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SOME FOSSIL SPECIES OF *MAHONIA* FROM  
THE TERTIARY OF EASTERN AND  
SOUTHEASTERN OREGON

BY  
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Editor: EUGENE S. McCARTNEY

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ERRATA ON PAGES 62-63 OF VOLUME V, ARTICLE 4

The following corrections should be made in the author's recent paper in this series, "Some Fossil Species of *Mahonia* from the Tertiary of Eastern and Southeastern Oregon," Vol. V, No. 4, July 31, 1936:

P. 62, below the middle. To *Odostemon simplex* add "Fig. 1, not Fig. 2."

P. 63, line 1. For "1924" read "1934."

P. 63, bottom of page. For *Mahonia eocenica* read *Mahonia eocenia*. For *Odostemon eocenica* read *Odostemon eocenia*.



## SOME FOSSIL SPECIES OF *MAHONIA* FROM THE TERTIARY OF EASTERN AND SOUTHEASTERN OREGON

By CHESTER A. ARNOLD

FOSSIL plant material referable to the genus *Mahonia* is occasionally mentioned in literature pertaining to the Tertiary floras of the Western States, but no comprehensive study of the material has been made. As compared with many genera existing in the Tertiary, *Mahonia* is relatively rare, and but few localities have yielded specimens in any quantity.

In addition to describing two new species of the genus an attempt is made in this account to set forth as precisely as possible the distinguishing characteristics of previously known forms. The existing descriptions of *M. simplex* and *M. Hollicki* are satisfactory for the material upon which they were based, but after a quantity of other material had been examined it became apparent that these descriptions were not founded upon a sufficient number of specimens to allow for the individual variations encountered in a large collection. Because of the variability the identification of specimens having the appearance of intergrades is difficult and uncertain. The collection in the Museum of Paleontology of the University of Michigan contains, however, enough material to make possible a satisfactory separation.

Most of the fossils described in the present account came from the Trout Creek diatomite in the southern part of Harney County, Oregon, or from several localities near Sheaville and Rockville in the eastern part of Malheur County, of the same state. They were collected by Mr. Percy Train during the summers of 1932, 1933, and 1935. Altogether nearly one hundred specimens of

*Mahonia* were secured, and it is believed that the collection is unique in the number of specimens and species.

The Trout Creek diatomite has been placed by previous authors in the upper Miocene and approximately contemporaneous with the well-known Mascall formation. The lacustrine deposits in the vicinity of Rockville and Sheaville and along Succor Creek are probably of similar age.

The first account of *Mahonia* in the Tertiary of the Western States is by Newberry (1883), who describes *Berberis simplex* from Bridge Creek, Oregon. Later references to either *Berberis* or *Odostemon* have been made by Cockerell (1908), Knowlton (1923), Chaney (1927), Dorf (1933), MacGinitie (1933), Brown (1934), and others. Most of the accounts are relatively recent, because of the fact that more attention has been centered upon the rich plant-bearing beds in eastern Oregon and western Idaho within the last few years.

The generic name *Mahonia* is used throughout this paper in preference to *Odostemon* because it is retained as the valid name in the list of "Nomina Conservanda" of the International Rules of Botanical Nomenclature. *Odostemon* was applicable under the old American Code, which has been generally replaced by the International Rules in the leading American institutions.

Although *Mahonia* is recognized by many botanists merely as a subgenus of *Berberis*, the fossil material conforms to *Mahonia* as it was originally defined, and this name is considered preferable to *Berberis*, which, as a genus, is very large and much too inclusive in the range of types embraced.

### ***Mahonia simplex* (Newberry), comb. nov.**

(Pl. I, Figs. 1-3, 6-7; Pl. II, Figs. 1-2)

*Berberis simplex* Newberry, 1883, 1898

*Odostemon simplex* Cockerell, 1908

*Odostemon simplex* Chaney, 1927

*Odostemon simplex* MacGinitie, 1933

After Newberry described this species as *Berberis simplex* in 1883 it was not reported again until Chaney found it in the Payette formation. Later Chaney (1927) discovered it in several localities

in the John Day and Crooked River basins, and from this material was able to supplement Newberry's original description and to give a detailed account of the shape and the venation of the leaflets. The present remarks concerning *M. simplex* will be confined mostly to features which may be used in distinguishing this species from others.

