Trip E

STRATIGRAPHY OF THE CHAZY GROUP (MIDDLE ORDOVICIAN) IN THE NORTHERN CHAMPLAIN VALLEY

by

Frederick C. Shaw
Herbert H. Lehman College
Bronx, New York

INTRODUCTION

The Chazy Limestone (the oldest Middle Ordovician Group of the Champlain Valley) was first named by Emmons (1842) from exposures 15 miles north of Plattsburgh at Chazy, New York. Here and elsewhere in the northern Champlain Valley (Fig. 1) the unit outcrops on a variety of normal fault blocks. Given the low dips and heavy cover, Chazy stratigraphy is most easily understood from various shore outcrops around Lake Champlain. Valcour Island, southeast of Plattsburgh, offers perhaps the best section of the Chazy, and has been intensively studied (Raymond, 1905; Hudson, 1931; Oxley and Kay, 1959; Fisher, 1968; Shaw, 1968). The Isle La Motte, Vermont, exposures to be covered in this trip and trip F are those studied by many of the same authors and, in addition, display the lower contact of the Chazy with the underlying Ordovician dolostones of Canadian age.

In the northern Champlain Valley (Valcour Island and north to the International Boundary), the Chazy Limestone (now Group) consists of about 800 feet of quartz sandstones, calcarenites, dolomitic calcilutites and biohermal masses (Fig. 2). Three formations, Day Point, Crown Point, and Valcour, in ascending order, were proposed by Cushing (1905) and have persisted to the present, albeit with some controversy (Fisher, 1968; Shaw, 1968). Oxley and Kay (1959) further subdivided the Day Point and Valcour into members, those of the Day Point (Head, Scott, Wait, Fleury) coming from southern Isle La Motte in the area to be visited. Shaw and Fisher experienced difficulty in using the Valcour subdivisions outside of their type areas at South Hero, Vermont.

DESCRIPTION AND INTERPRETATION OF CHAZY GROUP LITHOLOGIES

Day Point Formation

With the exception of the biohermal masses on Isle La Motte (Trip F), the Day Point consists of a basal, cross-bedded quartz sandstone, followed by alternating units of shale, more sandstone, calcarenite, and topped with

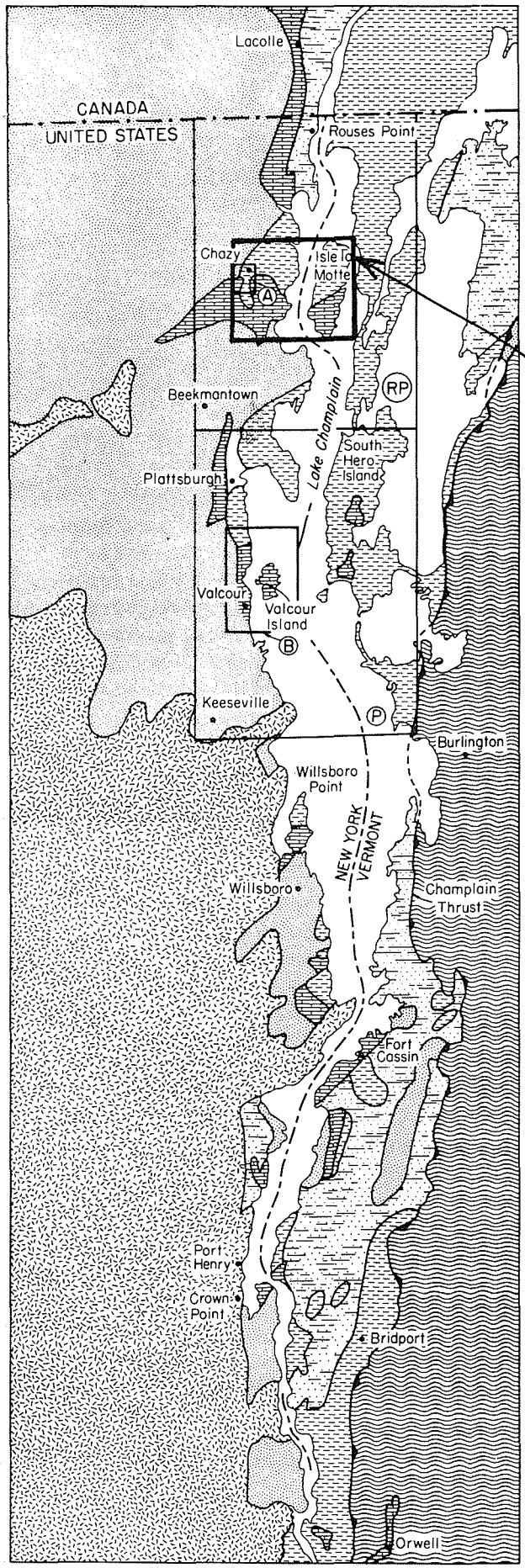


Figure 1. INDEX MAP

of
Champlain Valley
and portions of
New York, Vermont and Quebec
(area of figure 5)

EXPLANATION

- Pleistocene (sands, clays)
- Post-Chazy Ordovician sedimentary rocks (mainly shales)
- Chazy Group (limestones)
- Pre-Chazy Cambrian-Ordovician sedimentary rocks (sandstones, dolostones)
- Cambrian-Ordovician metamorphic strata
- Precambrian rocks (gneiss, metanorthosite, charnockite, marble, quartzite)
- (A) Chazy area
- (B) Valcour area
- (P) Plattsburgh quadrangle
- (RP) Rouses Point quadrangle

