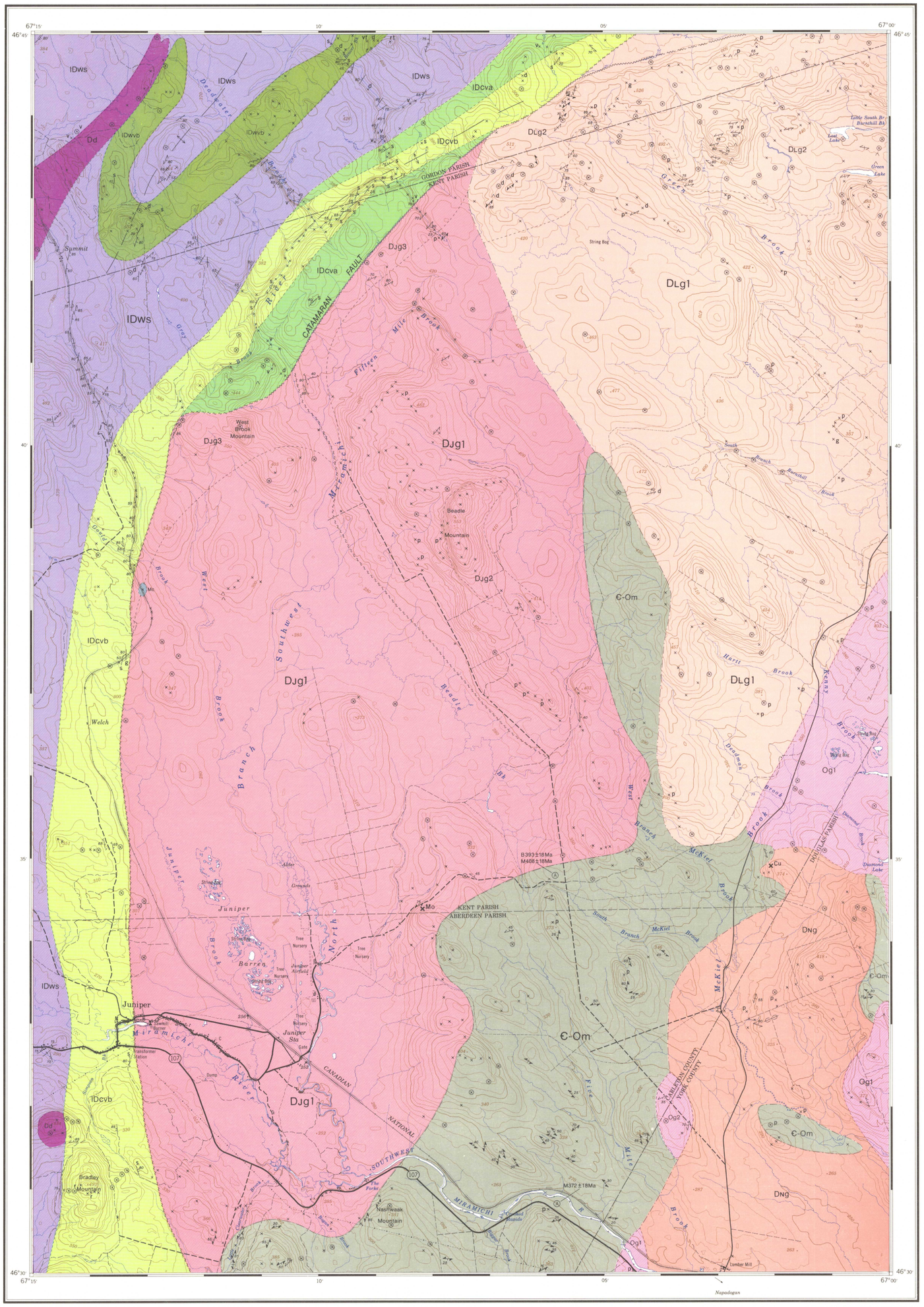
GEOLOGICAL SURVEY OF CANADA COMMISSION GÉOLOGIQUE DU CANADA