At Trout Creek, where recent investigations have shown *M. simplex* to be fairly abundant, the leaflets vary somewhat in size and shape, but are sufficiently constant to be readily recognized (Pl. I, Figs. 1-3, 6-7). Usually two or three forward-pointing marginal teeth are present. The apical tooth is long and prominent and tapers gradually to a sharp point. Well-preserved leaflets also show a pair of prominent basal veins, which pass upward at a steep angle for one third or one half of the length of the leaflets. This pair of veins seems to constitute a reliable means for distinguishing between *M. simplex* and *M. Hollicki* in specimens where size and marginal features are not clearly diagnostic.

A portion of a leaf with seven leaflets attached is believed to be the most nearly complete specimen of this species yet recovered (Pl. I, Fig. 3). The attachment of four pairs of leaflets is shown, but the uppermost leaflets are lacking. The basal leaflets are smaller and slightly broader in proportion to their width than are the higher ones, and the apical and marginal teeth are somewhat more obtuse.

Isolated and detached leaflets measure from 2 to 6 cm. in length. The long slender apical tooth makes up one half to one third of the total length of the leaflet.

Leaflets referable to *M. simplex* have been secured from several localities in the vicinity of Rockville and along Succor Creek in Malheur County. These are somewhat more variable than those from Trout Creek, indicating a tendency toward a greater prolongation of the apical and marginal teeth. In some specimens, however, the apical tooth, though acute, is small (Pl. II, Fig. 1). In others the apical tooth is strong and well developed and constitutes one half of the length of the leaflet (Pl. II, Fig. 2). Most of them are slightly curled, thus showing their original coriaceous texture. The thickened margin is prolonged at the apex of each

tooth into a sharp spine, and the details of the small veinlets are often well preserved (Pl. II, Fig. 1).

*M. hakeaefolia*, from Creede, Colorado, has leaflets much like those of *M. simplex*. The material figured by Knowlton (1923, Pl. XLIII, Figs. 1-6) and several specimens of the same type in the collections of the Museum of Paleontology of the University of Michigan show the prominent marginal and apical teeth with large sinuses between (Pl. I, Figs. 4-5). An additional point of similarity is the prominent pair of basal veins in each leaflet. A slight difference is that on most of the leaflets assigned to *M. hakeaefolia* three marginal teeth are apparent, whereas on the Trout Creek and Succor Creek material there are either two or three. However, Newberry's type figure of *M. simplex* shows three teeth on at least three leaflets. Also, the Colorado specimens appear consistently smaller, but the more important characters, such as venation, lobing, and general outline, are so like those of *M. simplex* as to leave one entirely in doubt whether there exists a satisfactory means whereby two species can be recognized. Lastly, it should be recalled that the type of *M. hakeaefolia*, which was originally designated as *Lomatia hakeaefolia* (Lesquereux, 1883), is of doubtful generic identity.

No living American species of *Mahonia* is directly comparable to *M. simplex*, although *M. Fremontii* has been compared to it. *M. trifoliolata* and *M. haematocarpa* are also similar, but the former has only three leaflets as compared with at least nine in some leaves of *M. simplex*. If features other than size and number of leaflets may be considered in making comparisons, it may be noted that there is quite a resemblance in the prominence and the shape of the terminal and marginal teeth of *M. simplex* and *M. trifoliolata*. Neither of the living species, however, shows the prominent basal veins which are so conspicuous in *M. simplex*. Therefore, since there are about as many points of difference as there are resemblances, it is believed that *M. simplex* is not exactly comparable to any living American species. Certain Asiatic species, as *M. japonica*, manifest some interesting resemblances not shown by the American forms.