Geology modified from D.W. Fisher et al., (1962)

N

SCALE IN MILES

0 5 10

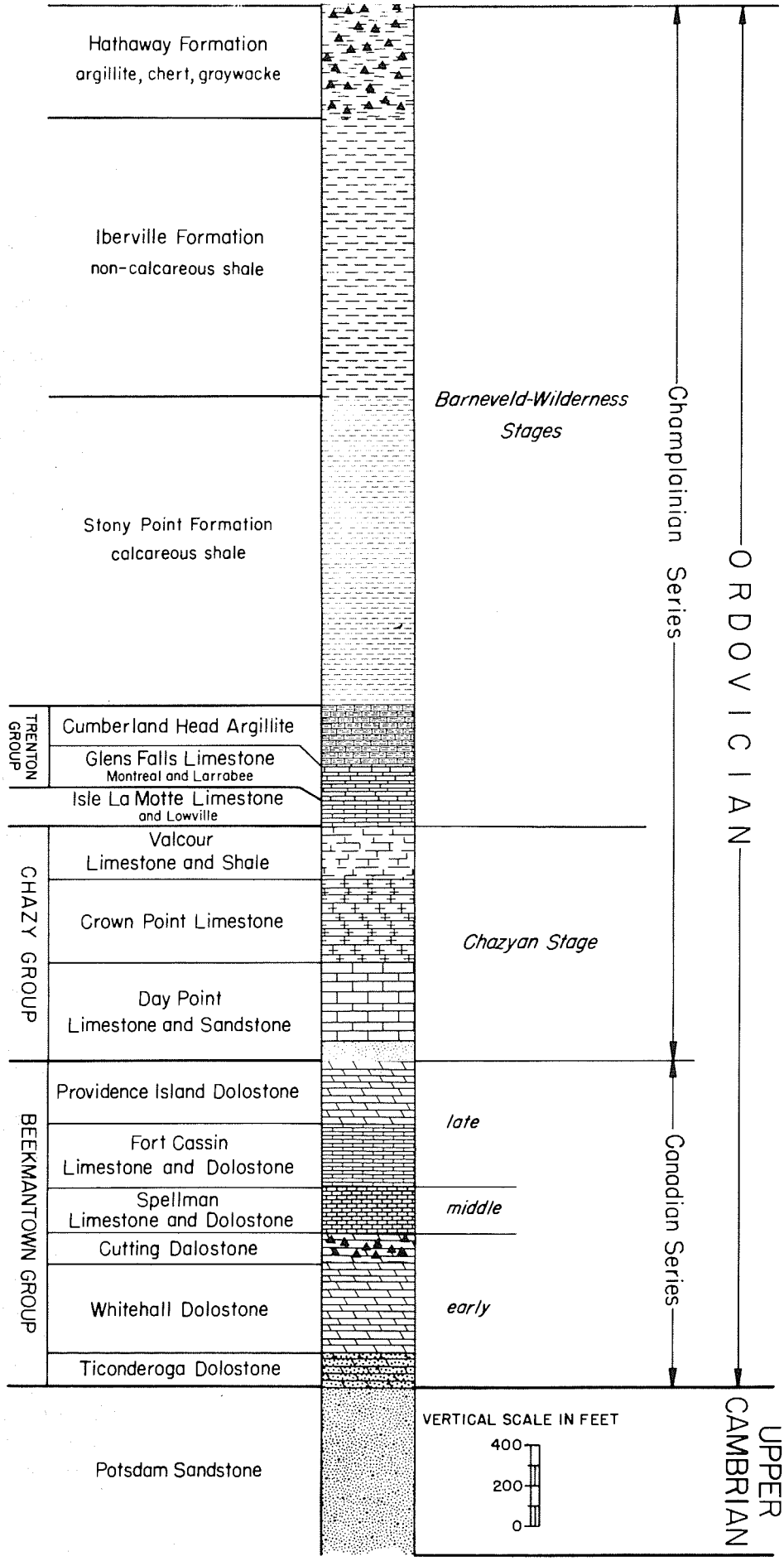


Figure 2. Generalized Stratigraphic Column—Champlain Valley

a relatively thick (35 feet) calcarenite unit (the Fleury Member). The lower sandstone, with its cross-bedding, presence of Lingula as nearly the only fossil, and overlying the supratidal Lower Ordovician, is clearly transgressive and probably of very shallow water origin. This is further borne out by the presence of an oolite band in some of the sections around Chazy, New York. The source of the sand is unknown and no petrographic studies on this formation or on most of the other Chazy units have been undertaken. Derivation from Cambrian sandstones exposed on lowly emergent land to the west appears feasible. The calcarenites are primarily echinodermal in origin, although bryozoans and trilobites also occur abundantly, particularly in the Fleury (Ross, 1963, 1964; Shaw, 1968). Again, shallow water seems indicated, although probably subtidal judging from the abundant faunas (compare Laporte, 1968).

At Valcour Island and on the adjacent shore at Day Point, the Upper Fleury calcarenites are interbedded with dark, muddy limestones, some of which contain the varied silicified trilobite fauna described by Shaw (1968).

