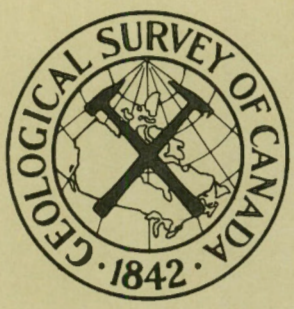

GEOLOGICAL SURVEY OF CANADA

DEPARTMENT OF ENERGY, MINES AND RESOURCES

PAPER 69-16

FORAMINIFERAL ZONATION AND STRATIGRAPHY OF THE TYPE SECTION OF THE NIZI FORMATION (CARBONIFEROUS SYSTEM, CHESTERAN STAGE), BRITISH COLUMBIA

(Report and 6 figures)

B. L. Mamet and H. Gabrielse

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ABSTRACT

The type section of the Nizi Formation in northernmost central British Columbia comprises more than 1,643 feet of well-bedded carbonates with a conglomeratic clastic unit near the base. An abundant microfauna defines four assemblage-zones ranging in age from Late Viséan to Early Namurian (zones 16 to 18 in Eurasia), an interval considered time-equivalent to the Chester Group (Upper Mississippian) of the midcontinent.

FORAMINIFERAL ZONATION AND STRATIGRAPHY OF THE TYPE SECTION OF THE NIZI FORMATION (CARBONIFEROUS SYSTEM, CHESTERAN STAGE), BRITISH COLUMBIA

INTRODUCTION

The Nizi Formation is a distinctive succession of well-bedded carbonate strata that outcrops near the headwaters of a tributary of Nizi Creek in McDame map-area (Fig. 1), northernmost central British Columbia (Gabrielse, 1963). Samples collected during initial reconnaissance studies were found to contain well-preserved foraminifera that seemed amenable to a more precise dating than the sparse macrofauna on which the age of the formation was initially based. The formation was therefore re-examined in 1967 and a type section was measured. The purpose of this paper is to describe the stratigraphy and foraminiferal zonation of that type section. A further purpose is to emphasize the potential importance of microfaunal studies for future investigations in the upper Paleozoic eugeosynclinal terrains of British Columbia and Yukon Territory.

Acknowledgments

The writers are indebted to R.A. Farley and D.G. Perry for their contributions to field work involved in this study. They are also grateful to E.W. Bamber for his interest and review of the manuscript.

REGIONAL AND LOCAL SETTING

The Nizi Formation is one of several fossiliferous upper Paleozoic carbonate units in the northwestern Cordillera west of Rocky Mountain Trench. These units are of great stratigraphic importance because, at present, they appear to provide the only means for correlation and subdivision of widespread and thick sequences of eugeosynclinal rocks generally included in the Cache Creek and Sylvester groups.

In the type area the Nizi Formation overlies a thick sequence of clastic and volcanic rocks of the Sylvester Group that occupies the core of

GSC Project 650010.
Critical readers: E.W. Bamber and J.O. Wheeler.
Ms. received: 8 January 1969.
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(Gabrielse)

