heer.

There are 46 species recorded from Juliaetta, 33 being common to the Latah of Spokane-Coeur d'Alene. We record 14 from Grangeville Mountain, of which 13 are common to Spokane-Coeur d'Alene and 10 are common to Whitebird. *Betula bryani*, Kn., *Laurus similis*, Kn., *Liquidambar californica*, Lesq., *Magnolia* sp., *Populus heteromorpha*, Kn., *Quercus cognatus*, Kn., and *Sophora spokaneensis*, Kn. are common fossils in this locality. The *Taxodium dubium* is fairly common, but *Sequoia* appears to be absent. The fossiliferous beds at Elk River (column 9) were exposed through quarrying operations. The rock is of the same general character as at Whitebird and the other localities from which collections were made. The beds are divided by a basaltic flow about eight feet thick, but there is no change in general character of the fossils above or below the basalt. We record 48 species from this locality, 29 being common to Spokane-Coeur d'Alene. The beds at Oviat Creek were brought to light through logging construction and through stream erosion. So far we have recorded 24 species from this locality, 21 being common to Spokane-Coeur d'Alene flora. The Clearwater Lumber Camp No. 2 locality was also exposed through the building of a logging railway. We record 44 species from here, 33 of which are common to Spokane-Coeur d'Alene.

The fossiliferous beds at Oviat Creek, Elk River and Clearwater Lumber Camp No. 2 are separated by only a few miles. It is of interest to take the total records for all three and compare them with Spokane-Coeur d'Alene. The total number is 75, of which 48 or 64 per cent are common to the Latah of Spokane-

⁵U. S. Geol. Survey, Professional Paper No. 154, 1930.
⁶Op. cit.

apparently
Coeur d'Alene. *Populus heteromorpha*, Kn. is approximately the best index fossil, since it appears to be the only one common to all localities.

Probably the most interesting feature of the fossil flora of the Latah formation is the association of species belonging to genera that are now isolated. These fossil plants link geographically distant places and help us

to realize the effect of geologic change on the distribution of plants.

The following table, compiled from Bailey,⁷ Sargent,⁸ Raeder,⁹ and Hutchingson,¹⁰ presents the essential facts concerning the present geographic distribution of the genera of ligneous plants that have been identified in the Latah formation:

Genus	Number of Species	Present Geographical Distribution
Acer	150	Temperate regions of Northern Hemisphere.
Aesculus	25	E. and W. North America, Europe and temperate Asia.
Alnus	15	Northern Hemisphere south to Central America.
Amelanchier	25	E. and W. North America, Europe and temperate Asia.
Aralia	20	North America, Malaya, Asia and Australia.
Arctostaphylos	50	North and Central America (1 circumpolar).
Betula	4	Temperate regions of Northern Hemisphere.
Carpinus	20	Northern Hemisphere, south to Central America.
Cassia	380	Warmer regions of both hemispheres, except Europe, Tasmania and New Zealand.
Castanea	8	Temperate regions of Northern Hemisphere.
Celastrus	30	E. and W. Asia, Australia, Madagascar, E. North America.
Cercidium	4 or 5	Southern borders of U. S. A., Mexico to Central America.
Cercis	7	E. and W. North America, Europe and temperate Asia.
Cercocarpus	20	Oregon to Mexico.
Comptonia	1	Nova Scotia to South Carolina.
Cornus	40	E. and W. North America, Europe and temperate Asia.
Corylus	15	E. and W. North America, Europe and temperate Asia.
Crataegus	1000	(Principally developed in Eastern U.S.A.)
Diospyros	200	Principally tropical and sub-tropical regions.
Euonymus (Euonymus)	120	North and South America, Asia and Australia.
Fagus	9	Temperate regions of Northern Hemisphere.
Ficus	600	Tropical and sub-tropical regions of both hemispheres.
Fraxinus	65	Northern Hemisphere, in America south to Mexico, Asia south to Java.
Ginkgo	1	Confined to China.
Glyptostrobus	1	Confined to China.
Hibiscus	200	Tropical and sub-tropical and temperate regions of both hemispheres.
Hydrangea	35	North and South America, Europe, North Africa, Asia south to Java.
Ilex	300	Largest number in Brazil and Guiana, 13 E. North America.
Juglans	15	Northern Hemisphere south to Central America.
Kalmia	8	North America and West Indies.
Laurus	2	Mediterranean region, Canary Isles and Madeira.
Liquidambar	4	E. North America, Central America, W. and E. Asia.
Liriodendron	2	1 Eastern North America, 1 China.
Magnolia	35	E. North America, Central America, E. Asia and Himalaya.
Menziesia	7	E. and W. North America and E. Asia.
Myrica	35	Sub-tropical and temperate regions of both hemispheres.
Nyssa	6	4 E. North America, 2 E. Asia.
Ostrya	7	North and Central America, Europe, W. and E. Asia.
Paliurus	6	South Europe and East Asia.
Pinus	80	Northern Hemisphere from Arctic to Guatemala, W. Indies, North Africa, Malay Archipelago.

