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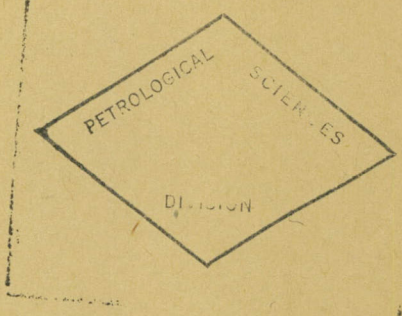
THE UPPER CRETACEOUS, DUNVEGAN FORMATION OF NORTHWESTERN ALBERTA AND NORTHEASTERN BRITISH COLUMBIA

(Report and Six Fossil Plates)

BY

F. H. McLearn



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OF

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INTRODUCTION

The Dunvegan formation has a wide distribution in parts of northeastern British Columbia and northwestern Alberta. It occurs in many areas now being investigated by companies searching for structures favourable for the accumulation of oil, and, consequently, it is important to be able to identify it. This can be done with the aid of guide or index fossils, that is, fossils peculiar to, and diagnostic of, the formation. The main purpose of this paper is to make these guide fossils known. In addition, the formation is described briefly and a few comments are offered on the relation of the Dunvegan faunas to other faunas, on the age of the formation, and on the palaeogeography of Dunvegan time.

The name "Dunvegan" was first used in 1881 by G.M. Dawson (1881)[1] for what he called the Lower sandstones and shales of the lower

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[1] Dates, in brackets, are the publication dates of reports listed at the end of this report.

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forks of Pine River and of parts of Peace River Valley. Since then this formation has been studied by R.G. McConnell, E.M. Spieker, R.L. Rutherford, M.Y. Williams, P.S. Warren, C.R. Stelck, R.T.D. Wickenden, G. Shaw, C.O. Hage, E.D. Kindle, C.H. Crickmay, and others. Special recognition is given to geologists of oil companies for tracing this formation south of Wapiti River along the Foothills Belt, and for the collection of some of the illustrated specimens.

DUNVEGAN FORMATION

The Dunvegan formation outcrops along the valley of Peace River from Cache Creek to near the mouth of the Smoky, and probably underlies the uplands northwest and northeast of the town of Peace River. It occurs in the valley of Smoky River from Watino to near the confluence of this river with the Peace. It is also present in the valley of Pouce Coupé River, in Pine River Valley, on Kiskatinaw River, on Flat (Rhubarb) Creek, and in the valley of Moberly River. To the north, Hage (1944) traced the formation along, and east of, the Alaska Highway from near Dunvegan to Indian Creek. Southwest of Fort Nelson, on the north side of Tetsa Valley, M.Y. Williams (1944) mapped a formation of conglomerate and sandstone on Table, Steamboat, and Teepee Mountains and considered it to be of the same age as the Dunvegan of the south and identical with the Fort Nelson formation. Yet farther north, on Nelson River, Kindle (1944) mapped the Fort Nelson formation and compared it chronologically with the Dunvegan. Far to the south the Dunvegan has been identified in Monkman Pass (McLearn and Henderson, 1944) and has been traced still farther south, beyond Wapiti River, along the foothills of the Rocky Mountains by geologists of oil companies. Far to the east, on lower Athabaska River, the 'Pelican sandstone' formation has been considered an eastern extension of the Dunvegan.

In the valley of Peace River, near the old Dunvegan trading post, the Dunvegan formation is about 550 feet thick, and consists of thick beds of light grey to yellowish or buff, massive, crossbedded sandstone with large, flat concretions in places, zones of thin-bedded sandstone and shale, and some thin beds of shelly limestone or calcareous siltstone. A few, very thin coal beds are present, and both freshwater and marine shells and fossil leaves have been collected. Gradational contacts with the shales of the underlying Shaftesbury formation and with the shales of the overlying Kaskapau formation have been observed.

On Smoky River the formation is a little thinner, about 450 feet of strata having been measured. The lithology is similar.

Warren and Stelck (1940) refer to two definite sandstone members of this formation in the valley of Pouce Coupé River. One, at the top, is the Pouce Coupé sandstone; the other, the Doe Creek sandstone, lies 100 feet below the top.

Wickenden and Shaw (1943) record the presence of crossbedded sandstone and some conglomerate in the Dunvegan of Pine River Valley.