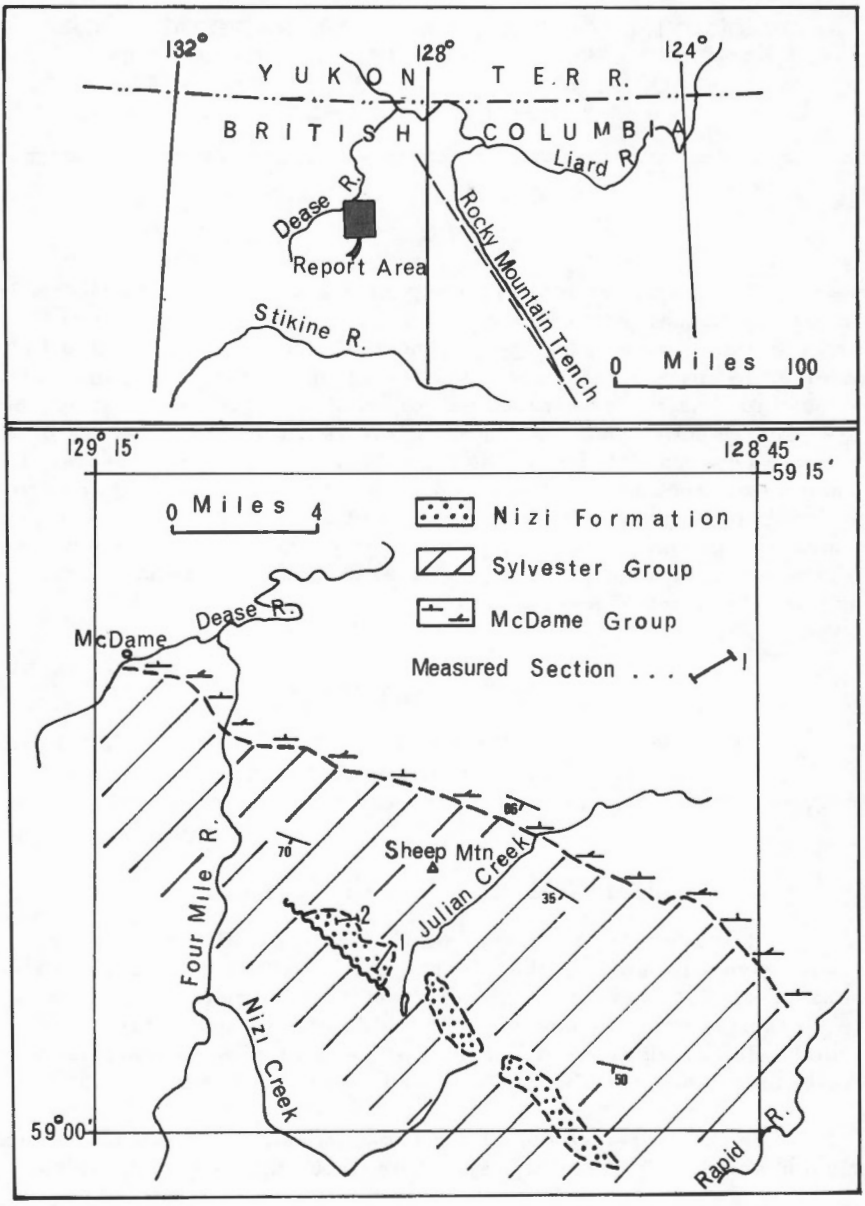


Figure 1. Location of the Nizi Formation type section.
Section 1. Members A to G.
Section 2. Lower part of Member A.

McDame Synclinorium (Gabrielse, 1963; also see Fig. 1). The Sylvester Group in turn overlies late Middle Devonian (Givetian) carbonates of the McDame Group. No diagnostic fossils have yet been obtained from the Sylvester Group and its age assignment can only be given within upper and lower limits provided by the dating of the Nizi Formation and McDame Group.

Strata younger than the Nizi Formation have not been recognized in the type area but the stratigraphic relationship of the formation to strata farther southwest is obscured by a major fault.

Basal beds of the Nizi Formation at the localities of Section 1 and Section 2 (see Appendix) overlie blocky chert of the Sylvester Group. Locally, the underlying beds appear to be much more tightly folded than overlying carbonates. This relationship was originally interpreted as an angular unconformity although nowhere has the contact been observed directly. Further investigation has neither confirmed nor denied this interpretation although it is evident that disharmonious folding may play an important role. In any event the composition and rounding of clasts in conglomerates in the lower part of the Nizi Formation point to uplift and erosion of the Sylvester Group in pre-Nizi time.

On the basis of a sparse macrofauna, the Nizi Formation in the type area was originally considered correlative with Mississippian carbonate strata in the eastern part of McDame map-area near Rocky Mountain Trench (Gabrielse, 1963). A study of the Nizi microfauna contained in this report, and a re-examination of the eastern McDame Mississippian macrofauna by E.W. Bamber indicate, however, that the Nizi Formation is probably entirely younger than the eastern McDame succession. The latter contains a fossil assemblage much like that found in the Tournaisian and Early Viséan (Osagean and Meramecian) Prophet Formation in northern Rocky Mountains (E.W. Bamber, personal communication, G.S.C. Loc. No. 43854; Sutherland, 1958). Therefore, the name Nizi Formation should not be retained for the Mississippian carbonates in the eastern part of McDame map-area.

STRATIGRAPHY OF THE NIZI FORMATION

A detailed macroscopic description of the type section of the Nizi Formation is given in the Appendix (see Section 1) and shown in columnar form in column A, Figure 2.

In the field the light grey weathering, well-bedded strata are in marked contrast to the underlying sombre, poorly bedded rocks of the Sylvester Group. The members as indicated in Section 1 are defined by lithology and weathering characterisitcs. In the type section members A and B are generally recessive whereas the overlying members are cliff-forming.

