
**GEOLOGICAL SURVEY OF CANADA**
**COMMISSION GEOLOGIQUE DU CANADA**

**Open File 3655**

# DEVONIAN SANDSTONES OF SOUTHWESTERN ONTARIO: SUMMARY OF LITERATURE

By

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OCTOBER 1998

## REGIONAL SETTING

In southwestern Ontario, a regional syncline on the northwestern side of the Algonquin Arch in the Michigan Basin, protected the thickest and youngest Devonian rocks from post-Devonian erosion (Bailey and Cochrane, 1985). However there are many major erosional disconformities within the Devonian carbonate-dominated section, and relatively thin siliciclastic units are associated with some of these (Fig. 1). In addition, many syn- and post-depositional faults affected the pattern of Salina salt solution which in turn influenced the structural configuration of the overlying Devonian units (Bailey and Cochrane, 1985). Devonian rocks unconformably overlie the Upper Silurian Bertie/Bass Islands formations, which were themselves affected by the first phase of Salina salt solution (Bailey and Cochrane, 1985). In some areas distinct trends of penecontemporaneous sinkholes were filled by significant thicknesses of Oriskany and Springvale sandstones, possibly marking underlying fault traces and lines of preferential salt solution (Bailey and Cochrane, 1985).

## ORISKANY FORMATION

### *Definition*

The term Oriskany Formation was introduced by Vanuxem (1839) for 6 m of white quartzose sandstone at Oriskany Falls, New York. A similar Lower Devonian clastic unit enters Southern Ontario near Fort Erie and is sporadically exposed through the Niagara Peninsula for about 80 km to the west to Springvale, Ontario (Caley, 1941) (Fig. 1). The best exposure is in the Oneida Lime and Sand Quarry near Hagersville (Caley, 1941, 1961). The sandy unit sharply and disconformably overlies the Late Silurian Bertie-Akron dolomites and is disconformably overlapped by the cherty limestone of the Lower-Middle Devonian Bois Blanc Formation (Telford and Johnson, 1984). Occurrences of the Oriskany in Ontario are sporadic erosional remnants of a unit that is widely distributed in the Appalachian Basin to the southeast, where it is a well-known gas producer (Abel and Heyman, 1981; Telford and Johnson, 1984). Where present the Oriskany forms the lowest stratigraphic unit of the Kaskaskia Sequence of Sloss (1963) (Fig. 1).

### *Lithology, thickness, contacts*

The Oriskany is described as light grey to white or yellow coarse sandstone, friable, well rounded, poorly sorted and massive or thick bedded (Caley, 1941, 1961; Winder, 1961). The lowest bed is commonly coarsest-grained and moulds of thick-shelled brachiopods are common (Telford and Johnson, 1984). A diverse and abundant fauna of brachiopods, molluscs, bryozoans, trilobites and other fossils was listed by Caley (1961). It ranges 0-6 m in thickness (thickening to the southeast into New York and Pennsylvania; Abel and Heyman, 1981), and may pinch out over very short lateral distances (as in the Oneida Quarry; Caley, 1961). The lower contact is an erosional disconformity with subangular dolostone fragments at the base and common sandstone fillings in joint cracks of the underlying Bass Islands or Bertie Formation (Caley, 1941; Winder, 1961). This contact likely represents a period of subaerial exposure at the Silurian-Devonian boundary (Telford and Johnson, 1984). The upper contact is also considered to be unconformable, resulting in large areas where the unit is absent. The sandstone generally has little matrix, and only a minor amount of carbonate or siliceous cement and porosity and permeability are good: in fact, in well cuttings the samples often consist completely of loose sand (Bailey and Cochrane, 1985). The Oriskany has not yet produced commercial hydrocarbons in Ontario, but has potential (Caley, 1961; Bailey and Cochrane, 1985).

Abel and Heyman (1981) describe the important Oriskany gas reservoirs of Pennsylvania.

