ART. XXXIX.—*Notes on some Mesozoic Plants from near Oroville, California*; by W. M. FONTAINE.

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DURING the season of 1894, Mr. T. W. Stanton made a small collection of fossil plants from near the Banner Mine in the vicinity of Oroville, California. They were sent to Mr. Lester F. Ward and by him submitted to me for determination. As the plants indicated an interesting flora, not hitherto known in the Mesozoic formations of America, suggesting, possibly, the existence of true Jurassic plants in the United States, Mr. Ward visited the locality in September in 1895, for the express purpose of making, if possible, additional collections. He was so fortunate as to find, in the same vicinity, exposures of the strata, unknown to Mr. Stanton, that were rich in fossils. Mr. Stanton's imperfect collection left the age of the formation yielding the plants in considerable doubt, which the larger one of Mr. Ward with its better preserved impressions served in large measure to remove. Mr. Ward's specimens also were submitted to me, and it is the object of this paper to briefly give some of the results obtained from the study of all the material now in hand from Oroville.

In order that the reader may have some idea of the occurrence of the fossils, it will be necessary to give a few preliminary statements regarding the geology of the region.

Mr. Ward collected from four localities, all in the immediate vicinity of the Banner Mine, and in these are included those that afforded the plants of Mr. Stanton. The plants were all found on the same geological horizon. As Mr. Ward informs me, the strata yielding the plants occur in a narrow belt, a few hundred yards wide, with a dip of 70° – 80° . They resemble, lithologically, the Jurassic Mariposa Slates, but, as they have hitherto yielded no fossils, and are connected stratigraphically with no known formation, their age is, as yet, not determined. Mr. W. H. Turner in a paper, "On the Age and Succession of the Igneous Rocks of the Sierra Nevada," published in the *Journal of Geology*, vol. iii, No. 4, May–June, 1895, p. 394, in speaking of the eruptive rocks of the Smartsville area, says, "These rocks, largely augite porphyries and their tuffs, are presumed to have covered, as with a mantle, the underlying Paleozoic formations. There are some streaks of slate among the eruptive masses, but these have not, in the Smartsville area, afforded any fossils. However, during the past season, in the northern extension of the same area, in a belt of clay slate interbedded with augite breccia and tuff, fossil plants were collected by T. W. Stanton. The exact locality is, by the stage

road, south of the Oroville Table Mountain, near the Banner gold quartz mine."

These are the plants referred to in the beginning of this paper.

Mr. Ward's collection, although much larger than that of Mr. Stanton, and containing better preserved specimens, still shows very imperfectly the character of a number of plants. Enough is made known, however, to prove that they are distinct species, but either the amount of material, or the state of preservation, does not suffice to fix with precision the identity or the affinity of the form. It is for this reason that the location of certain plants in the following list is left in doubt. The list below gives the plants made out with more or less definiteness from the Oroville beds.

List of Plants from the Oroville beds.

1. *Chadophlebis** *spectabilis*, Heer.
2. " *argutulus*, "
3. " *Whitbiensis tenuis*, var. *a*, Heer, species.
4. " *densifolia*, n. sp.
5. " *Indica*?, Old and Mor.
6. *Adiantites Orovillensis*, n. sp.
7. *Thyrsopteris Maakiana*?, Heer.
8. *Pecopteris gleichenoides*?, Old. and Mor.
9. *Tæniopteris Orovillensis*, n. sp.
10. *Angiopteridium Californicum*, n. sp.
11. *Sagenopteris rhoifolia*?, Presl.
12. *Macrotæniopteris Californica*, n. sp.
13. " *nervosa*, n. sp.
14. *Pterophyllum Rajmahalense*?, Mor.
15. *Ctenis grandifolia*, n. sp.
16. " *auriculata*, "
17. " *Orovillensis*, "
18. *Ctenophyllum Wardii*, n. sp.
19. " *angustifolium*, n. sp.
20. " *grandifolium*, var. *Storrsii*, n. var.
21. " *densifolium*, n. sp.
22. *Podozamites lanceolatus*, [L. and H. spec.] Schimp.
23. " " var. *latifolius*, Heer, var.
24. *Pinus Nordenskiöldi*?, Heer.
25. *Pagiophyllum Williamsoni*, [L. and H. spec.] Heer.
26. *Carpolithus Storrsii*, n. sp.
27. Undetermined Cone.

Whatever may be the true place of these 27 forms, they are all different. The flora does not seem to have had great variety, but judging from the number of specimens, such

* I prefer the name "*Cladophlebis*" for these plants, which Heer regards as *Asplenium*.

plants as *Teniopteris Orovillensis*, *Podozamites lanceolatus*, and *Ctenophyllum densifolium*, were very common, *Ctenis auriculata*, *C. grandifolia*, *Ctenophyllum grandifolium*, var. *Storrsii*, were less abundant, but still common. The rest occur more rarely, and some, such as *Adiantites Orovillensis*, are found only in a single specimen. The plants, considered in their identical and most nearly related forms, range in time from the Rhetic, or uppermost Trias, to the Potomac. No plant is identical with any belonging to the Potomac, and only a single one, *Ctenophyllum Wardii*, has relationship with a Potomac form, viz.: *Ctenophyllum latifolium*, Font. There can then be no doubt that the age is not Potomac. The following plants do not show a sufficiently near relationship with known species to indicate any particular age: *Adiantites Orovillensis*, *Macroteniopteris nervosa*, *Ctenis grandifolia*, *C. auriculata*, *C. Orovillensis*. Compared with uppermost Trias and Rhetic plants, we find, in the Oroville flora, one whose identity is doubtful, viz.: *Sagenopteris rhoifolia*, and four which show pretty close relationship. They are as follows: *Ctenophyllum angustifolium*, which is much like *C. Bravuanum*; *C. densifolium*, *C. grandifolium*, var. *Storrsii*; which are near, the latter especially, *C. grandifolium* of the older Mesozoic of Virginia; *Teniopteris Orovillensis*; which is much like *T. tenuinervis*, of the Infra-Lias (Rhetic) of France. As most of these are common plants in the Oroville flora, there is in it a pretty strong element indicating, by relationship not identity, an age near the beginning of the Lias. If we make a distinction between the members of the Jurassic as Lias and Oolite, and if we admit, as we probably should, the correctness of Feistmantel's contention, that the age of the Rajmahal Series is Liassic, we find a strong element in the Oroville flora pointing to both a Liassic and Oolitic age for it.

Three of the plants are doubtfully identified with Liassic ones, viz.: *Pecopteris gleichenoides*?, *Cladophlebis Indica*?, and *Pterophyllum Rajmahalense*?, and three show affinities with forms of that age. These are *Cladophlebis densifolia*, *Angiopteridium Californicum*, *Macroteniopteris Californica*; six of the plants occur in the lower Oolite, and two are identified doubtfully with lower Oolite species. The six Oolite forms are *Cladophlebis spectabilis*, *C. argutulus*, *C. Whitbiensis tenuis*, var. *a*, *Podozamites lanceolatus*, *P. lanceolatus latifolius*, *Pagiophyllum Williamsoni*. The two doubtful forms are: *Thyrsopteris Maakiana* and *Pinus Nordenskiöldi*.

From this it will be seen that the evidence that the age is Jurassic, is stronger than that for any other, and as the Oolitic plants predominate, we may assume with considerable probability, that it is rather late Jurassic, being about that of the lower Oolite.

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