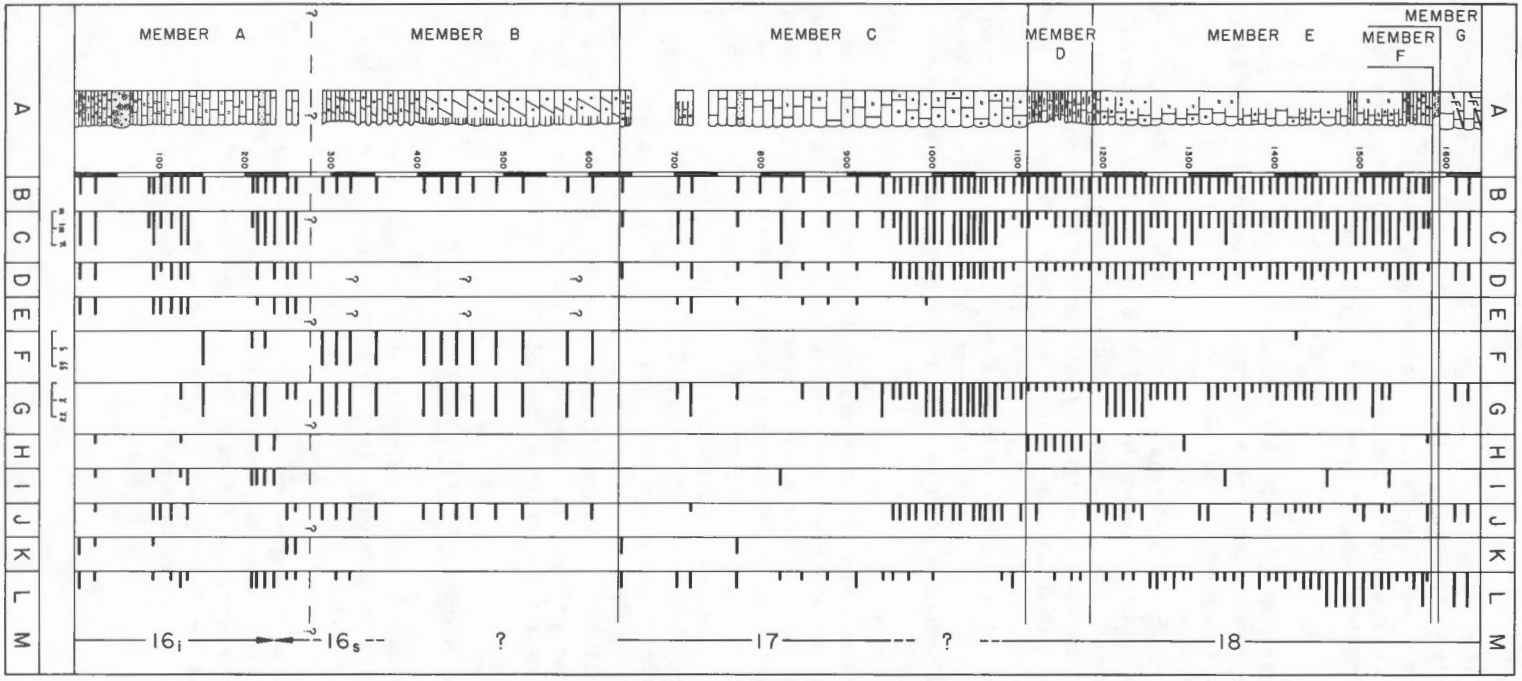


Figure 2. Microfacies of the Nizi Formation carbonate beds. For explanation of symbols see pp. 5-6.

A Lithostratigraphic column
B Position of the thin-sections
C Carbonate texture
D Pelmatozoans
E Bryozoans
F Dolomitization
G Phase transformation and recrystallization of the calcite assemblage
H Detrital quartz
I Non-skeletal carbonate debris
J Chertification
K Non-carbonate reworked debris (outside detrital quartz)
L Foraminiferal abundance
M Foraminiferal zonation

The lower part of Member A is well exposed, however, about 2 miles northwest of the type section and its description is included in the Appendix as Section 2.

The conspicuous, maroon-weathering beds of Member F comprise an excellent marker unit and facilitates correlation across one or more faults, downthrown to the northeast, that intersect Member G along the line of section. Because of tight folding, however, only the lower part of Member G was measured and it is probable that this member is considerably thicker than indicated in Section 1.

MICROFACIES OF THE CARBONATE BEDS OF THE NIZI FORMATION

The microfacies of the carbonate beds of the Nizi Formation are outlined in Figure 2. Thirteen columns express qualitatively the following characteristics:

The first two columns (A and B) give the position of the members and of the thin sections in the lithological column.

Column C shows the carbonate textures which range from micrite (m), to mud-supported (Im) and grain-supported (π).

Columns D and E record the occurrence of pelmatozoans (mostly pelmatozoan ossicles and minor echinoid plates) and bryozoans. The bulk of the fossils is composed of debris of these fossils; other faunal or floral elements (ostracods, algae, brachiopods, corals) played only a minor role in the carbonate sedimentation.

Column F indicates the extent of dolomitization ranging from nil to slightly dolomitic (δ) and dolomite ($\delta\delta$).

Recrystallization is expressed in column G and has been estimated by the degree of preservation of the shell walls (mostly foraminifera). Recrystallization is indicated "nil" in case of phase transformation, γ for incipient structure destruction and $\gamma\gamma$ for complete destruction.

Column H gives the amount of detrital quartz and column I, the amount of nonskeletal carbonate debris (carbonate "intraclasts" sensu lato).

Chertification is expressed in column J and reworked noncarbonate debris (mostly volcanic microbreccias) in column K.

Column L gives the importance of the foraminiferal population. The foraminiferal zones (biostratigraphy) are indicated in column M.

The comparison of the carbonate microfacies study and of the field observations indicates the following:

Member A is characterized by impure, pelmatozoan-bryozoan intraclastic-bearing packstones with reworked sedimentary and volcanic debris. Dolomite is scarce, whereas chertification is widespread. Foraminifera are present to abundant.

Member B comprises recrystallized, chertified dolomites. Destruction of the figured elements is complete and it is not feasible to estimate the original content of bryozoan-pelmatozoan. Fossils are (in places) recognizable as ghosts. Foraminifera have not been observed except at the base of the member.

Member C consists of highly recrystallized, pelmatozoan packstones and biomicrites. Cherts are scarce at the base but widespread at the top of the unit. The microfacies is unfavorable to foraminifera which are scarce although present throughout.

Member D is composed of slightly recrystallized pelmatozoan biomicrites with abundant detrital quartz. Foraminifera are scarce.

Member E is characterized by recrystallized, chertified pelmatozoan packstones and biomicrites. Foraminifera are abundant to very abundant.

Member F includes very minor carbonate beds lacking foraminifera.

Member G displays recrystallized packstones with abundant foraminifers.

BIOSTRATIGRAPHY OF THE NIZI FORMATION

Foraminifers are present throughout the entire column, with the exception of members B and F. The distribution of the families and principal genera is outlined in Figures 3, 4 and 5. The per cent distribution of the families is expressed circumferentially and the percentage of the most prominent genus of each family is given radially. For instance, in Figure 3, the Endothyridae is the most widespread family with about 38 per cent of the total microfauna. Approximately 75 per cent of these Endothyridae are represented by the genus Endothyra.

Foraminiferal family distribution is remarkably homogeneous throughout the whole formation. The Endothyridae (with the genus Endothyra) are very prolific although they show a gradual decline in the younger strata. This decline is counterbalanced by the outburst of Archaediscidae; the Viséan populations are characterized by Archaediscus, the Namurian ones by Neoarchaediscus.