## SPRINGVALE MEMBER

### *Definition*

Best (1953) proposed that many of the Lower Devonian sandstone outcrops in the Niagara Peninsula should properly be referred to the Springvale Member (a term introduced by Stauffer, 1913) of the Bois Blanc (or Onondaga) Formation, with a type section on Shoop's farm 4 km west of Hagersville. Since the Springvale has intermittent distribution and may actually include Oriskany lithologies reworked during the basal Bois Blanc transgression (Fig. 1), there has always been confusion surrounding the identification of the two sandstones (Abel and Heyman, 1981; Telford and Johnson, 1984).

### *Lithology, thickness, contacts*

The Springvale Member is described as white, brown-weathering, medium to coarse grained sandstone, friable, with a calcareous cement and very fossiliferous (Winder, 1961). Subangular dolostone fragments occur at the base and several thin grey limestone, chert and glauconitic pellet beds are commonly present (Winder, 1961). Where the sandstone is absent, the equivalent stratigraphic horizon is commonly marked by a zone of glauconite (Bailey and Cochrane, 1985).

Middleton (1958) described five main lithologies of the Springvale at the Hagersville Quarry, as follows: 1) normal sandstone of well rounded medium grained quartz with minor silica overgrowths and dolomitic cement, 2) large regularly-shaped siliceous nodules, 3) fossiliferous sandstone with a calcareous matrix and brachiopod and tabulate coral fragments, 4) basal burrowed calcareous sandstone, and 5) basal glauconitic joint-filling sandstone within the immediately underlying Bertie/Bass Islands dolomite.

The Springvale intertongues with the cherty carbonates of the Bois Blanc Formation. A rich fauna identical to the overlying Lower-Middle Bois Blanc Formation is present (Winder, 1961). The member ranges up to 5 m thick. The lower contact is an erosional unconformity on the Bass Island-Bertie Formation, or the Oriskany, whereas the upper contact is gradational with the Bois Blanc Formation (Winder, 1961). The Springvale and Oriskany are commonly in reservoir continuity, although in several areas they are separated by discrete tongues of Bois Blanc cherty carbonate, which is a tight seal (Bailey and Cochrane, 1985).

## SUBSURFACE DISTRIBUTION OF LOWER DEVONIAN SANDSTONES

At surface, scattered outcrops of these sandy units at the base of the Devonian occupy a very narrow belt 1-2 km wide by 100 km long. From this point, their subsurface presence is known in scattered wells, although they thin and become less obvious to the south and west. It is likely that sandy units present to the southwest are predominantly Springvale-equivalent, as in Pennsylvania (Abel and Leyman, 1981).

In the Brantford area several wells encountered sandstone with chert and glauconite between the underlying Bertie and the overlying Bois Blanc (Caley, 1941). In most wells of the Windsor-Sarnia area a significant thickness of Springvale-equivalent is present at the base of the Bois Blanc, overlying Bass Island (Bertie) dolostone (Caley, 1941; Sanford and Brady, 1955).

## SYLVANIA SANDSTONE

The Middle Devonian Sylvania Sandstone is a thin clastic wedge at the base of the Amherstburg Formation (Detroit River Group) in the Windsor-Sarnia area (Fig. 1). It lies disconformably on the Lower Devonian Bois Blanc Formation cherty limestones and grades upward into the Amherstburg bituminous limestones. It was originally defined in Ohio, and was identified as extending eastward into the subsurface of Ontario in Lambton county by Stauffer (1915). Subsequently, its existence in the subsurface of the Windsor-Sarnia area was established by Sanford and Brady (1955), extending about 30 km into Essex County. Samples of the unit were dredged from the Amherstburg channel east of Bois Blanc Island in 1958 (Winder, 1961). The Sylvania does not outcrop in Ontario, although it is never more than 60 m below surface, and thins rapidly to the north and east to zero (Sanford and Brady, 1955).