***Mahonia Hollicki* (Dorf), comb. nov.**

(Pl. II, Figs. 3-8; Pl. III, Figs. 5, 7, 9)

*Odostemon hollicki* Dorf, 1933*Odostemon hollicki* MacGinitie, 1933*Clematis reticulata* MacGinitie, 1933

*Mahonia Hollicki*, which was originally described from the Pliocene of California (Dorf, 1933), is common in the Trout Creek diatomite and in the lacustrine deposits of the Rockville and Succor Creek region. It is unfortunate that when the original description was being made the only material available was two fragments, which did not constitute a complete leaf. The species was compared to living *M. Aquifolium*, and on the basis of this similarity the material at hand is referred to *M. Hollicki*.

Considerable range of leaf form is shown by this species, and it is often difficult to determine exact specific limits. Dorf states that it differs from *M. simplex* in having a less lobate margin with shorter and more numerous teeth. Also, it is described as having an obtuse, rounded apex. The basal portion of the leaflet was missing in the type specimen, and since but two fragments were described no variations in form or venation could be stated. Likewise, most of the diagnostic terminology is relative and is difficult to apply to such highly variable material.

While the general statement that the marginal teeth of *M. Hollicki* are more numerous than those of *M. simplex* may apply in many instances, the smaller leaflets often depart considerably from this rule. Many of them have but two or three marginal teeth, which are separated by broad sinuses (Pl. II, Figs. 5, 7), and in this way are not greatly different from some leaflets of *M. simplex*. The terminal teeth of most leaflets are more obtuse and less prolonged than those of *M. simplex* (Pl. II, Figs. 3-5), but in many of them the apical portion is not well preserved, which makes other means of determination highly desirable.

It is believed that the venation is the most reliable character for distinguishing between *M. Hollicki* and *M. simplex*, since the former species lacks a very prominent pair of basal veins so conspicuous in the latter (Pl. II, Figs. 3, 5-7). This feature, with

the more obtuse terminal tooth (where it is preserved), and the somewhat less pronounced but more numerous marginal teeth, constitutes in most instances a satisfactory and reliable means of determination.

The material at hand shows a complete series of gradations from leaflets having fairly sharp marginal teeth to others with margins which are fairly smooth (Pl. II, Figs. 3, 7-8; Pl. III, Figs. 5, 7, 9). From this it is apparent that a specimen from the Trout Creek diatomite described by MacGinitie (1933) as *Clematis reticulata* is simply a form of *M. Hollicki* with a smooth margin. The venation of MacGinitie's specimen is identical with that of *Mahonia*, and he gives no reason for assigning it to *Clematis*. The only apparent similarity to *Clematis* is the lack of marginal teeth, which is not diagnostic, since some species of *Mahonia* have a smooth margin, for example, *M. tenuifolia* and *M. Chochoco*.

The possibility exists, of course, that more than one species is among the material assigned to *M. Hollicki*, but lacking satisfactory characters for separation all must for the present be considered one species.

### ***Mahonia Trainii*, sp. nov.**

(Pl. III, Figs. 4, 6, 8)

*Odostemon simplex* Berry, 1934

Three specimens of *M. Trainii* were secured from two localities in the vicinity of Rockville. The leaflets differ from those of *M. Hollicki* in tapering from the broad basal portion up to the apex. The marginal teeth are short; they vary in number from three to many, depending upon the size of the leaflet, and are separated from one another by shallow sinuses. Ordinarily they have from three to five teeth, but there may be more. Terminating each tooth is a sharp forward-pointing spine. The pattern of venation is similar to those of other species, and each specimen has a pair of rather prominent basal veins such as occurs in *M. simplex*. There is no possibility of confusing *M. simplex* with *M. Trainii* because of the differences in shape and marginal teeth. The leaflets at hand are from 4 to 4.5 cm. long and from 1.2 to 2 cm. broad at the widest portion, near the base.

A specimen described by Berry (1924) from Washington County, Idaho, and referred to *Odostemon simplex* appears to belong to *M. Trainii*.