Crown Point Formation

The Crown Point Formation begins where muddy limestones become the dominant lithology. A striking feature of this formation is the abundance of thin (maximum 1/2 inch thick) dolomite stringers. Thin section analysis of many of these irregular stringers indicates that they are composed of argillaceous material, calcite grains, and scattered dolomite rhombs (Barnett, pers. comm., 1969). Judging from the abundant faunas (gastropods, trilobites, ostracodes, brachiopods) and their preservation (some trilobites and ostracodes articulated), this lithology represents somewhat deeper and less agitated water. This leaves the origin of the dolomite to be explained inasmuch as recent discussions of dolomite have focused on a supratidal origin. Possibly this dolomite is secondary. Similar lithologies are known in the Ordovician of the southern Appalachians and Nevada and present a good petrologic problem. The 200-300 feet of the Crown Point Formation has never been subdivided into members, attesting to its homogeneity. Twenty-five miles south of Valcour Island, at Crown Point, New York, nearly the whole section (250 feet) is comprised of Crown Point Formation lithology (Fig. 3).

Valcour Formation

The Valcour Formation is characterized by a return to calcarenites, interspersed with limestones of Crown Point aspect. In addition, much of the Valcour as well as the underlying Crown Point display well-developed bioherms consisting of stromatoporoids, bryozoans, calcareous algae, and corals with an accompanying fauna of trilobites, brachiopods, cephalopods, and echinoderms. Spectacular examples of these will be covered on Trip F. The channels in these reefs, the packing of these channels with trilobite and nautiloid fragments, and the accompanying carbonate sands again argue for relatively shallow water, with the more typical muddy limestones occupying slightly deeper basins between.

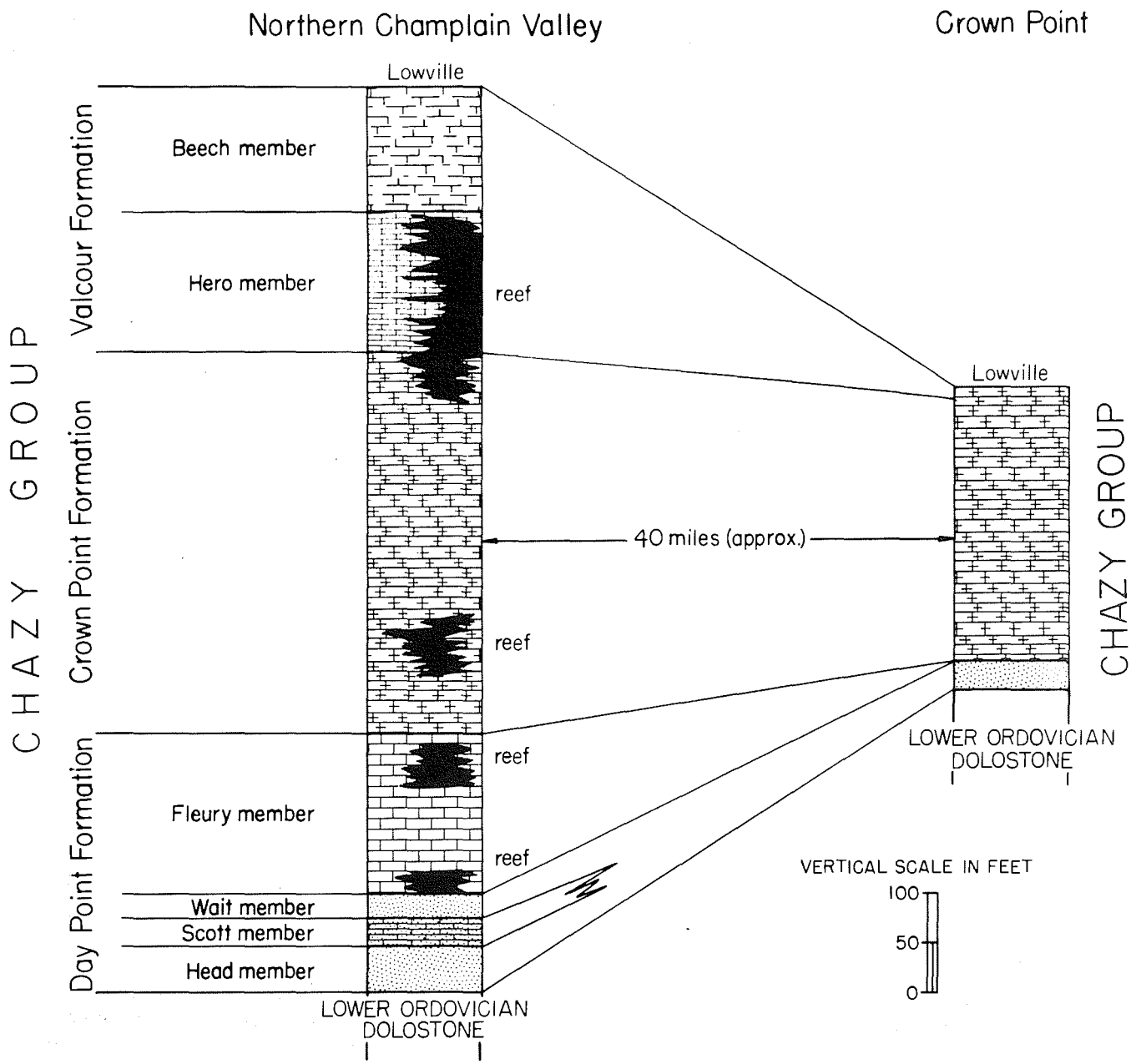


Figure 3. Lithologic Correlation

The Valcour is overlain by rock units usually assigned to the Black River Group, although outcrop or exact paleontological continuity with the type Black River of central New York and Ontario cannot be demonstrated. Paleontologically, the Isle La Motte (Fig. 2) is quite similar to the Chaumont, so that the 'Black River' designation for these units can be defended. The best exposure of the top of the Chazy will be seen at stop 5 south of Chazy.