The Sylvania comprises up to 30 m (but usually much less) of white rounded and frosted, loosely-cemented, coarse grained sandstone with glauconite pellets (Winder, 1961; Bailey and Cochrane, 1985). In well cuttings it is commonly recovered as loose sand grains. Its origin may be aeolian (Winder, 1961). The interbedded occurrence of limestone increases upward as the unit grades into the Amherstburg. The sandstone is so porous and friable that, in areas where it is present close to surface overlying salt mining operations, it readily collapses and flows into sinkholes (Bailey and Cochrane, 1985). No commercial oil or gas has been recovered, although there may be some potential, and it is an important local source of glass sand (Bailey and Cochrane, 1985).

In the London area, units of sandstone, sandy limestone and chert up to 15 m thick, occur at the disconformable base of the Detroit River Group (Caley, 1943). Even further to the west in the Windsor-Sarnia area, wells encountered traces of rounded, frosted sand grains over 2-6 m intervals at approximately the same level within the Detroit River-Onondaga series (Caley, 1946).

## COLUMBUS SANDSTONE

The Middle Devonian Columbus Sandstone is a thin series of sandy limestone tongues at the base of the Dundee Formation in the Windsor-Sarnia area (Fig. 1). It lies disconformably on the Lucas or Amherstburg formations (Detroit River Group) and grades upward and westward into Dundee, or Delaware, limestones. It was originally defined in Ohio, but had been recognized by drillers since exploration for shallow Devonian oil began in the mid-1800's (Winder, 1961). Ehlers and Stumm (1951) first applied the name in Ontario at the Ingersoll Quarry, and Sanford and Brady (1955) illustrate this thin sandy unit and considered it to be the producing reservoir at the Rodney oil field, located between Chatham and London. The Columbus sandstone outcrops on Pelee Island in Lake Erie (Winder, 1961).

The Columbus comprises generally up to 11 m of fining-upward, calcareous fine to coarse, well rounded and sorted sandstone to sandy limestone (Bailey and Cochrane, 1985). It grades upward into cherty limestones with floating sand grains of the lower Dundee Formation. Bailey and Cochrane (1985) mention several wells in western Lake Erie with 20-70 m of clean Columbus Sandstone filling Salina salt solution holes.

## BEREA SANDSTONE

In a few very small areas near the St. Clair River, Stauffer (1915) recognized the Port Lambton Formation, a thin succession of Upper Devonian shale and sandstone preserved above the Kettle Point shale and beneath the Quaternary drift (Fig. 1). Where present, the lower Bedford shale is about 30 m of light grey micaceous shale with siltstone interbeds, and is overlain by up to 60 m of the Berea sandstone, a light grey very fine grained micaceous sandstone (Sanford and Brady, 1955). Sands of the Berea are subangular and have a siliceous cement (Sanford and Brady, 1955). They do not outcrop in Ontario, but are present very near the surface.