DEPARTMENT OF ENERGY, MINES AND RESOURCES
MINISTÈRE DE L'ÉNERGIE, DES MINES ET DES RESSOURCES



LEGEND

PALEOZOIC

MISSISSIPPIAN

Mc — *Greyish red conglomerate and grit*

DEVONIAN

Dd — *Greenish grey, medium grained, massive diabase and gabbro: includes some undivided Lower Devonian volcanic and sedimentary rocks*

DJg — *JUNIPER GRANITE*: DJg1: *Grey and pink, medium grained, (porphyritic), massive, cataclastic biotite and muscovite-biotite granite; includes minor pink aplite and pegmatite dykes, and migmatite near contacts*. DJg2: *Pink and grey, medium- to coarse-grained, (porphyritic), massive, cataclastic biotite-muscovite and muscovite-biotite granite; includes minor pink aplite dykes*. DJg3: *Reddish orange, pink and grey, medium- to fine-grained, cataclastic, (mylonitic), massive to foliated biotite and muscovite-biotite (augen) granite*

DLg — *LOST LAKE GRANITE*: DLg1: *Grey and pink, medium grained, massive muscovite-biotite and biotite-muscovite granite; includes minor white pegmatite dykes and in the southwestern part migmatite*; DLg2: *Pink and grey, fine- to medium-grained, cataclastic, (foliated), (gneissic), biotite and muscovite-biotite (augen) granite (may be in part Ordovician)*

Dng — *NASHWAAK GRANITE: Light grey, fine- to medium-grained, massive biotite-muscovite granite, minor pink foliated leucogranite and mica schist*

LOWER DEVONIAN

TOBIQUE GROUP

IDws — *WAPSKE FORMATION: Basaltic Unit*: IDwvb: *greenish grey basalt, minor diabase, slate, siltstone and rhyolite; Sedimentary Unit*: IDws: *grey slate, greywacke, shale, minor basalt, diabase and rhyolite tuff*

IDcvb — *COSTIGAN MOUNTAIN FORMATION: Basaltic unit*: IDcvb: *greenish grey basalt flows and tuffs, minor siltstone, shale, greywacke, grit, rhyolite and diabase; Rhyolitic Unit*: IDcva: *pink, buff and red rhyolite and trachyte flows and tuffs, minor basalt and siltstone*

ORDOVICIAN

Og — Og1: *Light pink to grey, fine- to medium-grained, foliated biotite granite cut by minor muscovite-biotite granite dykes and garnetiferous pegmatite veins*; Og2: *Grey to light pink, fine- to medium-grained, gneissic biotite, feldspar-augen granite, minor migmatite*

CAMBRIAN-ORDOVICIAN

€-Om — *Grey and rusty grey, medium- to fine-grained, foliated to gneissic quartz-feldspar-muscovite-biotite (-cordierite) (-sillimanite) (-andalusite) migmatite and paragneiss, commonly containing lenses and clots of biotite and metasediment and quartz veins; grey, medium-grained massive biotite granite (Devonian?); minor quartzite, slate, amphibolite and pegmatite dykes*

Rock outcrop (definite, probable)
Rock rubble indicative of nearby bedrock
Geological boundary (approximate, assumed, gradational)
Bedding, tops known (inclined, overturned)
Bedding, tops unknown (inclined, vertical)
Cleavage, schistosity, foliation (inclined, vertical)
Gneissosity (inclined, vertical, dip unknown)
Shearing (inclined)
Fault (defined, approximate, assumed)
Anticline (approximate)
Glacial striae (direction of flow unknown)
Mineral prospect

ROCK TYPE

Basalt	v	*Rhyolite*	r
Diabase and gabbro	d	*Sediments*	s
Grit	g	*Tuff*	t
Pegmatite	p		

MINERAL OCCURRENCES

Copper	Cu	*Molybdenum*	Mo

Geology by R. Skinner, 1971; C.J. St. Peter, 1978

Geology compiled by R. Skinner, 1982

Geological cartography by R.Y. Potvin, Geological Survey of Canada

Any revisions or additional geological information known to the user would be welcomed by the Geological Survey of Canada

Base map at the same scale published by the Surveys and Mapping Branch in 1957. Roads were revised by the Geological Survey of Canada for this edition

Copies of the topographical edition of this map may be obtained from the Canada Map Office, Department of Energy, Mines and Resources, Ottawa K1A 0E9

Approximate magnetic declination 21°28.9' West decreasing 4.1' annually

DESCRIPTIVE NOTES

Juniper (east half) map area lies in the Appalachian Mountain System on the west flank of the New Brunswick Highlands. The map area forms part of the Miramichi Anticlinorium or Massif (Fyffe et al., 1981) – a belt of highly deformed lower Paleozoic volcanic and sedimentary rocks (intruded by Devonian and Ordovician granites) that extends northeasterly across the province from Woodstock to Bathurst. The map area is 50 km northeast of Woodstock, New Brunswick.