⁷ Bailey, L. H., Manual of Cultivated Plants.

⁸Sargent, John H., Trees of North America.

⁹Raeder, Alfred, Manual of Cultivated Plants and Shrubs.

¹⁰Hutchingson, J., Classification of Flowering Plants.

Genus	Number of Species	Present Geographical Distribution
Platanus	6 or 7	Temperate regions of Northern Hemisphere.
Populus	30	From Arctic south to high mountains in Tropics.
Porona	15	Old World Tropics and North Australia.
Prunus	200	Northern Hemisphere, south to South America.
Quercus	200	Temperate regions of Northern Hemisphere, in Tropics at high altitudes, south to Colombia in America and Malay Archipelago in Asia.
Rhamnus	100	Northern Hemisphere south to South America.
Rhus	150	Sub-tropical and temperate regions of both hemispheres.
Ribes	150	Northern Hemisphere south to South America.
Robinia	20	North America and Mexico.
Rubus	400	Chiefly colder regions of Northern Hemisphere, a few in Tropics and Southern Hemisphere.
Salix	300	Chiefly colder regions of Northern Hemisphere, few in Southern Hemisphere, none in Australia.
Sapindus	15	Chiefly in Tropics, 3 in U. S. A.
Sassafras	3	1 E. North America, 1 in China, 1 in Formosa.
Sequoia	2	From southern Oregon to California.
Smilax	200	Tropical, sub-tropical and temperate regions of both hemispheres.
Sophora	20	Temperate Asia and North America.
Taxodium	2	S.E. U. S. A. and North Mexico.
Tilia	30	Temperate regions of Northern Hemisphere, E. North America south to Mexico, in Asia south to central China and Southern Japan, none in W. North America.
Tsuga	10	Temperate Asia and North America.
Tunium (Torrya)	6	E. and W. North America and E. Asia.
Ulmus	18	Temperate Northern Hemisphere, none west of Rocky Mountains.
Umbellularia	1	South Oregon to California.
Vaccinium	130	From Arctic south to high mountains in Tropics.
Viburnum	120	North and Central America, Europe, North Africa, Asia south to Java.

E. No. Am.,

C. Am. and E. Asia In both habitats Magnolias are the more abundant and more widely distributed of the two. Ginkgo and Glyptostrobus are now confined to southwest China and are so greatly reduced that each genus consists of a single species.

The genus *Laurus* today consists of a single species and is found only in the Mediterranean region, Canary Islands and Madeira. Recent and instructive data concerning distribution of *Laurus* in Tertiary time is given by Morita¹¹ in a description of a Neogene flora of Uzen Province of Japan. He describes four species which are common in the Latah flora, viz., *Laur-*

us princeps, *Laurus californica*, *Glyptostrobus ? europaeus* and *Taxodium dubium*. More remarkable, however, is the occurrence as a fossil in the Uzen flora of the existing *Laurus nobilis* of the Mediterranean region. Of other genera common in the Latah flora Morita mentions *Salix*, *Sophora*, *Ulmus*, *Diospyros*, *Betula*, *Quercus*, *Castanea*, *Fraxinus*, *Pinus*, *Magnolia* and *Ficus*. Morita's work apparently makes it certain that the broad-leaved lauraceous plants of the Latah belong to the genus *Laurus*.

The probable climatic conditions under which the Latah flora flourished arouses perhaps the greatest general interest. Berry, Chaney and Knowlton¹² are not in agreement on the subject. Because of this, it seems de-

¹¹Morita, H., Japanese Journal of Geology and Geography, vol. 9, 1931, pp. 1-8.

¹²Op. cit.

sirable to present a brief discussion of the subject.