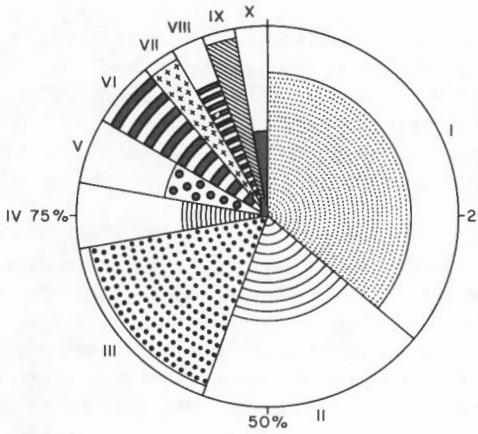


Fig. 3

Zones $16_{inf.}$ and $16_{sup.}$

I) Endothyridae (Endothyra)
II) Archaediscidae (Archaediscus)
III) Eostaffellidae (Eostaffella)
IV) Cornuspiridae (Hedraites ?)
V) Palaeotextulariidae (Palaeotextularia)
VI) Earlandiidae (Earlandia)
VII) Pseudoendothyridae (Pseudoendothyra)
VIII) primitive Bradyinidae (Endothyranopsis)
IX) Tetrataxidae (Tetrataxis)
X) Attached forms (with the exception of Cornuspiridae)

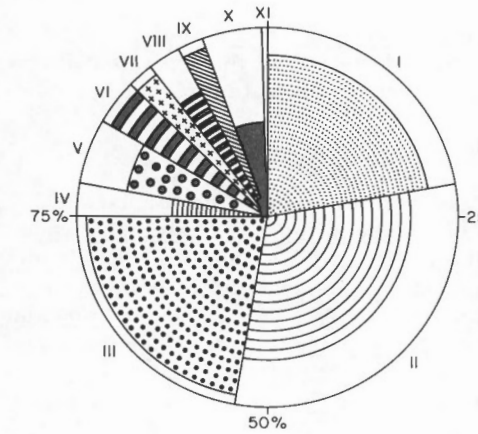


Fig. 4

Zone 17

I) Endothyridae (Endothyra)
II) Archaediscidae (Neoarchaediscus)
III) Eostaffellidae (Eostaffella)
IV) Cornuspiridae (Hedraites?)
V) Palaeotextulariidae (Climacammina)
VI) Earlandiidae (Earlandia)
VII) Pseudoendothyridae (Pseudoendothyra)
VIII) primitive Bradyinidae (Endothyranopsis)
IX) Tetrataxidae (Tetrataxis)
X) Attached forms (with the exception of Cornuspiridae)
XI) primitive Eolasiodiscidae (Monotaxinoides)

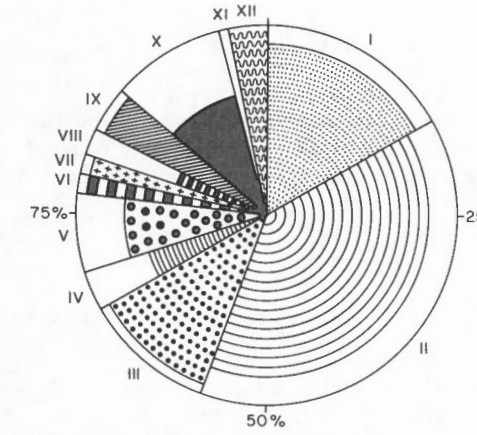


Fig. 5

Zone 18

I) Endothyridae (Endothyra)
II) Archaediscidae (Neoarchaediscus)
III) Eostaffellidae (Eostaffella)
IV) Cornuspiridae (Hedraites ?)
V) Palaeotextulariidae (Climacammina)
VI) Earlandiidae (Earlandia)
VII) Pseudoendothyridae (Pseudoendothyra)
VIII) primitive Bradyinidae (Yanichewkina)
IX) Tetrataxidae (Tetrataxis)
X) Attached forms (with the exception of Cornuspiridae)
XI) primitive Eolasiodiscidae (Monotaxinoides)
XII) Biseriamminidae (Globivalvulinella)

Figures 3-5: Distribution of the families and principal genera of the Upper Viséan - Lower Namurian Nizi Formation.

The Eostaffellidae (Eostaffella), Cornuspiridae (Hedraites?), Earlandiidae (Earlandia), Pseudoendothyridae (Pseudoendothyra) and Tetrataxidae (Tetrataxis) are evenly spread throughout the formation. The same distribution is observed for the Palaeotextulariidae where Climacammina supplants Palaeotextularia in Namurian time. Eolasiodiscidae are negligible and Biseriamminidae have a characteristic outburst in the upper part of the Nizi Formation.

Such homogeneity proves that at the family level, the transition from the Lower to the Middle Carboniferous is not reflected by any important faunal change and the zonation of the Upper Viséan-Lower Namurian strata must be established on a generic or even specific level. This contrasts with the microfaunal development in the Tournaisian and Viséan where substage boundaries can be underlined by appearance or extinction of one, two or even three families.

Fifty-two taxa of Foraminifera, incertae sedis and dasycladacaean algae have been recognized and their distribution is outlined in Figure 6. These taxa may be ranged in three main categories:

1. Ubiquitous taxa in the Nizi Formation.

Sixty per cent of the taxa are omnipresent in the formation. The bulk of the microfossils is composed of incertae sedis (Calcisphaera laevis Williamson and C. pachysphaerica (Pronina), Earlandiidae (Earlandia) clavatula (Howchin), E. vulgaris (Rauzer-Chernoussova and Reitlinger), Cornuspiridae (Cornuspira), Endothyridae (Endothyra of the group E. bowmani Phillips in Brown, Endothyra of the group E. similis Rauzer-Chernoussova and Reitlinger, Globoendothyra), Eostaffellidae (Eostaffella) and Palaeotextulariidae (Palaeotextularia of the group P. consobrina Lipina and P. of the group P. longiseptata Lipina).