Among living species of *Mahonia* some of the more tapering leaflets of *M. nervosa* and *M. lanceolatus* resemble *M. Trainii* to a certain extent.

***Mahonia malheurensis*, sp. nov.**

(Pl. III, Figs. 1-3)

*M. malheurensis* is based upon three specimens which differ somewhat, but which are alike in so many respects that it seems undesirable to attempt separation. Two specimens (Pl. III, Figs. 1, 3) came from Succor Creek near the Strode ranch; the other (Pl. III, Fig. 2) was secured from the Trout Creek diatomite.

All the specimens are slender, the length being six to ten times the width. The holotype (Pl. III, Fig. 1) measures  $1.2 \times 8$  cm.; the smallest specimen (Pl. III, Fig. 3) is only  $0.5 \times 4$  cm. Both are from Succor Creek. The Trout Creek specimen (Pl. III, Fig. 2) is much like the holotype and measures  $0.8 \times 8$  cm. Where the venation is visible it is of the *Mahonia* type, although modified somewhat because of the great prolongation of the leaflets. The lateral secondary veins pass upward at a very acute angle. The marginal teeth vary from 2 to 9 and are nearly equally spaced in the different specimens, being about 1 to 1.3 cm. apart. Each tooth is surmounted by a sharp forward-pointing spine, and the sinuses between the teeth are shallow. Both the Succor Creek specimens are slightly curved, a shape suggestive of a lateral position on the leaf, whereas the Trout Creek specimen is straight. The latter might have occupied a terminal position, although the oblique base suggests a different one.

Other previously described species from the Tertiary of the Western States referable to *Mahonia* are briefly discussed below.

***Mahonia eocenica* (Brown), comb. nov.**

*Odostemon eocenica* Brown, 1934

This species from the Green River shale is known from a single incomplete leaflet, from which the apex is missing. The venation

and the margin appear characteristic, but, because of the lack of more material, comparisons with other species cannot be made with certainty.

**Mahonia florissantensis** (Cockerell), comb. nov.

*Odostemon florissantensis* Cockerell, 1908

Since *M. florissantensis* has never been figured and since the type specimen has not been examined by the present author, it is impossible to compare it with the Oregon species. It is said to resemble *M. simplex*, except that the basal inferior angle is prolonged into a tooth, so that the truncate base of the leaflet is greatly broadened. It may be a variation within *M. simplex*.

**Mahonia hakeaefolia** (Lesquereux), comb. nov.

(Pl. I, Figs. 4-5)

*Carduus florissantensis* Cockerell, 1906

*Odostemon hakeaefolia* Knowlton, 1922

As stated in a preceding paragraph, the *Lomatia hakeaefolia* described by Lesquereux (1883, Pl. XXXII, Fig. 13), which was cited by Knowlton (1923) as the type of *Odostemon hakeaefolia*, is of doubtful generic identity. Also it appears to be different from the material Knowlton figured as *O. hakeaefolia* and from that material which is figured here (Pl. I, Figs. 4-5). The original of *L. hakeaefolia* is too tapering and the uppermost teeth are too short to be closely comparable with *M. hakeaefolia* as the latter is revealed by Knowlton's figures and by characteristic specimens in the collection of the Museum of Paleontology of the University of Michigan. Furthermore, it is believed that *M. hakeaefolia* is indistinguishable from *M. simplex*, which is quite different from the *L. hakeaefolia* of Lesquereux.

**Mahonia marginata** (Lesquereux), comb. nov.

*Hedera marginata* Lesquereux, 1883

*Odostemon marginata* Knowlton, 1923

Leaflets assigned to *M. marginata* are probably the basal ones of some other type, possibly *M. hakeaefolia*. This form, with

*M. hakeaefolia*, is reported from Creede and Florissant in Colorado.

A specimen from De Beque, Colorado, described by Hollick (1929) as *Odostemon Reynoldsii*, is indeterminate. Brown (1934) says that the type bears considerable resemblance to *Fraxinus flexifolia*. In the figure the venation is obscure.