The commonest trees in the Latah flora are poplars, oaks, sequoias, maples, bald cypress, chestnuts and birches. The flora was therefore decidedly mesophytic in aspect. In eastern United States the greatest variety of deciduous trees is found between thirty and forty degrees latitude. In this region, excepting mountainous districts, the number of days free from killing frosts¹³ varies from 180 to 240. The forest reaches its maximum development on the lower slopes of the Southern Appalachians in North Carolina and Tennessee, and in the valleys of the Ohio and lower Mississippi. The greatest part of this area falls between 34 degrees and 37 degrees latitude, the rainfall varies between 50 and 70 inches a year, July and August being the wettest months. The average temperature of the growing season is between 64 degrees and 67 degrees Fahrenheit. The dominant trees are oaks, maples, birches, ash, lime, chestnut and beech. South of the Carolinas and Tennessee the forests have a warmer climatic aspect due to the presence of evergreen oaks, persea and magnolias. The range of evergreen trees anywhere in the temperate regions is determined more by annual and diurnal range of temperature than by relatively high mean temperature.

A rainfall of 50 inches is not necessary for the luxuriant growth of tulip trees, magnolias, oaks and maples, or indeed any of the important forest types of the eastern or southeastern states. What is necessary is an evenly distributed rainfall and absence of ex-

treme temperatures. Representative species of oaks, sycamore, red-bud, sophora and *Ginkgo biloba* have flourished in the Royal Botanic Gardens, Kew, England, since 1760. This is a cool oceanic climate and the rainfall is less than 35 inches. It therefore appears probable that the forests of the Latah formation flourished in a climate characterized by fogs, mild winters, cool summers and a well distributed rainfall, the mean temperature of which was probably no higher than that of the southern Appalachian, or at most that of the lower Mississippi Valley at present.

Some 18 specimens were found with sufficiently distinct characteristics to warrant descriptions as new species. The descriptions follow. In establishing new species the usual paleobotanical practice was carefully followed.

Pinaceae.
No. 97, U. of Idaho collection from Whitebird, Idaho. *Juniperus sabinooides*, Ashlee.

Pl. 1, No. 1. Specimens showing three years' growth. One-year old wood bearing small (2 mm. long) acute lanceolate, two year-old wood bearing appressed, nearly opposite leaves somewhat spreading spirally alternate leaves, 1 mm. long, apiculate and strongly keeled. The leaves on three-year old wood appear to have been dead, but persistent, and forming a scabrous twig.

Ceratophyllaceae.

No. 85, U. of Idaho collection, from Whitebird, Idaho. *Ceratophyllum praedemersum*, Ashlee.

Pl. 1, No. 2. Fossils detached whorls of leaves; four specimens. Leaves in whorls of about 12; finely dissected, sessile, several times forked and terminating in rigid teeth. Length of leaves from 1.3 to 2 cm.

Aristolochiaceae.

No. 206, U. of Idaho collection, from Whitebird, Idaho. *Aristolochia whitebirdensis*, Ashlee.

Pl. 1, No. 3. Leaf evidently of thin, leathery texture, apical portion missing, unequally cordate at base, entire; midrib strong only near the base, soon becoming thin; secondaries exceedingly faint except the lower portion of lower pair, which arise at about 90° but are abruptly arcuate, tertiaries

