THE LOCKPORT FORMATION IN WESTERN NEW YORK

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On examining the Lockport sequence in western New York and in neighboring Ontario, one may understandably question the writer's seemingly unnecessary change of Lockport "Dolomite" to Lockport "Formation" (Zenger, 1962; 1965). In this region, the Lockport is practically all dolomite, exceptions being the dolomitic limestone beds in the Gasport Member. In west-central and east-central New York, however, the Lockport includes sandstone, limestone, and shale. A brief statement of the overall relationships within the Lockport will follow a more detailed description of the very interesting section in the type area in western New York.

Hall (1839) designated exposures along the old Erie Canal (now represented by outcrops along the Barge Canal) south of Lockport as the type section of the Lockport. In western New York the lower part of the formation is well exposed along the Niagara Escarpment. From 1959 to 1961 excellent exposures were made available through the excavations of the Niagara Power Project. Most of these sections are now covered, although the lower part of the formation may be observed along the access road about two miles south of Lewiston. Quarries provide continuous sections of parts of the Lockport, most, however, being in the lower part of the unit.

Generally characteristic of the carbonates are a brownish-gray color, medium to thick bedding, stylolites, carbonaceous parting, mineralized vugs, and poorly preserved fossils. The Lockport in the Niagara Falls and Tonawanda quadrangles is divisible into five vertical members which will be described from oldest to youngest (see Figure 1).

The DeCew is considered by this writer as the basal member of the Lockport. It ranges in thickness from 8 to 15 feet between Niagara Falls and Lockport. Dolomitic shales are common in the lower part whereas thicker bedded, fine-grained, silty dolomite is prevalent in the upper part. At many outcrops the more dolomitic portion of the DeCew exhibits a convolute or enterolithic structure. This irregular bedding, considered a kind of flow roll by the writer, can be seen along the road leading to the docks on the Canadian side of the gorge opposite the American Falls; along the road across the escarpment south of Lewiston; and in the vicinity of Lockport (Frontier Dolomite quarry and "The Gulf"). Caves and other solution features are common, Devil's Hole being the most notable. Fossils are neither abundant nor well preserved. *Atrypa reticularis*, *Fardenia? decewensis*, *Trimerus delphinocephalus*, and *Buthotrephis gracilis* are among the forms present.

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* The writer is very grateful for the support of the New York State Museum and Science Service.

Except where the enterolithic structure in the more massive dolomite is in immediate contact with the underlying Rochester, this contact is gradational through a few feet of dolomitic shales. The upper contact with the Gasport Member of Niagara Falls is sharp and commonly marked by a corrosion surface which this writer interprets as a minor diastem. Farther west in Ontario, however, the contact is perhaps a more significant disconformity. Many workers are of the opinion that the DeCew should be placed in the underlying Clinton Group. The lower gradational contact with the Rochester and the sharp upper contact with the Gasport at some localities near Niagara Falls tends to support their contention. On the other hand, in the Tonawanda and Lockport quadrangles there is evidence of a gradational to interfingering relationship between the DeCew and Gasport. The writer considers the corrosion surface to be of minor significance time-wise. The lithologic nature of the main dolomitic portion of the DeCew (dolomite content, texture, bedding, and topographic expression) seems more closely related to the Lockport than to the underlying Rochester. The DeCew is truly transitional between the Clinton and the main mass of the Lockport and its stratigraphic assignment in western New York seems to be a subjective matter.

The Gasport Member (Kindle and Taylor, 1913, p. 7), which extends from Hamilton, Ontario, to the Albion quadrangle, ranges in thickness from 15 to 30 feet in this area. It is well exposed along the escarpment. It is, perhaps, the most interesting member of the Lockport. The Gasport is characterized by brownish-gray, coarse-grained, low-insoluble, fossil-fragmental, pelmatozoan-rich limestone and dolomite. Fossils, which are quite well preserved in the less dolomitized beds, are predominantly brachiopods, corals, bryozoans and stromatopoids including *Atrypa reticularis, Leptaena "rhomboidalis", Rhynchotreta americana, Stegerhynchus neglectum, Whitfieldella nitida, Cladopora* spp., *Cystiphyllum niagarense, Diplophyllum caespitosum, Enterolasma caliculum, Favosites* spp., *Fenestrellina elegans, Hallopora elegantula?, Clathyrodictyon vesiculosum,* and *Stromatopora concentrica?*. Small bioherms of limestone and of replacement dolomite are exposed along the Niagara Gorge, along the main north-south road at the northern edge of Pekin, in the roadcut just west of the Niagara Sanatorium two miles west of Lockport, and in the Royalton quarry near Gasport. A dark, silty, finer-grained dolomite occurs between bioherms. Dendroid graptolites have been found in such beds both in the Frontier Dolomite quarry at Lockport and in the Royalton quarry. Bioherm detrital beds are present adjacent to some bioherms.