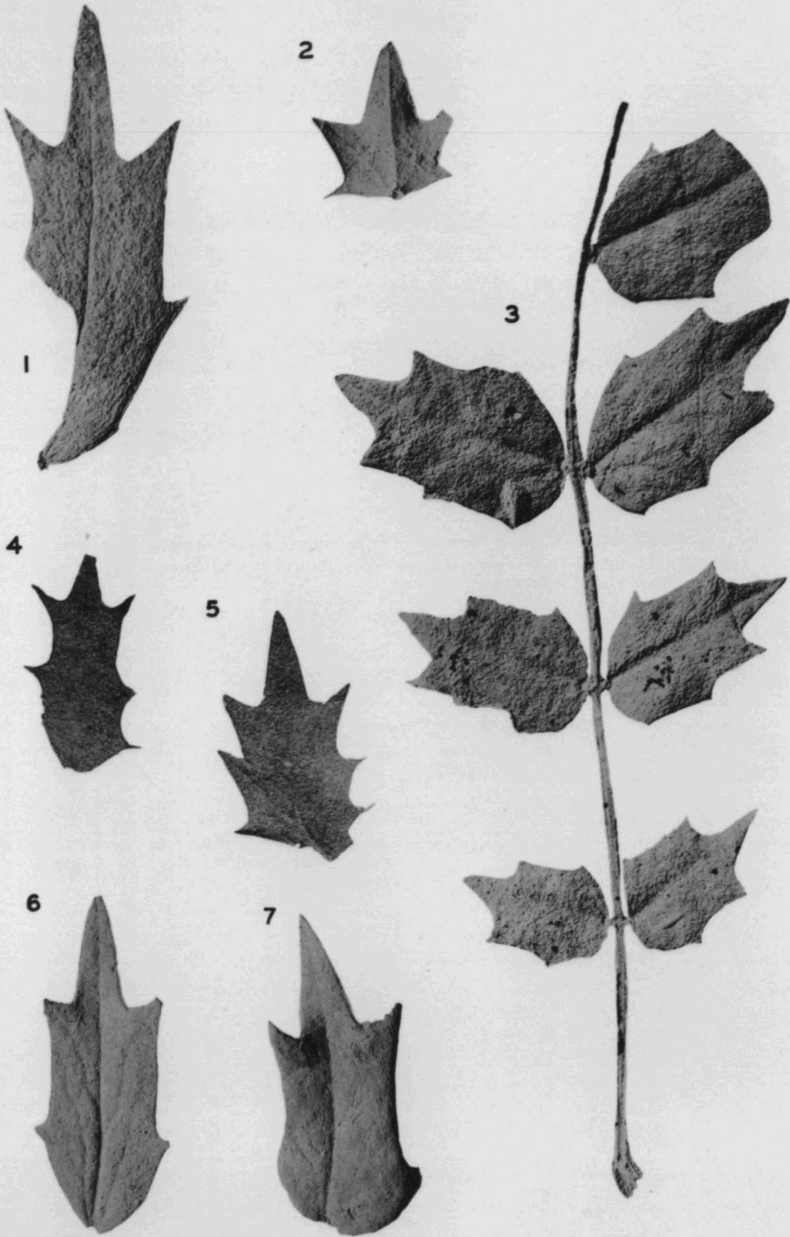
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## EXPLANATION OF PLATE I

- FIGS. 1-3. *Mahonia simplex* (Newb.) Arnold. From Trout Creek diatomite. No. 17226 U.M.
- FIGS. 4-5. *M. hakeiaefolia* (Lesq.) Arnold. From Creede, Colorado. No. 15412 U.M.
- FIGS. 6-7. *M. simplex* (Newb.) Arnold. Data as for Figures 1-3.