PALEOGEOGRAPHIC SETTING OF THE CHAZY GROUP

As mentioned above, the lower Chazy Group evidently represents a transgressive sequence over Lower Ordovician dolostones. The relative thinness, lack of abundant clastics, shallow water features, lack of volcanics and predominance of 'shelly' rather than graptolitic faunas all argue for a setting on the platform or at best at the very edge of the miogeosyncline. Most paleogeographic reconstructions of Chazyan time (Kay, 1947) exhibit this relationship. Although the Chazy Group thins and disappears southward and westward into New York State, lithologically and faunally similar units persist northward to the Montreal area and eastward into the Mingan Islands of eastern Quebec (Hofmann, 1963; Twenhofel, 1938). Westward thrusting of perhaps as much as 100 km along Logan's Line has removed much of the miogeosyncline from view to the east, leaving us with either unfossiliferous or graptolite-bearing rocks which defy exact comparison to the Chazy Group. Speculation as to the exact geography of the Appalachian geosyncline in this area during Chazyan time thus is hazardous.

FAUNAS OF THE CHAZY GROUP

Raymond (1906) identified three faunal zones in the northern Champlain Valley Chazy Group, corresponding roughly to the three formations proposed by Cushing (1905). These were not really assemblage zones in the modern sense but relied heavily on two brachiopods and the large gastropod Maclurites magnus LeSueur (Pl. 1, Fig. 3). Raymond and later workers (Welby, 1961; Erwin, 1957; Oxley and Kay, 1959) also thought that the trilobite Glaphurus pustulatus (Walcott) first appeared at the base of the Valcour Formation. All of the above instances now appear to be examples of local abundance and/or facies control, although they are of some stratigraphic use locally in the Champlain area. Ross (1963, 1964), Cooper (1956), and Shaw (1968), using bryozoans, brachiopods and trilobites, respectively, were unable to make meaningful faunal subdivisions of the Chazy Group. Nevertheless, the Group as a whole is distinctive, marking as it does the first appearance of stromatoporoids, primitive tetracorals, bryozoans (?), and primitive pelecypods. In addition, twenty-four genera of trilobites appear first in the North American Ordovician here in the Chazy Group. By contrast, graptolites and several long-ranging groups of trilobites such as robergioids and agnostids are absent from the Group, probably as a result of facies control or restricted oceanic circulation.