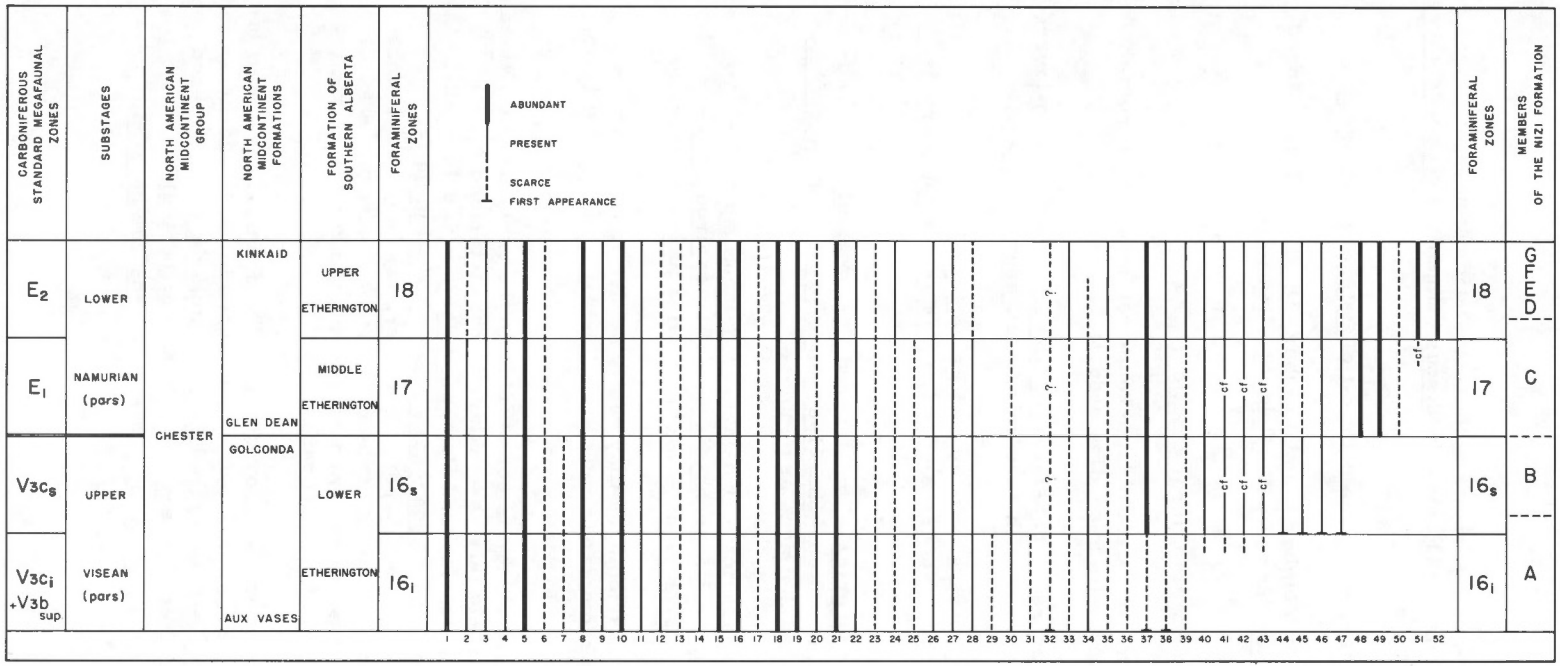
2. Viséan taxa restricted to the lower part of the formation.

Two Viséan foraminifers, the middle to late Viséan Endothyranopsis compressa (Rauzer-Chernoussova and Reitlinger) and the late Viséan Endothyranopsis crassa (Brady) are known in the lower part of the Nizi Formation. The Viséan algae Koninckopora has only been encountered in the basal part of Member A.

3. Late Viséan-Namurian taxa.

Twenty taxa, that is 35 per cent of the microfauna, are characteristic of late Viséan and Namurian time.

(a) Presence of Eostaffella (?) discoidea (Girty) and of scarce Neoarchaediscus is characteristic of the lower part of Member A. Neither Eoendothyranopsis, nor Eoforschia have been encountered in the basal part of the Nizi Formation.



