U.S. GEOLOGICAL SURVEY

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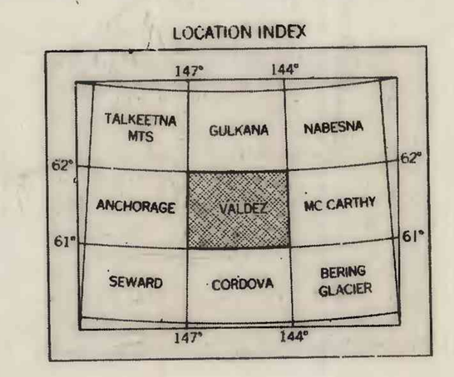
FOLIO OF THE VALDEZ QUADRANGLE, ALASKA

WINKLER AND OTHERS--GEOLOGY

Sheet 1 of 2

Base from USGS 1:250,000 topo series:
Valdez, Alaska (1960)



GEOLOGIC MAP AND SUMMARY GEOCHRONOLOGY OF THE VALDEZ QUADRANGLE, SOUTHERN ALASKA

By

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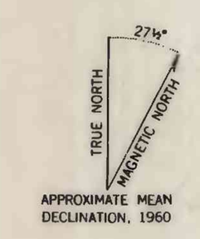
1981

This report (map) is preliminary and has not been reviewed for conformity with U. S. Geological Survey editorial standards (and stratigraphic nomenclature)

Geology compiled from unpublished mapping by J.E. Case, Arthur Grantz, C.D. Holloway, K.M. Johnson, E.M. MacKevett, Jr., P.A. Metz, R.L. Miller, W.J. Pickthorn, George Plafker, M.L. Silberman, R.G. Tysdal, W.K. Wallace, J.R. Williams, and G.R. Winkler, 1964-1979; isolated outcrops west of the Copper River between Willow Creek and Kenny Lake are from Nichols and Yehle (1969)