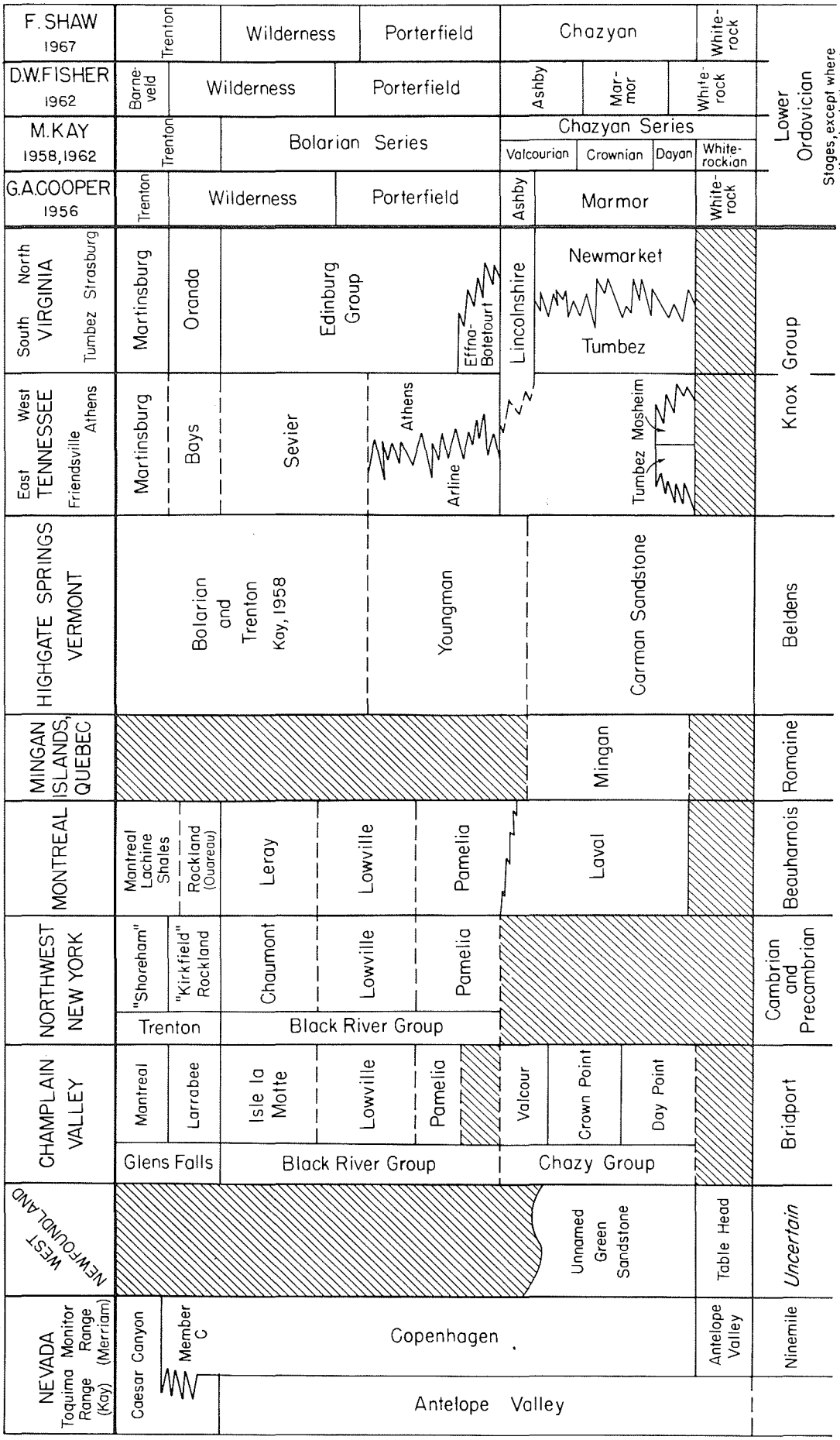


Figure 4 Correlation Chart

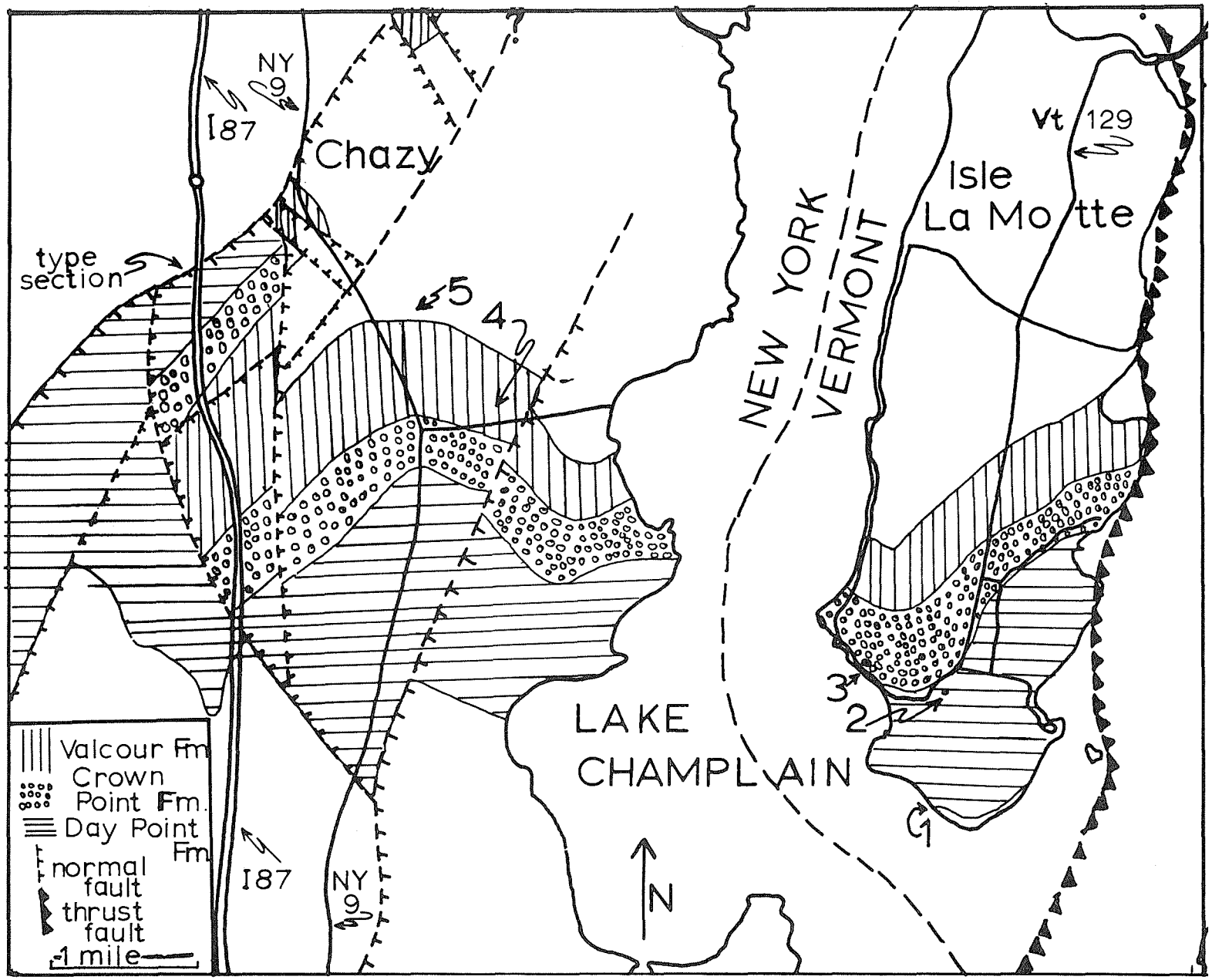
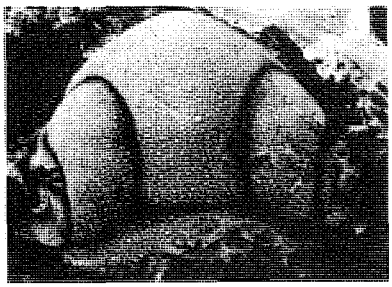
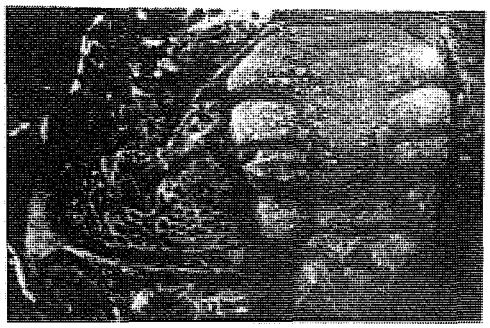