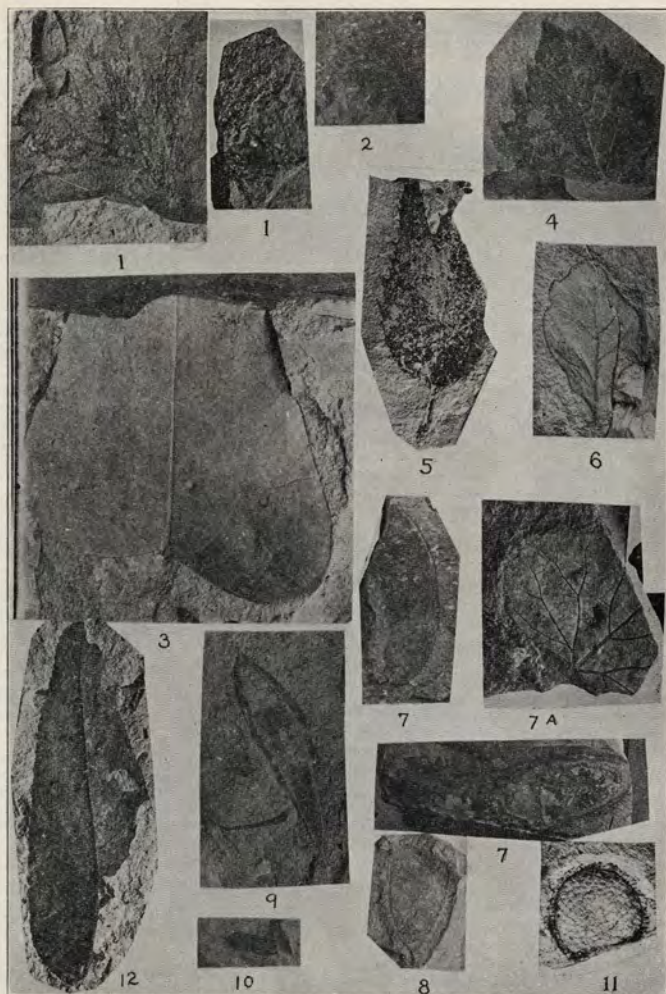


PLATE I—1. *Juniperus sabinooides*, Ashlee. 2. *Ceratophyllum praedemersum*, Ashlee. 3. *Aristolochia whitebirdensis*, Ashlee. 4. *Rubus idahoensis*, Ashlee. 5. *Rubus* sp. 6. *Crataegus latahensis*, Ashlee. 7.7. *Cercis* sp. 7A. Leaf associated with *Cercis* sp. 8. *Gleditschia praequatica*, Ashlee. 9. *Cercidium hesperium*, Ashlee. 10. *Robinia? idahoensis*, Ashlee. 11. *Platanus* sp. Fruit. 12. *Salix kemppii*, Ashlee.

¹³Shantz, H. L. and Zon, Raphael, Atlas of American Agriculture, Sec. E, Natural Vegetation, 1924.

Read, W. G., Atlas of American Agriculture, Sec. I, Frost and Growing Season, 1924.

anastomosing to form a fine reticulation. Rosaceae.

No. 388, U. of Idaho collection from Grangeville Mountain, *Rubus idahoensis*, Ashlee.

Pl. 1, No. 4. Fossil imperfect, base missing. Leaf ovate-lanceolate, acute 4 cm. x 5.9 cm., margin doubly serrate, part of apex missing. Midvein strong, tapering, secondaries opposite, regularly spaced, arising at an initial angle of about 45 degrees and entering the larger teeth, tertiaries entering secondary teeth or joining another secondary vein, finally nervulose and reticulated. This appears to be a terminal leaflet of a 3 or 5-foliate leaf.

No. 387. *Rubus* sp.

Pl. 1, No. 5. This specimen is from the same piece of rock as number 388 and is probably the same species. The specimen apparently a leaf of a fruiting branch, showing base, petiole and part of two lobes. Base rounded, margin doubly serrate but less coarse than No. 388, petiole 1.5 x 1 mm. Blade 1 cm. above, petiole 2.3 cm. wide, greatest length of specimen 5 cm., apparent length about 7 cm., the leaf apparently trilobate.

No. 53, U. of Idaho collection, from Whitebird, Idaho.

No. 414, U. of Idaho collection from Juliaetta, Idaho. *Crataegus latahensis*, Ashlee.

Pl. 1, No. 6. Leaves obovate, cuneate at base, slightly acute, length of No. 53, 3.8 x 2.4 mm. at widest part, No. 414, imperfect, apparent length 4 cm., greatest width 2.5 cm. Margin denticulate and slightly lobed for upper two-thirds of the margin. Midrib tapering from the base, secondaries arising to acute angles, widely spaced, alternate and entering the teeth at the lobes; tertiaries few, entering teeth; finer nervation obscure. Caesalpiniaceae.

No. 352, U. of Idaho collection, from Oviat Creek, Idaho.

No. 460, U. of Idaho collection, from Elk River, Idaho. *Cercis* sp. Fruit.

Pl. 1, No. 7-7. *Oviat Creek specimen*. Fruit 6 cm. x 2 cm., evidently somewhat inflated, thickening on dorsal margin, round at both ends. *Elk River specimen*. Incomplete, falcate, 5 cm. x 1.5 cm. showing part of thickened dorsal margin.