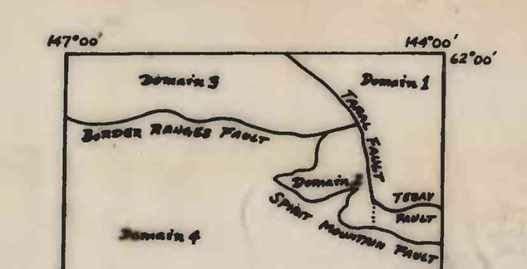


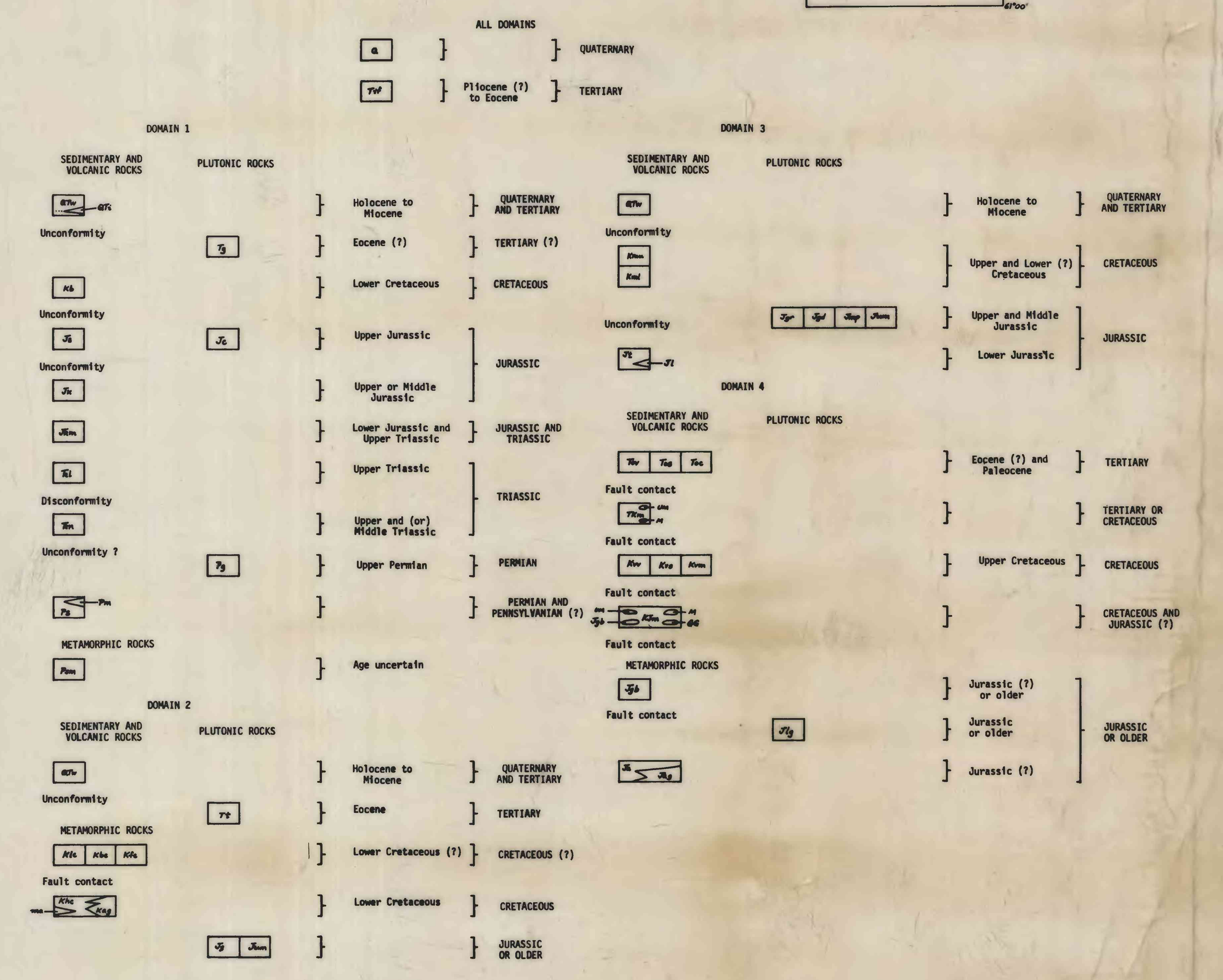
EXPLANATION

- g — Glaciers and superglacial moraine
- Approximate contact, showing dip; dotted where concealed; queried where assumed
- Concealed contact, extended beneath surficial deposits by inference from aeromagnetic survey
- High-angle fault, approximately located, showing dip; dotted where concealed; queried where assumed; U, upthrown side, D, downthrown side
- Thrust fault, approximately located, showing dip; dotted where concealed; queried where assumed
- Concealed fault, extended beneath surficial deposits by inference from aeromagnetic survey
- Anticline, approximately located, showing trace of axial surface; dotted where concealed; queried where assumed
- Minor asymmetric anticline, showing dip of limbs and plunge of axis
- Minor overturned anticline, showing dip of limbs and plunge of axis
- Syncline, approximately located, showing trace of axial surface; dotted where concealed; queried where assumed
- Minor overturned syncline, showing dip of limbs and plunge of axis
- Minor horizontal isoclinal fold, showing dip of axial surface
- Minor isoclinal fold, showing plunge of axis and dip of axial surface
- Strike and dip of beds
- Strike and dip of overturned beds
- Horizontal beds
- Strike of vertical beds, showing top of beds
- Estimated strike and dip of beds
- Estimated strike of vertical beds
- Strike and dip of layering in igneous rocks
- Strike and dip of foliation
- Strike of vertical foliation
- Trend of felsic dike in bedrock
- xxxx — Area of prominent iron-staining
- ▲2 — Dated K-Ar sample (see Table 1)
- ●3 — Dated radiolarian collection (see Table 2)

CORRELATION OF MAP UNITS

Bedrock units of the Valdez quadrangle are divided into four fault-bounded domains that differ markedly in stratigraphy, structural style, or ages (paleontologic or radiometric) of their component rocks. Three of the domains coincide conceptually with tectonostratigraphic terranes that have been defined previously: domain 1 = Wrangellia (Jones and others, 1977); domain 3 = Peninsular terrane (Jones and Silberling, 1979); and domain 4 = Chugach terrane (as redefined by Plafker and others, 1977) and Prince William terrane (Jones and Silberling, 1979). Domain 2 is of uncertain affinity; perhaps it represents a selvage of upper plate rocks that were subjected to more intense deformation than neighboring rocks during accretion of subduction complexes comprising the lower plate of the Border Ranges fault.