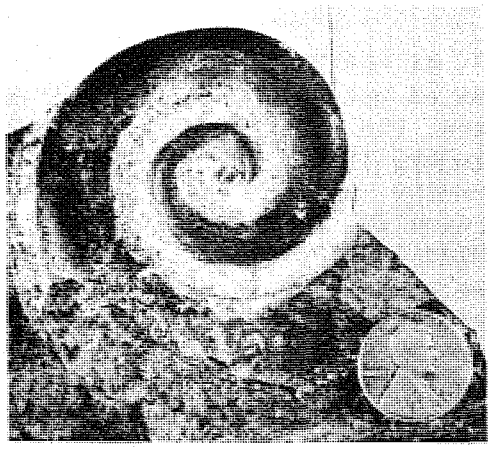
Figure 5 Geologic sketch map of the Chazy-Isle La Motte area, New York and Vermont. Numbers 1-5 are Field Trip Stops. (modified from Fisher, 1968, Plate 1)



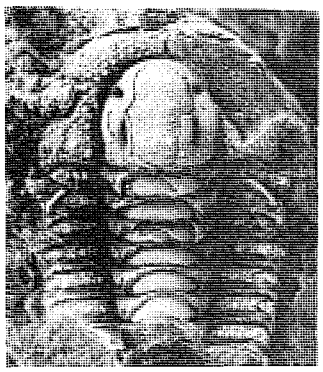
1



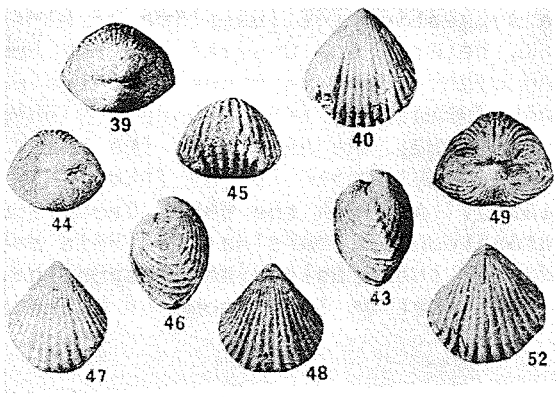
2



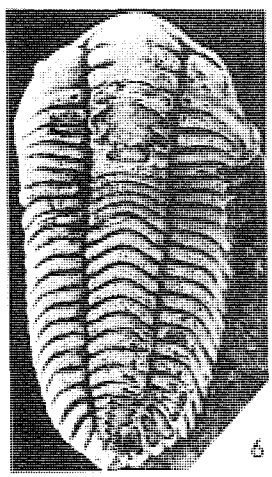
3



4



5



6

Plate 1

1. Amphilichas minganensis: cranidium, dorsal view x2, from fine lime mud infilling reef framework at Sheldon Lane, New York (Stop 4).

2. Paraceraurus ruedemanni: cranidium, dorsal view x1, same lithology and locality.

3. Maclurites magnus: shell largely recrystallized. Crown Point Fm. Intersection of NY348 and I87, SW of Chazy Village.

4. Glaphurus pustulatus: partial cranidium and thorax, dorsal view x4. Same lithology and locality as 1 and 2.

5. Rostricellula plena: Valcour Fm., Chazy, New York. (From Cooper, 1956) x1.

6. Pliomerops canadensis: complete specimen, lower Valcour Fm., east side of Valcour Island, New York. x1.

Figures 1, 2, 4, 6 also appear in Shaw (1968)

In sum, the Chazy Group records a diverse marine fauna of cratonic aspect, including the very early representatives of a number of successful Paleozoic taxa. Exclusion of other taxa expected to be present, as well as facies dependence of organisms within the various facies of the Chazy Group (Shaw, 1968) generate some problems in correlating the Group to other North American Ordovician sequences.

THE CHAZYAN AS A STAGE

Since the days of Emmons (1842), it has been recognized that rocks of Chazy lithology and faunal content do not occur southwest of the Adirondacks in the Mohawk Valley. There, the transgressive Black River Group (Schopf, 1966; Young, 1943; Winder, 1960) overlies Lower Ordovician units with a pronounced unconformity (Fisher, 1954).[1] Ulrich, Grabau, Raymond and others thus proposed the Chazyan Stage, deemed the lowest stage of the North American Middle Ordovician. The geologic isolation of the Chazy Group makes close comparison to other standard Ordovician rock units difficult. However, since stages must ultimately be recognized by their faunas, the modern studies by Cooper (1956), Flower (1958), Ross (1963, 1964), Shaw (1968), Kraft (1962), Pitcher (1964), and Schopf (conodonts, proposed) leave the Group well known. Cooper (1956), expressing dissatisfaction with the traditional arrangement of Ordovician stages, proposed several new stage names for the Middle Ordovician based on sections in the southern Appalachians and Nevada. Of particular interest was the suggestion for inserting an older Middle Ordovician stage, the Whiterock, between the Chazyan and the Lower Ordovician. Kay (1960, 1962) and others have vigorously contested this, claiming that supposed Whiterock formations from Nevada, Oklahoma and Newfoundland are really Chazyan in age. At any rate, the Chazy faunas do differ from the nearest supposed Whiterock faunas (the Table Head Formation of western Newfoundland). As both the Chazy Group and Table Head Formation appear to be autochthonous, marginal cratonic sequences along strike on the western edge of the Appalachian geosyncline, the present writer favors the argument that at least some of Whiterock is older (Shaw, 1968).