The area is underlain mainly by granitic rocks, most of which are of Devonian age and all lie south and east of the Catamaran Fault. The oldest rocks (**€-Om**) are biotitic migmatites and paragneisses of Cambrian and/or Ordovician age and extend into adjoining areas to the east (Poole, 1963, 1980), northeast (Skinner, 1975) and south (Anderson, 1968). Their age is based on relationships in the Hayesville map area (Poole, 1963; Crouse, 1979) where sillimanite gneiss and pegmatite grade easterly into schist, quartzite and phyllite that pass conformably upward into brachiopod-bearing siltstone, dated Early Ordovician (Neuman, 1967). The migmatites contain lenses and veins of granitic material interlayered with micaceous layers and clots. The protolith of the micaceous material is probably of Cambro-Ordovician age, whereas the granitic material appears to be identical to the granite in the adjacent granitic bodies and more than likely is of Devonian age.

The oldest granites in the map area are foliated cataclastic "Sugar" (**Og1**) and feldspar augen (**Og2**) granites. Poole (1980) dated the "Sugar" granites in the Hayesville map area adjacent to the Juniper map area. Five of the eight whole rock samples defined an isochron age of 498 ± 19 Ma, initial ratio 0.7034 ± 0.0029 and mean square of weighted deviates (MSWD) 1.13. The three other samples fall below this line. An errorchron age of 484 ± 33 Ma, intercept 0.7039 ± 0.0052 and MSWD 4.85 is obtained if all eight samples are included in the regression analysis. These ages fall about early Ordovician.

The Tobique Group rocks are extensions of those present to the north in the Plaster Rock (east half) map area (Skinner, 1981) and have been traced over 110 km from Upper Kintore in the southwest (C. St. Peter, in preparation) to Serpentine River in the north (Irrinki, 1977a,b) and are named after the river along which it outcrops west and northwest of the area. The Early Devonian age, probably Helderbergian and possibly New Scotland (Gedinnian), given these rocks is based on dating by A.J. Boucot, Oregon State University, of brachiopods collected by Skinner in 1970 (1981). Irrinki in 1975 and 1977 (1977c) and St. Peter in 1976 (1978) in the Plaster Rock (east half) map area. Although the Wapske Formation, rich in sediments and mafic volcanics conformably overlies the Costigan Mountain Formation, rich in acid volcanics (in the Plaster Rock map area), fossils collected from each indicate similar ages. It is possible that the Wapske is a lateral facies equivalent of the upper part of the Costigan Mountain Formation.

Most of the Devonian granites in the map area are grey or pink and contain varying proportions of biotite and/or muscovite. The predominantly muscovite-bearing granites are pale grey to leucocratic and are confined largely to the highest parts of Beadle Mountain (**DJg2**) and to the Nashwaak body (**Dng**). The granites adjacent to the Catamaran Fault are cataclastic, commonly foliated, and in places contain feldspar augen, and those along the northwestern border of the Juniper granite body (**DJg3**) have a distinctive reddish-orange colour.

The ages of the Devonian granites are based mainly on ages obtained in adjoining areas. The Nashwaak granite (**Dng**) yielded a K-Ar date of 386 ± 16 Ma[1] from a biotite concentrate obtained from granodiorite in Napadogan map area (Poole, 1958; Anderson and Poole, 1959) 4.4 km east-southeast of Juniper map area (W.H. Poole *in* Wanless et al., 1972, p. 71). The age of the Lost Lake granite (**DLg1**) is speculative. In the adjoining Hayesville map area, Poole (1963) gave these rocks an Ordovician age based on K-Ar ages of 418 and 443 Ma (*in* Lowdon et al., 1963, p. 110 and 111) and the fact that they are commonly cataclastic, particularly in the northern part (**DLg2**). Later, these dates were re-examined and reserve concentrates of biotite and muscovite were re-analyzed, yielding K-Ar ages of 394 ± 18 and 363 ± 16 Ma respectively (*in* Wanless et al., 1973, p. 79-83). In 1980 Poole carried out a Rb-Sr study of the Lost Lake granite but the results were inconclusive. Of five whole rock samples, four with $^{87}Rb/^{86}Sr$ ratios less than 11 form an errorchron of age 444 ± 72 Ma, initial $^{87}Sr/^{86}Sr$ ratio of 0.7070 and MSWD 11.52, which spans between Late Cambrian and Late Devonian (Poole, 1980).