In the Monkman Pass area (McLearn and Henderson, 1944) the Dunvegan formation consists of massive to thinly layered, fine- to medium-grained, buff to brownish grey sandstone; grey, sandy shales; and siltstones. Prostrate fossil stems, small pieces of 'driftwood', small vertical rootlets, marine and non-marine shells, and fossil leaves have been found in it.

On the Alaska Highway (Hage, 1944) the Dunvegan formation consists of some conglomerate; fine- to coarse-grained, grey and brownish weathering, crossbedded sandstones; and grey and brown weathering shales. These beds include some very thin coal seams, and carry fossil leaves.

The Fort Nelson formation consists of conglomerate, grit, partly crossbedded sandstone, and some dark shale (Kindle, 1944; Williams, 1944).

The 'Pelican sandstone' on lower Athabaska River comprises about 35 feet of crossbedded sandstone, conglomeratic at the top. At the base is thin-bedded sandstone and shale.

GUIDE FOSSILS

The following non-marine species appear to be diagnostic of the Dunvegan formation; Unio (Pleurobema) dowlingi, Unio (Elliptio) sulfuriensis n.sp., and Melania ? sp. (See Plate I). U. (Pleurobema) dowlingi has a wide distribution in the Dunvegan formation, occurring in exposures near Dunvegan, on the lower part of Smoky River, on Pine River, in the Monkman Pass area, and in the Foothills Belt south of Wapiti River. It is one of the most important guide fossils of this formation. U. (Elliptio) sulfuriensis n.sp., is an important guide species south of Wapiti River in the Foothills Belt. It is probably present in the Monkman Pass area, but is poorly preserved. Melania ? sp. may have some value as a guide. It is confined to the formation, is present in exposures near Dunvegan, and is also probably present in the Foothills Belt south of Wapiti River.

Corbula pyriformis var. dunveganensis n. var. (See Plate II) may record a non-marine or brackish water habitat, although it has been found in association with marine shells. It is easily recognized, and to date has been found at two localities, near Dunvegan and on Kiskatinaw River. Corbula cf. nematophora (See Plate II) occurs with marine fossils, and has been collected from exposures near Dunvegan, on Flat (Rhubarb) Creek, and in the Foothills south of Wapiti River.

The marine pelecypod genus Inoceramus provides several species and varieties confined to the Dunvegan formation, and others with a longer range. The variable species Inoceramus dunveganensis (See Plates II, III) is confined to this formation, and mostly to the exposures near Dunvegan. The var. mcconnelli (See Plate III) has a wider known distribution, being found not only near Dunvegan but also south of the Wapiti on Big Berland River. It appears that Inoceramus rutherfordi (See Plate III) will prove to be a good guide fossil to this formation. It was collected originally by Rutherford from talus of the Dunvegan formation on Smoky River, and has been collected recently from this formation at two localities in the Foothills Belt south of Wapiti River by geologists of oil companies. The appearance of this species at this low horizon in the Upper Cretaceous calls for some revision of the history of the 'Perna' stock of Inoceramus. It records an earlier appearance of radial furrows and ridges (in this stock) than indicated in a recent paper on Inoceramus (McLearn, 1943). The large species Inoceramus athabaskensis (See Plates II, V, VI) is present in the Dunvegan formation in the Monkman Pass area. It, however, was described originally from the base of the LaBiche formation, on lower Athabaska River, and probably from a little higher horizon than the Dunvegan. Fragments of a species of Inoceramus similar to I. allani were found in the Dunvegan in Monkman Pass. I. allani (?) occurs in the overlying Kaskapau formation. Warren and Stelck (1940) report the presence of Inoceramus corpulentus (= capulus) from the Dunvegan of Pouce Coupé River Valley. It is not confined to the Dunvegan, however, for it occurs in the overlying Kaskapau and Blackstone formations.