FIELD TRIP STOPS

PLEASE NOTE: STOPS 1 AND 2 ARE ON PRIVATE PROPERTY WHICH WE HAVE SPECIAL PERMISSION TO ENTER. DO NOT SMOKE IN THE FIELDS, KNOCK OVER FENCES, ETC. OTHERS MAY WANT TO RETURN TO THIS CLASSIC LOCALITY AFTER YOU.

Stop 1. The Head, Isle La Motte, Vermont, 3 miles SSW of Isla La Motte Village. Lakeshore outcrops of the Providence Island Dolostone (Lower Or-

[1]Schopf and Raring (pers. Comm., 1969) appear to have found some close relationships between Black River and Chazy Group conodonts. The break in the Mohawk Valley section may thus not be as large as previous workers have supposed.

dovician) and the Day Point Formation (Chazy Group). Dip of both units several degrees to the north. Contact well-exposed and at least locally unconformable. Locality discussed by Shaw (1968), Erwin (1957). Section measured and described by Oxley and Kay (1959).

Approximately 40 feet of Providence Island Dolostone is exposed, being very fine-grained, massive, thinly laminated, and unfossiliferous. Mudcracks and a few ripple marks complete the picture of a unit deposited in very shallow water. Following Laporte (1967), the environment of formation was probably supratidal, closely paralleling modern day environments of dolomite formation described from Florida and the Bahamas. No detailed petrologic work has been done on this unit. In the absence of fossils, the age of this unit is not known. The underlying Fort Cassin Limestone (not exposed here) is known to be Late Canadian.

The Chazy Group begins here with about 20 feet of quartz sand and siltstones together with minor amounts of greenish shale (Head Member of Oxley and Kay, 1959). Ripple marks and cross-bedding are common. The fossils consist primarily of 'fucoids' (probably recording a variety of trails, worm tubes and the like) and Lingula. The succeeding Chazy unit (Scott Member of Oxley and Kay) consists of about 40 feet of echinodermal lime sand, cross-bedded in some places. Brachiopods (Orthambonites?) and indeterminable trilobite scraps are the chief recognizable fossils. The overlying 15 feet of quartz sandstone (Wait Member of Oxley and Kay) appears very similar to the initial sandstone.

This second sandstone is followed by a thick (115 feet) lime sand (Fleury Member of Oxley and Kay) which occupies most of Scott Point and The Head south of the road. Much of the unit is composed of echinoderm fragments, although little is known about the actual morphology of the creatures involved. Both the fragmental nature of the fossils and the frequently observed cross-bedding argue for considerable agitation of the ocean bottom.

Stop 2. Same vehicle location as stop 1. Upper Fleury Member of Day Point Formation and overlying Crown Point Formation. 200 yards south of the right angle bend in the road is locality R 25 (Shaw, 1968) which yielded 12 genera of trilobites, including Sphaeroxochus and Ceraurinella, from a particularly coarse pocket in the upper Fleury lime sands. Gastropods (Raphistoma) and brachiopods (Orthambonites?) are also present. This same stratigraphic level elsewhere, particularly 1 mile to the NE, displays spectacular bryozoan bioherms and the very early tabulate coral Lichenaria (Pitcher, 1964). These will be viewed on Trip F.

About 50 yards north of the road at this same stop, the silty, Maclurites-bearing limestones of the Crown Point appear. The actual contact with the Day Point is not visible but the lithologic change is evident. The Crown Point here contains several modest bioherms which have not been studied in detail. The earliest known stromatoporoids (Pitcher, 1964) are

known to be important reef builders nearby in this unit and doubtless are dominant here as well (see Trip F).

Stop 3. Fisk Quarry, 2.5 miles SSW of Isle La Motte Village. Middle Crown Point Formation, consisting of fine-grained, dark, silty limestone with buff-colored dolomitic partings. This is 'typical', non-reef Crown Point lithology. However, in the quarry wall and some of the cut blocks, small reeflets can be seen. These are assumed to be largely stromatoporoids and calcareous algae, although they have not been studied as intensively as the reefs at the same horizon to the east (Trip F). Evidently, these reef masses could grow at some depth in relatively silty waters. The mechanism of their establishment thus does not appear to be tectonic. Maclurites (large gastropod, rare) and a few trilobites and brachiopods may possibly be collected from the limestone, although they are not abundant.

Stop 4. Sheldon Lane, 2 miles SE of Chazy Village, New York. Upper Crown Point and Valcour Formations; dip north several degrees. Locality R3 of Shaw (1968) and "Road to Little Monty Bay" locality of Raymond and others.