These fruits were in both cases associated

with leaves apparently identical with *Populus lindgreni*, Kn. The leaves appear to have a somewhat firmer texture than *P. lindgreni*, but have the same general structural characteristics. These may only be small specimens of *Cercis idahoensis*, Bry.

No. 461, U. of Idaho collection, from Elk River, Idaho. *Gleditsia procaequatica*, Ashlee.

Pl. 1, No. 8. This fossil fruit is so close to, as to seem identical with, *Gleditsia acquatica*, Marsh, that I propose the specific name *procaequatica*. Description: Fruit obliquely ovate, 2.8 x 1.6 cm., stalk absent, tip 2 mm., margins thickened.

No. 527, U. of Idaho collection, from Clearwater Lumber Camp No. 2, Elk River district, Idaho. *Cercidium hesperium*, Ashlee.

Pl. 1, No. 9. Fossil a legume 5.5 cm. long, acute at both ends, 1 cm. wide at widest part, clavate, slightly falcate, and evidently turgid; margins thickened; apex with sharp apical point, basal end with point 4 mm. long terminating in a persistent calyx ring.

Papilionaceae.

No. 378, U. of Idaho collection, from Grangeville Mountain, Idaho. *Robinia ? idahoensis*, Ashlee.

Pl. 1, No. 10. Pod elliptical, 1.5 cm. long, 5 mm. wide, slightly constricted near the middle, stalk 2 mm. long, apical point 1.5 mm.; three-seeded and bristly hispid.

Platanaceae.

No. 472, U. of Idaho collection, from Elk River district, Clearwater Lumber Camp No. 2. *Platanus* sp.

Pl. 1, No. 11. Fruit 2.7 cm. in diameter, specimen evidently a crushed globular syncarp, the margin consisting of angular nutlets, the center showing the stem scar. This fossil was found associated with *Platanus dissecta*, Lesq., and is doubtless the fruit of that species.

Salicaceae.

No. 488, U. of Idaho collection, from Elk River district, Idaho, Clearwater Camp No. 2. *Salix kempffii*, Ashlee.

Pl. 1, No. 12. Leaf thick, apparently soft, lanceolate, 9 cm. x 3 cm. at greatest width, blunt at apex, apparently rounded at base (base in specimen imperfect), margin irregularly denticulate; midrib very thick be-

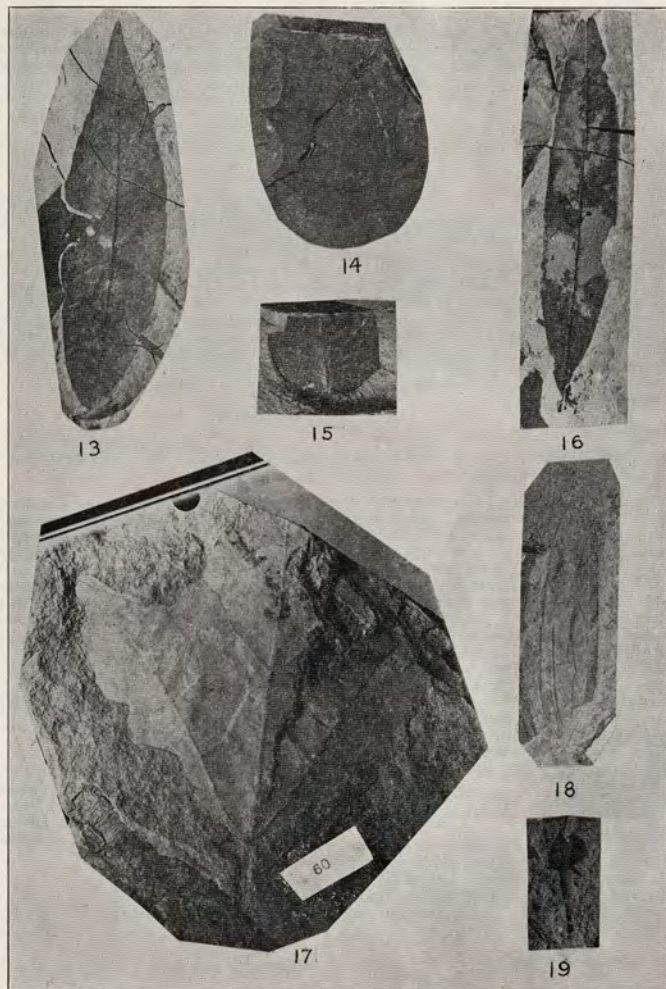


PLATE 11—13. *Myrica idahoensis*, Ashlee. 14. *Ilex latahensis*, Ashlee. 15. *Ilex* sp. 16. *Kalmia ? elongata*, Ashlee. 17. *Viburnum whitebirdensis*, Ashlee. 18. *Smilax praelaurifolia*, Ashlee. 19. Unnamed fruit.

low becoming gradually thinner towards apex, secondaries of about 16 closely spaced pairs which arise at an initial of about 45°, but soon become camptodrome and joining the next above, finer nervation not clear.