The only age determinations made within the Juniper map area were on pegmatite cutting migmatite, and on paragneiss (migmatite?) from the oldest map unit (**€-Om**). The ages yielded apparently represent Acadian granitic activity. The pegmatite dated cuts migmatite on Highway 107, 1.7 km east of Biggar Brook and gave a K-Ar age of 372 ± 18 Ma from a muscovite concentrate (W.H. Poole *in* Wanless et al., 1973, p. 80). The paragneiss (migmatite?) dated is on a logging rod 5.6 km east-northeast of the bridge over North Branch Southwest Miramichi River. A biotite concentrate gave a K-Ar age of 393 ± 18 Ma and a muscovite concentrate a K-Ar age of 408 ± 18 Ma (W.H. Poole *in* Wanless et al., 1965, p. 108 and 109). These ages are considered unreliable by Poole (*in* Wanless et al., 1973, p. 82).

The Burnthill granite (map units 8b, 9 and 10a *in* Poole, 1963) 4.4 km to the east in the Hayesville map area yielded a whole rock Rb-Sr age of 352 ± 9 Ma from the northern part of the body (C. Brooks, personal communication, 1980; *in* Fyffe et al., 1981, p. 32). Earlier, Poole obtained a 346 Ma K-Ar age from a biotite concentrate from the eastern part of the body (*in* Lowdon et al., 1963, p. 112) and a 400 Ma K-Ar age from a muscovite concentrate from a gneiss bordering a quartz vein in the southwestern part of the body (*in* Leech et al., 1963, p. 100 and 101).

In the Tuadook Lake map area the Redstone granite (Crouse, 1978; unit 4c, Skinner, 1975) 10 km to the north yielded a whole rock Rb-Sr age of 409 ± 20 Ma, essentially the same as the whole rock Rb-Sr age of the Costigan Mountain volcanics (**IDcva**) (Fyffe and Cormier, 1979, p. 2049) and a smaller granodiorite body 25 km to the east of the Redstone granite yielded a K-Ar age of 382 ± 16 Ma (R. Skinner *in* Wanless et al., 1972, p. 75).

The Mississippian rocks (**Mc**) in the map area apparently outcrop in only one place, a low railway cut 0.4 km south of Gould Brook. There the outcrop is poorly exposed and extends for less than 20 m along the west side of the tracks. Not enough strata is visible to estimate the attitude of the highly weathered conglomerate which consists mainly of rounded pebbles and boulders up to 45 cm long of red to pink Costigan Mountain rhyolite and granite and green basic volcanics in a brown gritty matrix. The conglomerate is similar to Mississippian conglomerate to the south in the Coldstream map area (Anderson, 1968 and personal communication, 1981).

The Cambro-Ordovician paragneiss and migmatite have pronounced gneissic and schistose structures and the Ordovician granites (**Og**) commonly have a well developed foliation. The attitude of these structures is highly variable, probably as a result of deformation by both the Taconic and Acadian orogenies. The Tobique Group rocks on the other hand have been folded into simple open folds with planar, steeply dipping cleavage. The Devonian granite bodies are so similar petrographically and so close to one another that they no doubt coalesce at depth. The Juniper (**DJg**) and Lost Lake (**DLg**) bodies have been highly sheared and altered along the Catamaran Fault up to a distance of at least 4 km from the fault in the latter case and are commonly mylonitic adjacent to the fault.