PLATE I

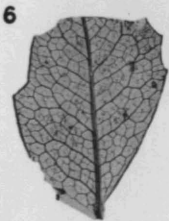
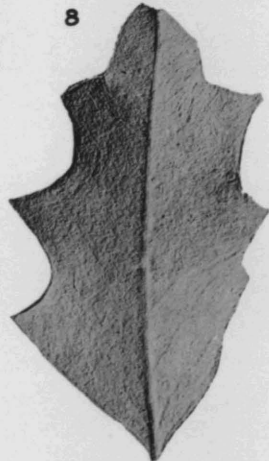
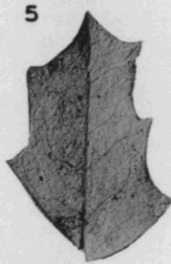
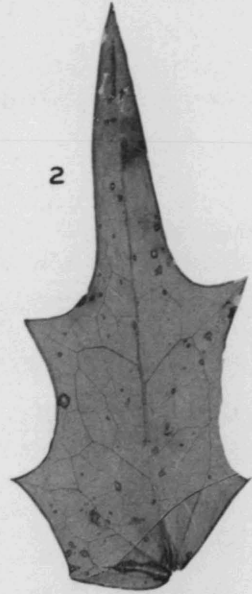
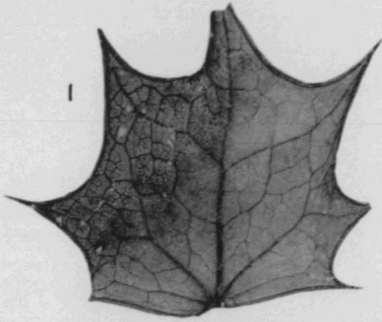


## EXPLANATION OF PLATE II

- FIGS. 1-2. *Mahonia simplex* (Newb.) Arnold. From lacustrine deposits along Carter Creek, about 6 miles west of Rockville, Malheur Co., Oregon. No. 17316 U.M.
- FIG. 3. *M. Hollicki* (Dorf) Arnold. From lacustrine deposits about 2 miles west of Fenwick ranch and about 7 miles south of Rockville, Malheur Co., Oregon. No. 17314 U.M.
- FIG. 4. Counterpart of specimen shown in Figure 3, with apical portion of leaflet.
- FIGS. 5-6, 8. *M. Hollicki* (Dorf) Arnold. From Trout Creek diatomite. No. 17225 U.M.
- FIG. 7. *M. Hollicki* (Dorf) Arnold. From lacustrine deposits along Carter Creek, about 7 miles southwest of Rockville, Malheur Co., Oregon. No. 17315 U.M.



PLATE II



### EXPLANATION OF PLATE .III

- FIG. 1. *Mahonia malheurensis* Arnold. Holotype. From lacustrine deposits along Succor Creek, north of Strode ranch, Malheur Co., Oregon. No. 17307 U.M.
- FIG. 2. *M. malheurensis* Arnold. Paratype. From Trout Creek diatomite. No. 17303 U.M.
- FIG. 3. *M. malheurensis* Arnold. Paratype. From same locality as Figure 1.
- FIG. 4. *M. Trainii* Arnold. Paratype. From lacustrine deposits 2 miles west of Rockville, Malheur Co., Oregon. No. 17302 U.M.
- FIG. 5. *M. Hollicki* (Dorf) Arnold. From lacustrine deposits north of Strode ranch, Malheur Co., Oregon. No. 17310 U.M.
- FIG. 6. *M. Trainii* Arnold. Paratype. From lacustrine deposits along Succor Creek north of Strode ranch, Malheur Co., Oregon. No. 17301 U.M.
- FIG. 7. *M. Hollicki* (Dorf) Arnold. From lacustrine deposits along Carter Creek, about 7 miles southwest of Rockville, Malheur Co., Oregon. No. 17315 U.M.
- FIG. 8. *M. Trainii* Arnold. Holotype. From same locality as Figure 6. No. 17300 U.M.
- FIG. 9. *M. Hollicki* (Dorf) Arnold. From the Trout Creek diatomite. No. 17315 U.M.

PLATE III