1) Calcisphaera laevis Williamson.
2) Calcisphaera pachysphaerica (Pronina).
3) Climacammina of the group C. prisca Lipina
4) Climacammina of the group C. patula Brady.
5) Cornuspira sp.
6) Cribrospira sp.
7) Cribrostomum sp. and Coskinotextularia sp.
8) Earlandia clavatula (Howchin).
9) Earlandia vulgaris (Rauzer-Chernoussova and Reitlinger).
10) Endothyra sp.
11) Endothyra of the group E. bowmani Phillips in Brown emend TCZN.
12) Endothyra of the group E. similis Rauzer-Chernoussova and Reitlinger.
13) Endothyranella sp.
14) Eostaffella sp.
15) Globoendothyra sp.
16) Globoendothyra of the group G. globulus D'Eichwald.
17) Omphalotis sp.
18) Palaeotextularia of the group P. consobrina Lipina.
19) Palaeotextularia of the group P. longiseptata Lipina.
20) Parathurammina sp.
21) Pseudoendothyra sp.
22) Tetrataxis sp.
23) Tuberitina sp.
24) Yanichewkina sp.
25) Archaediscus of the group A. chernoussovensis Mamet in Mamet, Choubert, Hottinger.
26) Archaediscus gnormis Schlykova.
27) Archaediscus of the group A. krestovnikovi Rauzer-Chernoussova.
28) Archaediscus of the group A. moelleri Rauzer-Chernoussova.
29) Endothyranopsis compressa (Rauzer-Chernoussova and Reitlinger).
30) Endothyranopsis crassa (Brady).
31) Koninckopora sp.
32) Bradyina sp.
33) Calcivertella sp.
34) "Eostaffella" (?) discoidea (Girty).
35) Hedraites sp.
36) Helicospirina sp.
37) Neoarchaediscus sp.
38) Neoarchaediscus incertus (Grozdilova and Lebedeva).
39) Trepeilopsis sp.
40) Neoarchaediscus parvus (Rauzer-Chernoussova).
41) Neoarchaediscus cf. N. postrugosus (Reitlinger).
42) Neoarchaediscus subbaschkiricus (Reitlinger).
43) Neoarchaediscus timanicus (Reitlinger).
44) Planospirodiscus sp.
45) Planospirodiscus minimus (Grozdilova and Lebedeva OBJ).
46) Pseudoendothyra circuli (Thompson).
47) Pseudoendothyra of the group Ps. kemenskensis Rozovskaia.
48) Asteroarchaediscus sp.
49) Asteroarchaediscus baschkiricus (Krestovnikov and Teodorovitch).
50) Endothyranopsis sphaerica (Rauzer-Chernoussova and Reitlinger).
51) Globivalvulina sp.
52) Globivalvulina parva Chernysheva.

Figure 6. Microfossils of the Nizi Formation.

(b) The upper part of member A shows a characteristic outburst of Neoarchaediscus, mixed with Planospirodiscus. Gigantic Pseudoendothyra appear for the first time.

(c) Member C is characterized by the outburst of Asteroarchaediscus.

(d) The uppermost part of Member C and Members D, E and G have abundant Asteroarchaediscus mixed with Globivalvulina parva.

Foraminiferal zonation.

The following four assemblage-zones can be derived from the ranges expressed in Figure 6 (in ascending order):

1. an Endothyranopsis crassa – two-layered Palaeotextularia – two-layered Climacammina assemblage with rare primitive Neoarchaediscus.

2. an Endothyranopsis crassa – two-layered Palaeotextularia – two-layered Climacammina – Neoarchaediscus incertus – Planospirodiscus assemblage.

3. an Endothyranopsis sphaerica – two-layered Palaeotextularia – two-layered Climacammina – Neoarchaediscus incertus – Planospirodiscus – Asteroarchaediscus baschkiricus assemblage.

4. an Endothyranopsis sphaerica – two-layered Palaeotextularia – two-layered Climacammina – Neoarchaediscus – Planospirodiscus – Asteroarchaediscus baschkiricus – Globivalvulina parva assemblage.

These four assemblages may easily be tied to the standard European and Tethyan Carboniferous zonation. (Mamet, 1962, 1968; Mamet and Mason, 1968).

The first assemblage is comparable to the early late late Viséan assemblage 16_{inf}. In Eurasia this assemblage is characterized by Endothyranopsis crassa – two-layered Palaeotextularia – two-layered Climacammina – first primitive Neoarchaediscus – Valvulinella – Howchinia – Bradyina rotula – Archaediscus karreri assemblage. In most of North America (with the exception of the northernmost part of the Cordillera) the last four taxa are not encountered and the zone is recognizable by the association of the first four taxa.

The second assemblage found in the Nizi Formation, is similar to the latest Viséan 16_{sup} zone. In Eurasia this assemblage is characterized by Endothyranopsis crassa – two-layered Palaeotextularia – two-layered Climacammina – acme of Neoarchaediscus – Planospirodiscus – Valvulinella – Howchinia – Bradyina rotula – Archaediscus karreri

assemblage. As for zone $16_{inf.}$, the last four taxa are not present in most of North America; in British Columbia, zone $16_{sup.}$ is therefore characterized by only the first five taxa.

The third assemblage recognized in the Nizi Formation is of earliest Namurian age, zone 17. The base of the Namurian stage is characterized in Western Europe by Endothyranopsis sphaerica - two-layered Palaeotextularia - two-layered Climacammina, abundant Neoarchaediscus, Planospirodiscus and Asteroarchaediscus, and the extinction of Valvulinella and Howchinia (Mamet, Choubert and Hottinger, 1966). The first six taxa characterize the zone in British Columbia but Valvulinella and Howchinia are restricted to the Eurasiatic and Arctic realm.

The last assemblage known in the Nizi Formation is middle early Namurian, zone 18. In Eurasia, this zone is characterized by Endothyranopsis sphaerica - two-layered Palaeotextularia - two-layered Climacammina - Neoarchaediscus - Planospirodiscus - Asteroarchaediscus and abundant Globivalvulina parva. These taxa are all present in the Lower Namurian of British Columbia.

Comparison of the Nizi and North American midcontinent microfauna is also feasible (Mamet and Skipp, in press). Archaediscidae assemblages similar to those of the basal Nizi Formation are present in the Renault and Aux Vases formations in Missouri and Illinois. At that level, the most obvious difference between the foraminiferal populations of British Columbia and the midcontinent involves the Palaeotextulariidae which are poorly developed in the entire American craton.