The Catamaran Fault has been traced to the east-northeast of the map area for more than 75 km by Anderson (1972). Movement along the fault produced a right lateral displacement of about 7 km on Middle Ordovician basic volcanics at Catamaran Brook 60 km east-northeast of the map area (Anderson, 1970, 1972; Irrinki, 1979) and 20 km to the west of the map area a probable splay off the fault sets Mississippian redbeds against Lower Devonian Wapske Formation sedimentary rocks (St. Peter, 1979).

The Cambrian-Ordovician paragneiss and migmatite (**€-Om**) have been metamorphosed to the amphibolite grade as indicated by the scattered occurrences of cordierite, sillimanite and andalusite, whereas the Tobique Group rocks have only undergone prehnite-pumpellyite facies metamorphism.

No significant metallic mineral occurrences are known within the map area. However, molybdenite and pyrite are present in quartz veins up to 60 m thick cutting migmatite-bearing granite 4 km northeast of Juniper Station. The mineralization can be seen in prospect pits and rubble along the south side of the main logging road about 2.6 km east-northeast of the bridge over the North Branch of the Southwest Miramichi River.

St. Peter (1980) reported disseminated pyrite and malachite in highly fractured Nashwaak granite about 2.5 km west of Diamond Lake in the southeastern part of the map area. He also reported the presence of a uranium anomaly on the north end of Beadle Mountain. A combined geochemistry and scintillometer survey of the area was carried out by J.D. Irving Ltd. as a result of a New Brunswick Department of Natural Resources – Canada Department of Energy, Mines and Resources airborne reconnaissance gamma-ray spectrometric survey of pre-Carboniferous rocks of New Brunswick in 1976 (Woodstock, New Brunswick, Geological Survey of Canada Map 36021G). The stream silt samples gave high U_3O_8 values and the scintillometer detected an anomaly three times background (New Brunswick Mines Branch Assessment File No. 472216).

Lead, zinc, copper and fluorine are present in the Rhyolitic unit of the Costigan Mountain Formation (**IDcva**) on Costigan Mountain, 25 km to the north in the Plaster Rock (east half) map area (Skinner, 1981). Probably these rhyolitic rocks in the Juniper map area are also mineralized.