South of the road, a very low-dipping section of Crown Point and Day Point extends for almost 2 miles across fields. The transition between the two units is similar to that on Isle La Motte. Bioherms appear not to be present in the Day Point in this area. The Crown Point, however, is only about 100-150 feet thick here, being composed largely of biohermal masses. These can be seen just south of the road. Just north of the road, in and around the abandoned quarry, are exposed bioherms usually classified as basal Valcour. They are characterized by somewhat more silt than the reefs south of the road. Similar reefs on Isle La Motte have been classed by Pitcher (1964) as having a higher percentage of bryozoan and algal components than the Crown Point reefs. Billingsaria (tabulate coral) may also be important here.

Impressive cephalopod and trilobite faunas have come from the Valcour reefs here, including Glaphurus (trilobite, Pl. 1, Fig. 4) and large asaphids, illaenids and ceraurids (trilobites). Shaw (1968) has discussed the restriction of some of these forms to the reef environment. Most of the fossils appear in fine lime mud which apparently was trapped in channels and pockets in the reef framework. Lime sands of pelmatozoan origin drape the reefs.

Stop 5. Abandoned quarry of International Lime and Stone Company, 1 mile SE of Chazy Village, New York. This is the uppermost part of the same section covered at stop 4 and shows well the contact of the Valcour with the overlying Black River Group (see also Fisher, 1968, Fig. 25). The upper Valcour, here, probably equals the Pamelia (lowest Black River), and is a shaly dolostone bearing Rostricellula (brachiopod, Pl. 1, Fig. 4). The contact with the overlying Lowville Limestone, a massive, gray limestone is gradational. The early horn coral Streptelasma is present in this unit,

although possibly not here. The Isle La Motte appears correlative to the Chaumont west of the Adirondacks.

REFERENCES CITED

Cooper, G. A., 1956, Chazyan and related brachiopods: Smithsonian Misc. Pubs. v. 127 (2 parts), pp. 1023.

Cushing, H. P., 1905, Geology of the northern Adirondack region: N.Y. State Mus. Bull. 95, pp. 271-453.

Emmons, Ebenezer, 1842, Geology of New York, Part 2 - Survey of the 2nd Geological District: Albany, p. 437.

Erwin, R. B., 1957, The geology of the limestones of Isle La Motte and South Hero Island, Vermont: Vermont Geol. Surv. Bull. 9, pp. 94.

Fisher, D. W., 1954, Lower Ordovician (Canadian) stratigraphy of the Mohawk Valley: Geol. Soc. Amer. Bull. v. 65, pp. 71-96.

_____, 1968, Geology of the Plattsburgh and Rouses Point, New York-Vermont Quadrangles: New York State Museum and Science Service, Map and Chart Series, #10, pp. 51, pl. 2.

Flower, R. H., 1958, Some Chazyan and Mohawkian Endoceratida: Jour. Paleont. v. 32, pp. 433-458.

Hudson, G. H., 1931, Fault systems of the northern Champlain Valley, New York: N.Y. State Mus. Bull. 286, pp. 5-80.

Kay, Marshall, 1960, Classification of the Ordovician system in North America: Rep. 21st Int. Geol. Cong. pt. 7, pp. 28-33.

_____, 1962, Classification of Ordovician Chazyan shelly and graptolite sequences from central Nevada: Geol. Soc. Amer. Bull. v. 73, pp. 1421-1430.

Kraft, J. C., 1962, Morphologic and systematic relationships of some Middle Ordovician Ostracoda: Geol. Soc. Amer. Mem. 86, pp. 104.

Laporte, Leo, 1968, Ancient environments, Prentice-Hall, pp. 116.

Pitcher, Max, 1964, Evolution of Chazyan (Ordovician) reefs of eastern United States and Canada: Bull. Can. Pet. Geol. v. 12, pp. 632-669.

Raymond, P. E., 1905, The fauna of the Chazy limestone: Am. Jour. Sci. ser. 4, v. 20, pp. 353-382.

Raymond, P. E., 1906, The Chazy formation and its fauna: Ann. Carnegie Mus. v. 3, no. 4, pp. 498-596.

Ross, J. P., 1963a, Chazyan (Ordovician) leptotrypellid and atactotoechid Bryozoa: Palaeont. v. 5, pp. 727-739.

_____, 1963b, Ordovician Cryptostome Bryozoa; standard Chazyan Series, New York and Vermont: Geol. Soc. Amer. Bull. v. 74, pp. 577-608.

_____, 1963c, The bryozoan trepostome Batostoma in Chazyan (Ordovician) Strata: Jour. Paleont. v. 37, pp. 857-866.

_____, 1964, Champlainian Cryptostome Bryozoa from New York State: Jour. Paleont. v.38, pp. 1-32.

Schopf, T. J. M., 1966, Conodonts of the Trenton Group in New York, southern Ontario, and Quebec: N.Y. State Museum and Science Service, Bull. 405, pp. 105.

Shaw, F. C., 1968, Early Middle Ordovician Chazy Trilobites of New York: N. Y. State Museum and Science Service, Memoir 17, pp. 163.

Welby, C. W., 1961, Bedrock geology of the central Champlain Valley, Vermont: Vermont Geol. Surv. Bull. 14, p. 296.

Winder, C. G., 1960, Palaeoecological interpretation of Middle Ordovician stratigraphy in southern Ontario, Canada: Int. Geol. Cong. Rep. 21st Session, pt. 7, pp. 18-27.

Young, F. P., 1943, Black River stratigraphy and faunas: American Jour. Sci., v. 241, 141-166, 209-240.