In Canada the marine pelecypod species Barbatia micronema (See Plate II) is found only in the Dunvegan formation, and has been collected from exposures near Dunvegan and from Flat (Rhubarb) Creek in the basin of Pine River. Another marine pelecypod confined in Canada to the Dunvegan is Ostrea anomioides (See Plate II). It has, however, a restricted distribution, being known at present only from exposures near Dunvegan. Brachydontes multilinigera (See Plate II) is a marine pelecypod common and widely distributed in this formation. It is, however, too long ranging to be diagnostic. Ostrea soleniscus may prove to be a guide fossil of the formation. Warren (1933) has recorded it from Bullmoose Creek, and it is probably in a collection from Flat (Rhubarb) Creek. Specimens of one or more other species of Ostrea are common in places in the formation. Some may belong to Warren's species Ostrea dunveganensis, but they are difficult to identify. Modiolus silentiensis (See Plate II) is another marine pelecypod known at present only from the Dunvegan. It has, however, been collected only from exposures near Dunvegan. Other species of marine pelecypods have been described from the Dunvegan, but as they are rare and not broadly distributed they do not make good guide fossils.

Ammonoids are rare in the Dunvegan. Warren and Stelck (1940) have, however, described Dunveganoceras poucecoupense from the Pouce Coupé sandstone at the top of the formation. There are no specimens of this species in the Geological Survey collections, but Dunveganoceras cf. albertense, which occurs at the base of the overlying Kaskapau formation, is figured (See Plate V).

The species confined to the Dunvegan are: Unio (Pleurobema) dowlingi, Unio (Elliptio) sulfuriensis, Melania ? sp., Corbula pyriformis var. dunveganensis, Corbula cf. nematophora, Inoceramus dunveganensis, I. dunveganensis var. mcconnelli, Inoceramus rutherfordi, Barbatia micronema, Ostrea anomioides, Modiolus silentiensis, Ostrea soleniscus ?, and Dunveganoceras poucecoupensis. The genus Dunveganoceras is confined to the Dunvegan formation and to beds immediately overlying it. The same appears to be true of Inoceramus athabaskensis. Brachydontes multilinigera is very common, but is long ranging. Other known species are rare or long ranging or both.

COMMENTS

The fauna of the Dunvegan appears to be a distinct one. It has only one known species, Brachydontes multilinigera, in common with the earlier fauna of the Goodrich formation. With the later Prionotropis or Inoceramus labiatus fauna it has only Inoceramus capulus and possibly Inoceramus allani in common. It may, however, be very close to the fauna at the very base of the Kaskapau, having the genus Dunveganoceras in common. It may also be close to the fauna at the base of the LaBiche formation on lower Athabaska River, having Inoceramus athabaskensis in common.

All students of Canadian Cretaceous faunas today accept an early Upper Cretaceous age for the Dunvegan formation, and, tentatively at least, a Cenomanian date in terms of European chronology. The latest work, that of Warren and Stelck (1940) definitely accepts the Cenomanian age. This is a reasonable interpretation, but it may be noted that no typical Cenomanian species or genus is present. Thus the diagnostic Cenomanian ammonoid genera, Schloenbachia and Acanthoceras are absent. Inoceramus dunveganensis shows some relation to the typical Cenomanian species Inoceramus crippsi, but it is not close enough to assume an identical age. An Inoceramus like I. rutherfordi is more advanced in the development of radial folds and furrows than any species of Cenomanian age in the English succession. There is the further possibility, as recently noted (McLearn, 1945), that the Goodrich formation may be of early Upper Cretaceous age, and, therefore, that the Dunvegan may not be the basal Upper Cretaceous formation in northeastern British Columbia and northwestern Alberta. At present, however, it seems best to accept a Cenomanian age for this formation and to regard it as of lowest Upper Cretaceous age.

The writer has already pointed out the presence in the fauna of some species that occur also far to the south in the interior of the United States (See McLearn, 1937). Thus Barbatia micronema occurs in the No. 1 zone at Coalville, Utah, and in the Woodbine of Texas. Ostrea soleniscus has a similar occurrence, but has also a higher range. Ostrea anomioides occurs in Montana, low in the Colorado group. Corbula pyriformis is in the Bear River formation of Utah. Brachydontes multilinigera is in the No. 1 zone at Coalville, Utah.

Not much is as yet known of the palaeogeography of Dunvegan time. The fauna records both marine and non-marine environments, the sediments, apparently, having been deposited on a marginal, alluvial or "delta" plain, flooded at times by the sea (See McLearn, 1919). The delta appears to have been built out from the western shore of the interior sea, and to have been confined to the northwestern part of the Rocky Mountain geosyncline. The seaway probably had open connections with the site of Texas and Utah in the southern interior of the United States (See McLearn, 1935).

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