Anderson, F.D.
1968: Woodstock, Millville and Coldstream map areas, Carleton and York Counties, New Brunswick; Geological Survey of Canada, Memoir 353.
1970: Geology of McKendrick Lake map area, New Brunswick; Geological Survey of Canada, Paper 69-12.
1972: The Catamaran Fault, north central New Brunswick; Canadian Journal of Earth Sciences, v. 9, p. 1278-1286.
Anderson, F.D. and Poole, W.H.
1959: Geology of Woodstock-Fredericton, York, Carleton, Sunbury and Northumberland Counties, New Brunswick; Geological Survey of Canada, map 37-1969.
Armstrong, R.L.
1978: Pre-Cenozoic Phanerozoic time scale – computer file of critical dates and consequences of new and in-progress decay – constant revisions; *in* Contributions to the Geologic Time Scale, ed. G.V. Cohee, M.F. Glaessner, and H.D. Hedberg; American Association of Petroleum Geologists, Studies in Geology No. 6, p. 73-91.
Crouse, G.W.
1978: Geology of head of Clearwater Brook, map area K-13; New Brunswick Department of Natural Resources, Mineral Resources Branch, Map Report 77-1.
1979: Geology of parts of Burnthill and Clearwater Brooks, map area K-14; New Brunswick Department of Natural Resources, Mineral Resources Branch, Plate 79-32.
Fyffe, L.R. and Cormier, R.F.
1979: The significance of radiometric ages from the Gulquac Lake area of New Brunswick; Canadian Journal of Earth Sciences, v. 16, p. 2046-2052.
Fyffe, L.R., Pajari, Jr., G.E. and Cherry, M.E.
1981: The Acadian plutonic rocks of New Brunswick; Maritime Sediments and Atlantic Geology, v. 17, p. 23-36.
Irrinki, R.R.
1977a: Geology of Nictau Forks of Tobique River, map area J-9; New Brunswick Department of Natural Resources, Mineral Resources Branch, Plate 77-9.
1977b: Geology of Tobique-Bald Mountain-Riley and Neary Brooks, map area J-10; New Brunswick Department of Natural Resources, Mineral Resources Branch, Plate 77-10.
1977c: Geology of South Branch Gulquac River, map area J-12; New Brunswick Department of Natural Resources, Mineral Resources Branch, Plate 77-12.
1979: Geology of North and South Little Sevogle Rivers – North Branch Little Southwest Miramichi River – McKendrick and Catamaran Lakes region; New Brunswick Department of Natural Resources, Mineral Resources Branch, Map-Report 79-1, 36 p.
Leech, G.B., Lowdon, J.A., Stockwell, C.H. and Wanless, R.K.
1963: Age determinations and geological studies (including isotopic ages – Report 4); Geological Survey of Canada, Paper 63-17.
Lowdon, J.A., Stockwell, C.H., Tipper, H.W. and Wanless, R.K.
1963: Age determinations and geological studies (including isotopic ages – Report 3); Geological Survey of Canada, Paper 62-17.
Neuman, R.B.
1967: Bedrock geology of the Shin Pond and Stacyville quadrangle, Penobscot County, Maine; United States Geological Survey, Professional Paper 524-I, 37 p.
Poole, W.H.
1958: Geology Napadogan, New Brunswick; Geological Survey of Canada, Map 11-1958.
1963: Geology, Hayesville, New Brunswick; Geological Survey of Canada, Map 6-1963.
1980: Rb-Sr ages of the "Sugar" granite and Lost Lake granite, Miramichi Anticlinorium, Hayesville map area, New Brunswick; *in* Current Research, Part C, Geological Survey of Canada, Paper 80-1C, p. 170-180.
Skinner, R.
1972: Juniper (east half) map area, New Brunswick; *in* Report of Activities, Part A, April to October, 1971; Geological Survey of Canada, Paper 72-1, Part A, p. 11-14.
1975: Geology of Tuadook Lake map area, New Brunswick (21 J/15); Geological Survey of Canada, Paper 74-33.
1981: Geology of the Plaster Rock (east half) map area, New Brunswick; Geological Survey of Canada, Paper 81-8.
St. Peter, C.
1978: Geology of Head of Wapske River, map area J-13; New Brunswick Department of Natural Resources, Mineral Resources Branch, Map-Report 78-1.
1979: Geology of Wapske-Odell River-Arthurette region, New Brunswick; New Brunswick Department of Natural Resources, Mineral Resources Branch, Map-Report 79-2.
1980: Geology of North Branch Southwest Miramichi River; New Brunswick Department of Natural Resources, Mineral Resources Branch, Map-Report.
Steiger, R.H. and Jäger, E., compilers
1977: Subcommission on Geochronology: convention on the use of decay constants in geo-and cosmochronology; Earth and Planetary Science Letters, v. 36, no. 3, p. 359-362.
Wanless, R.K., Stevens, R.D., Lachance, G.R. and Rimsaite, R.Y.H.
1965: Age determinations and geological studies, Part 1 – Isotopic Ages, Report 5; Geological Survey of Canada, Paper 64-17 (Part 1).
Wanless, R.K., Stevens, R.D., Lachance, G.R. and Delabio, R.N.
1972: Age determinations and geological studies, K-Ar isotopic ages, report 10; Geological Survey of Canada, Paper 71-2, 96 p.
1973: Age determinations and geological studies, K-Ar isotopic ages, report 11; Geological Survey of Canada, Paper 73-2, 139 p.

[1]All K-Ar and Rb-Sr ages quoted from published papers have been calculated or recalculated using the new constants recommended by Steiger and Jäger (1977). The time scale used in this report is that of Armstrong (1978), constructed using the new constants.

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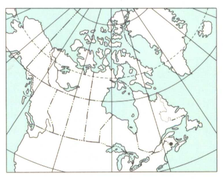


INDEX MAP

MAP 1578A

GEOLOGY

JUNIPER

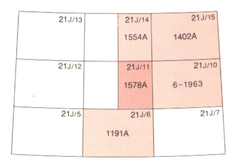
(East Half)

NEW BRUNSWICK

Scale 1:50 000

Kilometres 1 0 1 2 3 4 Kilometres
Miles 1 0 1 2 Miles

Transverse Mercator Projection



NATIONAL TOPOGRAPHIC SYSTEM REFERENCE AND INDEX TO GEOLOGICAL SURVEY OF CANADA MAPS

MAP 1578A
JUNIPER
NEW BRUNSWICK