Conformably overlying the Gasport is a 20 to 25 foot unit of low insolubie dolomite designated the Goat Island Member by Howell and Sanford (1947, p. 34) for the exposures on Goat Island at the brink of the falls. In the Niagara Peninsula of Ontario the lower part of the equivalent interval is characterized by very abundant white chert nodules. The unit is completely exposed and accessible along the access road of the Niagara Power Project, where it is brownish-gray, medium-grained, thick-bedded, vuggy, saccharoidal dolomite. Chert nodules are found sporadically in its lower part and higher at the Eramosa contact. Between Niagara Falls and Medina the insoluble content is very low, averaging three percent. At its easternmost recognizable point at Clarendon the Goat Island is very cherty and crinoidal and the insoluble content (excluding chert nodules)

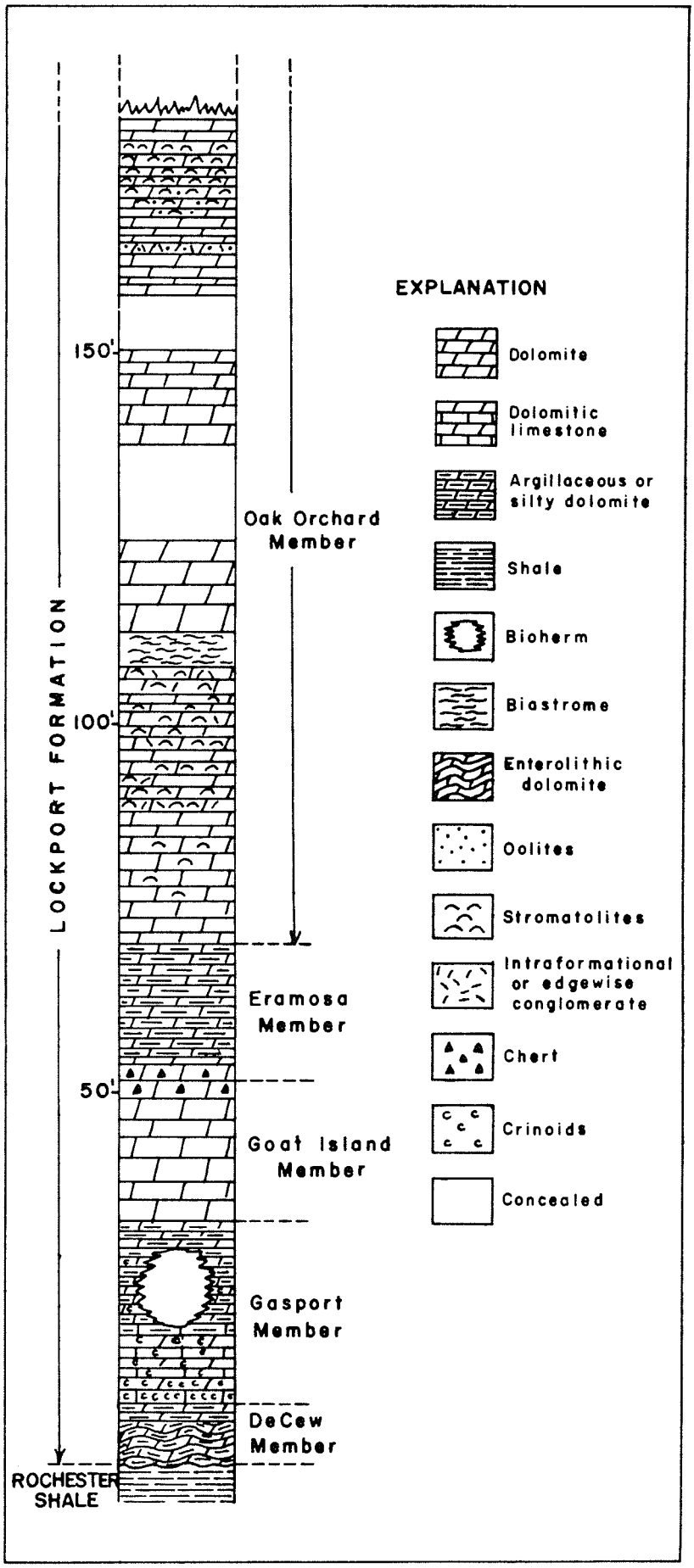
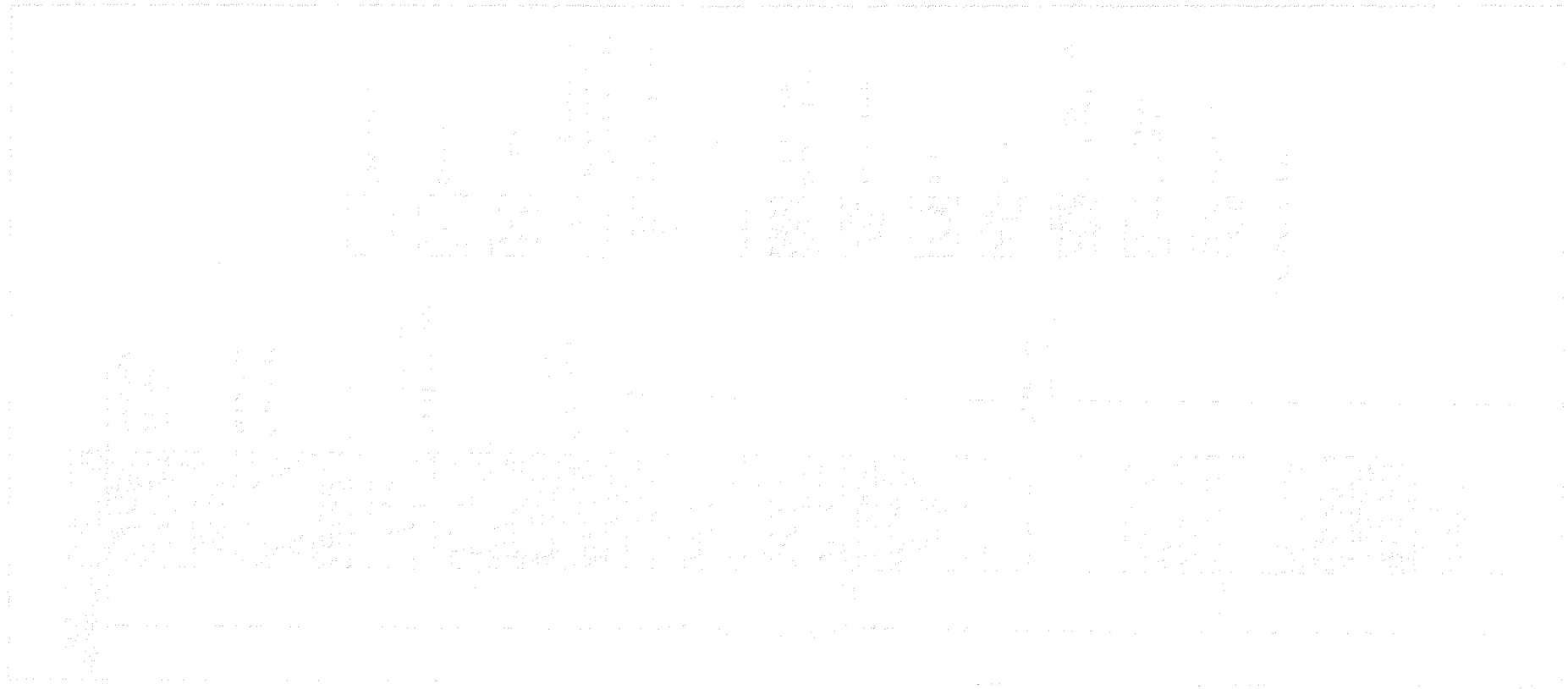


Figure 1.--Columnar section of the Lockport Formation in the Niagara Falls area



is higher. These characteristics suggest an easterly passage into the crinoidal, quartzose Penfield Member at Rochester. Poorly preserved fossils include *Leptaena "rhomboidalis"*, *Protomegastrophia profunda*, *Whitfieldella nitida*, *Enterolasma caliculum*, and stromatoporoids. The lower contact with the Gasport of Niagara Falls and Lockport is conformable. Along the access road the Goat Island-Erasmosa contact is along a limonitic shaly parting. Chert nodules with well-preserved fossils are found on both sides of this contact. Along Oak Orchard Creek south of Shelby (Medina quadrangle) the Eramosa is absent and the thin- to medium-bedded Goat Island grades upward into the Oak Orchard Member. The "lower Shelby" of Clark and Ruedemann (1903, p. 9-11) would be within the Goat Island as used here although the lower Guelph faunas were not found. Other Goat Island exposures are in the Frontier Dolomite quarry at Lockport and along the Barge Canal south of that city.