The assemblage of Archaediscidae in Member C of the Nizi Formation is also encountered in the Glen Dean Limestone. The main difference between the Canadian Cordilleran fauna and that of the midcontinent again involves the Palaeotextulariidae; moreover the Eostaffellidae and Pseudoendothyridae populations of the midcontinent are devoid of gigantic Eurasiatic forms such as Pseudoendothyra of the group P. kemenskensis etc.

Finally the Archaediscidae and Biseriamminidae assemblages of members D and E of the Nizi Formation are in all respects comparable to these of the Kinkaid Limestone. (Indiana and Illinois).

CONCLUSIONS

The Nizi Formation is assigned a late Viséan to early Namurian age (Chesteran Stage) on the basis of its microfauna. The dating of these rocks and of late Middle Devonian carbonates provide minimum and maximum age limits for the bulk of the Sylvester Group, a thick, poorly fossiliferous, typical eugeosynclinal sequence.

The late Paleozoic eugeosynclinal terrains of the western Cordillera include many discontinuous limestone units. Microfaunal studies of such strata may provide a useful tool for unravelling some of the problems in these stratigraphically and structurally complex areas.

REFERENCES

Gabrielse, H.
1963: McDame map-area, Cassiar district, British Columbia; Geol. Surv. Can., Mem. 319.

Mamet, B.
1962: Remarques sur la microfaune de Foraminifères du Dinantien; Soc. Belge, Géol., Bull., vol. 70, No. 2, pp. 166-173.

1968: Foraminifera, Etherington Formation (Carboniferous), Alberta, Canada; Bull. Can. Petrol. Geol., vol. 16, No. 2, pp. 167-179.

Mamet, B., Choubert, G. and Hottinger, L.
1966: Note sur le Carbonifère du jebel Ouarkziz; Etu de du passage du Viséen au Namurien d'après les Foraminifères; Ser. Géol. Maroc., Notes et Mémoirs No. 198, pp. 6-20.

Mamet, B. and Mason, D.
1968: Foraminiferal zonation of the Lower Carboniferous Connor Lake Section, British Columbia; Bull. Can. Petrol. Geol., vol. 16, No. 2, pp. 147-166.

Mamet, B. and Skipp, B.
in press: Lower Carboniferous Foraminifera; Preliminary zonation and stratigraphic implications for the Mississippian of North America; Proc. 6th Internatl. Congress of Carboniferous Stratigraphy and Geology.

Sutherland, P.K.
1958: Carboniferous stratigraphy and rugose coral faunas of north-eastern British Columbia; Geol. Surv. Can., Mem. 295.

APPENDIX

Section 1

Type section of Nizi Formation on north-northeast trending ridge four miles southwest of Sheep Mountain and 12 miles southeast of McDame, northern British Columbia at lat. 59°03'40"N and long. 129°02'00"W.

NIZI FORMATION

Member	Lithology	Thickness in Feet Unit	Total from base
G	Limestone, light grey, weathers light grey to buff, fine to coarse grained, thick-bedded to massive, resistant; faulted and tightly folded; contains brachiopods in uppermost beds and large pelmatozoan columnals in middle part.	50+	1643+
F	Shale and siltstone, maroon, weathers maroon, very fine grained; contains a 1-foot bed of green, massive shale similar to shale at 1556 feet; includes some interbeds of argillaceous, buff-weathering limestone.	10	1593
E	Limestone, crinoidal, argillaceous, medium grey, weathers medium buff-grey and grey, coarse grained, in 2-inch platy beds; includes minor interbeds of limestone, slightly dolomitic, medium grey, weathers grey to orange-buff, coarse grained, in 2-inch, to 8-inch beds, similar to limestones from 1546 feet to 1556 feet.	14	1583
	Limestone, recrystallized, light grey, weathers grey-buff to orange-buff, cryptograined to fine grained, in beds 2 inches to 8 inches thick, includes minor interbeds of limestone, crinoidal, argillaceous, medium grey, weathers buff and grey, coarse grained, in platy		

Member	Lithology	Thickness in Feet Unit	Total from base
	beds 2 inches thick, abundant crinoid columnals; at 1556 feet, 1-foot bed of massive, green shale.	21	1569
	Limestone, medium grey, weathers grey, coarse grained, indistinct beds 8 to 18 inches thick, abundant crinoid columnals less than 1/4-inch in diameter; similar to limestone from 1194 feet to 1356 feet.	50	1548
	Limestone, crinoidal, medium grey, weathers light grey to buff, fine to coarse grained, in 8-inch to 18-inch indistinct beds, contains abundant crinoid columnals less than 1/4 inch in diameter.	14	1498
	Limestone, cherty in part, medium grey, weathers light grey to buff-grey, fine to coarse grained, in 8-inch to 18-inch indistinct beds or massive; contains poorly preserved brachiopods at 1446 feet.	128	1484
	Limestone, cherty in part, bioclastic in part, mottled light grey to dark grey, weathers grey to buff-grey, fine to coarse grained, massive; contains large solitary rugose corals at 1254 feet to 1256 feet; abundant recrystallized crinoid columnals less than 1/4-inch in diameter.	162	1356
	Limestone, cherty in part, bioclastic in part, light to medium grey, weathers light grey, fine to coarse grained, in 2-inch platy, argillaceous beds near base but massive in upper part.	10	1194
D	Limestone, argillaceous, medium to dark grey, weathers grey to buff-grey, cryptograined to fine grained, in platy beds		