Named in honor of Professor Gerhard Kempff of the School of Forestry, U. of Idaho.

Myricaceae.

No. 301, U. of Idaho collection, from Elk River, Idaho. *Myrica idahoensis*, Ashlee.

Pl. 2, No. 13. Leaf lanceolate-elliptic, 9.3 cm. long, 2.5 at greatest width, rounded at base, somewhat acuminate at apex, finely and rather remotely serrate above the middle, lower half of margin entire, petiole missing; midrib slender, secondaries very fine, entering the teeth of the upper part of the blade, on lower half anastomosing to form a fine reticulation.

Aquifoliaceae.

No. 463, Univ. of Idaho collection, from Elk River, Idaho. *Ilex latahensis*, Ashlee.

Pl. 2, No. 14. Leaves coriaceous elliptic-oblong or elliptic-lanceolate, truncate at base, apical portion missing, specimen 5 cm. long, apparent length 7 or 8 cm., width between basal sinuses 2 cm., between second and third 3.5 cm., margins thickened, undulate, with few very stout teeth, (specimens three on either side and part of fourth), spreading at right angles to the midrib, except lower pair which point 45° downward. Midrib stout, grooved and tapering from the base; secondaries sub-opposite, close, arising at an initial angle of 45°, ascending for about half their length, then slightly curving downward, forking near the margin. Petiole short, stout, 4 mm. long, 3 mm. wide, evidently grooved. This leaf resembles *Ilex aquifolium*, L.

No. 399, U. of I. collection, from Juliaetta, Idaho. *Ilex* sp.

Pl. 2, No. 15. This specimen is inadequate for full description. This fossil is the lower part of the leaf. Length 1.7 cm., apparent total length 3 or 3.5 cm., width 2.5 cm., base slightly cordate, margin very

slightly thickened, undulate with one small tooth, midrib stout and tapering, secondaries opposite or sub-opposite, arising at an initial angle of about 60°, forked and forming a mesh near the margin. Petiole bent and only base clearly shown. This fossil is very like a leaf of *Ilex opaca*, Ait., but may be only a variant of *Ilex latahensis*.

Ericaceae.

No. 303, U. of Idaho collection, from Elk River, Idaho. *Kalmia* ? *elongata*, Ashlee.

Pl. 2, No. 16. Specimens, two leaves. Leaves sub-coreaceous, entire, narrowly elliptical, .9 x 1.7 cm., obtuse, margins apparently slightly undulate, petiole short 2-4 mm. long. Midrib stout, grooved, tapering from base; secondaries weak, arising at various angles, ascending for various distances; tertiary irregularly anastomosing and forming a fine reticulation.

Caprifoliaceae.

No. 60, U. of Idaho collection, from Whitebird, Idaho. *Viburnum whitebirdensis*, Ashlee.

Pl. 2, No. 17. Leaf trilobate, lobes divergent (apical portion of central lobe missing), 7.5 cm. long, 8 cm. broad, irregularly dentate; strongly three-ribbed, secondaries rather widely spaced, arising at a wide angle and barely entering teeth, finer nervation obscure, base rounded and entire for a short distance; petiole strong, 1.5 cm. x 2 mm. This species is so near as to seem identical with *Viburnum opulus*, L.

Liliaceae.

No. 500, U. of Idaho collection, from Elk River district, Clearwater Camp No. 2. *Smilax praelaurifolia*, Ashlee.

Pl. 2, No. 18. Leaf of firm texture, oblong-lanceolate, blunt at apex, narrowed at the base (base incomplete), entire, three-nerved, 6.5 cm. x 1.5 cm., petiole missing. This species is very near *Smilax laurifolia*, L.

Unclassified.

Pl. 2, No. 19. Unnamed fruit.