Overlying the Goat Island in the Niagara Falls and Tonawanda quadrangles is 18 to 20 feet of dark-gray, light-gray weathering, thin- to medium-bedded, fine-grained, silty and bituminous dolomite which average more than 15 per cent insoluble. These beds have been assigned to the Eramosa Member (named by Williams, 1915, for exposures along the Eramosa River in Ontario). Occurring on shaly parting surfaces is a brachiopod-mollusk assemblage characterized by *Dawsonoceras americanum*, *Lechitochochras desplainense?*, *Atrypa reticularis*, and *Stegerhynchus neglectum*. The Eramosa is considered to be, at least in part, the equivalent of the Eramosa Member in Ontario; the New York section, however, is much thinner, darker, and finer-grained. The Eramosa in New York apparently pinches out somewhere in the Tonawanda or Medina quadrangle. Twenty feet of the unit crops out along the access road where it is the uppermost Lockport member exposed; the upper 12 feet, weathering distinctly lighter than the overlying Oak Orchard Member, may be observed in the lower part of the Niagara Stone Company quarry about four miles east of Niagara Falls.

The Oak Orchard Member forms the upper 120 to 140 feet of Lockport in western New York. It is a brownish-gray to dark-gray, medium- to thick-bedded, medium-grained, bituminous, stylolitic, low-insoluble dolomite (average less than 2% insoluble). Carbonaceous shaly parting are common as are mineral-filled vugs. Stromatolite zones and generally poorly preserved stromatoporoids and corals are also characteristic. A lower stromatolite zone is exposed in the Niagara Stone Company quarry beneath a biostrome containing a profusion of relatively well-preserved specimens of *Favosites niagarensis?* A higher stromatolite zone was exposed in the excavations for the intake area of the power project (on the north side of the Niagara River two miles above the falls). Loose blocks showing the hemispherical structure of the stomatolites may be seen in dump piles beside the Barge Canal in the southern part of the Lockport outcrop belt in the Lockport quadrangle. The unit has been traced more than 100 miles to the east, although exposures are very scanty east of the Tonawanda quadrangle. It is considered to be roughly the time equivalent of the Guelph Dolomite of Ontario but the characteristic buff, saccharoidal dolomite of the Guelph is not present in New York. A chert-nodule zone occurs in the Oack Orchard Member in the Medina quadrangle and eastward. Guelph fossils were reported from such chert nodules ("upper Shelby" of Clarke and Ruedemann, 1903) at the type section (Howell and Sanford, 1947) along Oak Orchard Creek south of Shelby. The writer

considers the Oak Orchard as an indivisible lithologic unit with sporadic Guelph fossils. The upper contact with the overlying Salina Group is everywhere covered, but diamond drill cores south of Albion, south of Lockport, and at the north end of Grand Island bridge suggest a conformable contact.

In the vicinity of Rochester the Lockport is divided into three vertical members, in order of decreasing age, as follows: The DeCew (silty and sandy dolomite), the Penfield (dolomitic sandstone and quartzose dolomite), and Oak Orchard with characteristics similar to those in western New York. Between Rochester and Syracuse the Lockport undergoes a facies change into limestone-dolomite complex which is considered a separate member, the Sconondoa. In the Oneida region the Sconondoa passes eastward into the shale and dolomite of the Ilion Member which in turn pinches out southeast of Utica. Faunal and lithologic evidence suggests that the Ilion is the time equivalent of the upper Lockport (i.e., Eramosa? and Oak Orchard Members) at Niagara Falls. There is other evidence to support the contention that the uppermost Clinton in east-central New York (upper Herkimer Formation) is the time equivalent of the lower Lockport in western New York. Those interested in the detailed aspects of these correlations are referred to Zenger (1965) and to Berdan and Zenger(1965).

Petrological evidence (dolomitized bioherms, fossils, oolites, etc) suggest that the dolomite originated through replacement.

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