## LIST OF FIGURES

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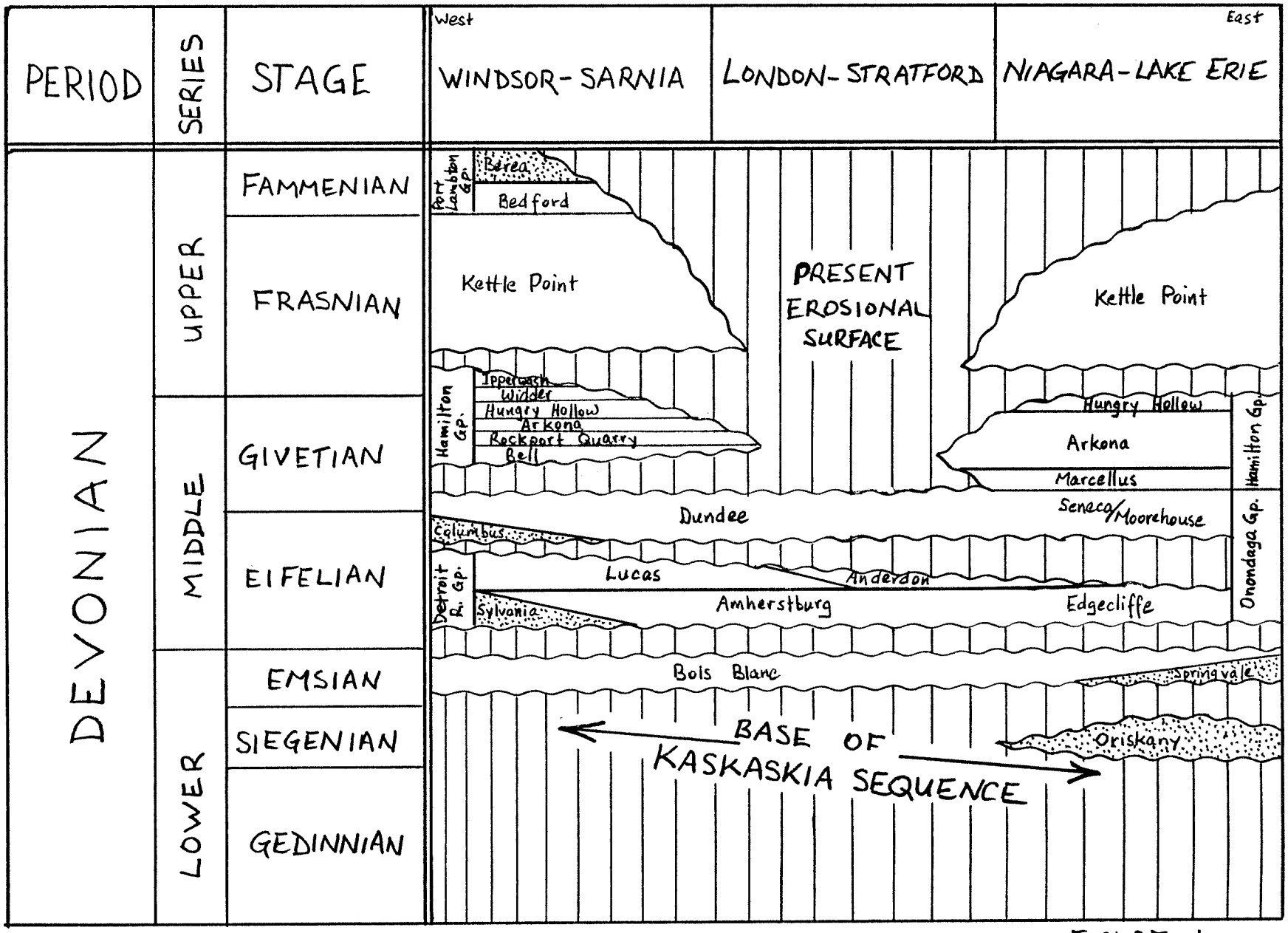
PERIOD
SERIES
STAGE
west
WINDSOR-SARNIA
LONDON-STRATFORD
East
NIAGARA-LAKE ERIE
DEVONIAN
UPPER
MIDDLE
LOWER
FAMMENIAN
FRASNIAN
GIVETIAN
EIFELIAN
EMSIAN
SIEGENIAN
GEDINNIAN
Port Lambton Gp.
Berea
Bedford
Kettle Point
PRESENT EROSIONAL SURFACE
Kettle Point
Hamilton Gp.
Ipperwash
Widder
Hungry Hollow
Arkona
Rockport Quarry
Bell
Hungry Hollow
Arkona
Marcellus
Hamilton Gp.
Dundee
Seneca/Moorehouse
Onondaga Gp.
Columbus
Detroit R. Gp.
Lucas
Anderdon
Sylvania
Amherstburg
Edgecliffe
Bois Blanc
Springvale
BASE OF KASKASKIA SEQUENCE
Oriskany

FIGURE 1.

# Photo Mechanical/ Reproduction

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