Member	Lithology	Thickness in Feet Unit	Total from base
	2 inches thick; contains poorly preserved crinoid columnals less than 1/4-inch in diameter.	8	1184
	Limestone, dolomitic and argillaceous, medium grey, weathers buff-orange, fine grained, in 2-inch to 6-inch distinct beds.	25	1176
	Limestone, recrystallized, argillaceous, medium grey, weathers buff-orange, fine grained, in distinct beds 4 to 12 inches thick, locally laminated; interbedded with shale, calcareous, dark dark grey-brown, weathers dark brown, very fine grained, in 1/4-inch to 1/2-inch beds, recessive; shale forms 50 per cent of outcrop.	15	1151
	Limestone, recrystallized and argillaceous, medium to dark grey, weathers medium grey to buff-orange, fine grained and cryptograined with a few medium-grained crystals, in 4-inch to 12-inch distinct beds.	12	1136
	Limestone, recrystallized and argillaceous, medium to dark grey, weathers medium grey to buff-orange, fine grained, in 2-inch to 12-inch distinct beds, slightly recessive.	13	1124
C	Limestone, cherty in part, in places contains minor sand, weathers grey to mottled buff and grey, fine to coarse grained, in distinct beds 2 inches to 2 feet thick; entire unit is very well bedded and cliff-forming; contains silicified, solitary corals at 879 feet, abundant brachiopods, solitary corals, and auloporid corals at 1072 feet, and poorly preserved crinoid columnals generally about 1/4-inch in diameter throughout unit.	371	1111

Member	Lithology	Thickness in Feet Unit	Total from base
	Covered interval.	16	740
	Limestone, bioclastic, medium grey, weathers light grey, medium to coarse grained, crystalline.	18	724
	Limestone, bioclastic in part, locally cherty, medium to dark grey, weathers light grey to buff, medium grey chert weathers out in patches on surface, fine to coarse grained, in 2-inch to 12-inch indistinct beds.	5	706
	Covered interval.	48	701
	Limestone, bioclastic in part, locally cherty, medium to dark grey, weathers light grey to buff with medium grey chert weathering out in patches, fine to coarse grained, in 2-inch to 12-inch indistinct beds, resistant; contains a few fragments of crinoid columnals to 1/2-inch in diameter.	14	653
B	Dolostone, in part very cherty, buff-pink, weathers medium grey to medium orange-brown with grey chert weathering out in patches on surface, chert occurs locally as nodules and lenses, medium grained, crystalline, in 2-inch to 12-inch indistinct beds; contains a few poorly preserved brachiopods and crinoid columnals as much as 1/2-inch in diameter; rocks are generally recessive and interval consists of alternating ribs of dolostone and covered areas; dolostones grade down into limestone described at 326 feet to 403 feet.	236	639
	Limestone, bioclastic, cherty, dark grey, weathers grey to orange-buff with grey chert weathering out in patches, coarse grained, in 2-inch to 12-inch distinct beds, upper part grades into overlying		

Member	Lithology	Thickness in Feet Unit	Total from base
	dolostone; contains a few poorly preserved fragments of crinoid columnals as much as 1/2-inch in diameter.	77	403
	Dolostone, pink to buff, weathers pink-buff fine to medium grained, beds 2 inches to 12 inches thick.	38	326
A	Mainly covered interval with scattered outcrops of limestone.	58	288
	Calcarenite, sandy, dark grey with orange-brown speckles, weathers medium orange-brown, coarse grained, in 2-inch to 12-inch indistinct beds; includes rounded grains of quartz sand.	10	230
	Covered interval.	122	134
	Calcarenite, sandy, medium grey, weathers light to medium brown, coarse grained, massive; contains rounded grains of quartz sand; locally contains crinoid columnals as much as 1 inch in diameter.	12	12
	Overlies light greenish grey weathering, massive chert of Sylvester Group.		

Section 2

Section of lower part of Member A of Nizi Formation at head of northwesterly trending gully on west side of mountain 2 miles northwest of type section of Nizi Formation. Lat. 59°04'30"N and long. 129°03'00"W.

LOWER PART OF MEMBER A, NIZI FORMATION

Member A Unit	Lithology	Thickness in Feet Unit	Total from base
5	Calcarenite, sandy, medium grey, weathers buff to light brown, coarse grained; contains sparse to abundant rounded grains of quartz sand.	10	226
4	Limestone, sandy, medium grey, weathers pale buff to medium grey, coarse grained, medium-bedded, similar to limestone from 101 feet to 121 feet.	93	216
	Dolostone, medium grey, weathers medium brown, fine-grained, in 2-inch to 3-inch beds.	2	123
	Limestone, medium grey, weathers light grey, coarse grained, medium-bedded.	20	121
3	Limestone, bioclastic, fetid, dark grey, weathers buff and medium to dark brown, coarse-grained, blocky, in 6-inch to 12-inch beds.	32	101
	Shale, medium to very dark grey, weathers medium to dark grey, green and slaty at base, in 1/16-inch to 1/2-inch beds.	3	69
2	Conglomerate, chloritic, moderately sheared, dark green to apple green, weathers dark green to dark brown, subrounded clasts of chloritic volcanics and angular to subrounded clasts of chert		

Member A Unit	Lithology	Thickness in Feet Unit	Total from base
	as much as 4 inches in diameter but generally less than 1 inch in diameter, forms indistinct rubbly beds.	24	66
	Greywacke, slightly sheared, fine to medium grained, calcareous, locally micaceous, dark brownish green.	22	42
1	Limestone, argillaceous, sandy, bioclastic in part, locally crinoidal, dark grey, weathers mottled medium grey and dark grey, medium grained, forms indistinct 6-inch to 8-inch beds; in places limestone is coarse grained, chloritic and contains crinoid columnals as much as 1 inch in diameter.	20	20
	Overlies blocky, light greenish grey chert of the Sylvester Group.		