ALL DOMAINS
QUATERNARY
Pliocene (?) to Eocene
TERTIARY
DOMAIN 1
SEDIMENTARY AND VOLCANIC ROCKS
PLUTONIC ROCKS
Holocene to Miocene
QUATERNARY AND TERTIARY
Unconformity
Eocene (?)
TERTIARY (?)
Lower Cretaceous
CRETACEOUS
Unconformity
Upper Jurassic
JURASSIC
Unconformity
Upper or Middle Jurassic
Lower Jurassic and Upper Triassic
JURASSIC AND TRIASSIC
Upper Triassic
TRIASSIC
Disconformity
Upper and (or) Middle Triassic
Unconformity ?
Upper Permian
PERMIAN
PERMIAN AND PENNSYLVANIAN (?)
METAMORPHIC ROCKS
Age uncertain
DOMAIN 2
SEDIMENTARY AND VOLCANIC ROCKS
PLUTONIC ROCKS
Holocene to Miocene
QUATERNARY AND TERTIARY
Unconformity
Eocene
TERTIARY
METAMORPHIC ROCKS
Lower Cretaceous (?)
CRETACEOUS (?)
Fault contact
Lower Cretaceous
CRETACEOUS
JURASSIC OR OLDER
DOMAIN 3
SEDIMENTARY AND VOLCANIC ROCKS
PLUTONIC ROCKS
Unconformity
Holocene to Miocene
QUATERNARY AND TERTIARY
Upper and Lower (?) Cretaceous
CRETACEOUS
Unconformity
Upper and Middle Jurassic
Lower Jurassic
JURASSIC
DOMAIN 4
SEDIMENTARY AND VOLCANIC ROCKS
PLUTONIC ROCKS
Eocene (?) and Paleocene
TERTIARY
Fault contact
TERTIARY OR CRETACEOUS
Fault contact
Upper Cretaceous
CRETACEOUS
Fault contact
CRETACEOUS AND JURASSIC (?)
Fault contact
METAMORPHIC ROCKS
Jurassic (?) or older
Fault contact
Jurassic or older
Jurassic (?)
JURASSIC OR OLDER

Table 1. K-Ar ages and analytical data for plutonic, volcanic, and metamorphic rocks from the Valdez quadrangle 1/

Domain	Map Number	Sample Number	Map Unit	Rock Type	Mineral Dated	K_2O 2/	$^{40}Ar^* \times 10^{-10}$ (mole/gm)	$^{40}Ar^*/^{40}Ar_{tot}$ 3/	Apparent Age (m.y.)	Reference or Comment 4/
DOMAIN 1	1	63Le14b	Jk	Granodiorite clast	Biotite	3.97 3.97	9.633	0.90	161 ± 6	Grantz and others, 1966
DOMAIN 1	1	63Gz213	Jc	Diorite dike	Hornblende	0.668 0.672	1.460	0.83	145 ± 5	Grantz and others, 1966
DOMAIN 1	2	78MS517	Jc	Biotite granodiorite	Biotite	3.42 3.46	7.460 7.398	0.68 0.67	144 ± 7	
DOMAIN 1	3	78MS515	Jc	Hornblende granodiorite	Hornblende	0.804 0.814	1.837	0.80	151 ± 6	
DOMAIN 1	4	78MS516	Jc	Hornblende diorite	Hornblende	1.194 1.200	2.800 2.845	0.73 0.73	157 ± 8	
DOMAIN 1	5	78MS513	Jc	Hornblende-biotite epidote granodiorite	Hornblende	1.028	2.326	0.86	151 ± 5	
DOMAIN 1	6	79WK387	Jc	Hornblende granodiorite	Hornblende	0.990 0.990 0.994 0.991	2.272	0.83	153 ± 5	
DOMAIN 1	7	78WK8b	Jc	Hornblende-biotite granodiorite	Biotite	7.79 7.81	1.480 1.634	0.76 0.71	134 ± 7	Mineral pair
DOMAIN 1					Hornblende	0.753 0.754	1.665 1.648	0.24 0.58	147 ± 7	Mineral pair
DOMAIN 1	8	79BS081	Ŧn	Greenstone	Whole Rock	1.157	1.937	0.82	113 ± 3	See description of map unit Ŧn. Ages fall on 112 ± 11 m.y. isochron defined by ages of Nikolai Greenstone in McCarthy quadrangle (Silberman and others, 1980)
DOMAIN 1	9	79BS065B	Ŧn	Greenstone	Whole Rock	0.477	0.753	0.87	107 ± 3	
DOMAIN 1	9	79BS066	Ŧn	Greenstone	Whole Rock	0.891	1.603	0.79	121 ± 4	
DOMAIN 1	10	79WK271	Pg	Hornblende gabbro	Actinolitic hornblende	0.108 0.112	0.425	0.36	246 ± 12	
DOMAIN 1	11	78MS518	Psm	Hornblende gabbro	Hornblende	0.966 0.964	2.205	0.81	152 ± 6	Reset, see description of map unit Psm
DOMAIN 2	12	79WK290F	Tif	Dacite porphyry dike	Hornblende	0.442 0.460	0.310	0.61	47.2 ± 1.4	
DOMAIN 2	13	78MK33A	Tt	Altered tonalite	Muscovite	10.48 10.46	8.073 7.955	0.63 0.65	52.4 ± 2.6	
DOMAIN 2	13	74MZ001	Tt	Altered tonalite	Hornblende	0.319	0.217	0.45	46.6 ± 1.4	Metz, 1975
DOMAIN 2	13	74MZ002	Kfc	Hornfels	Hornblende	0.414	0.256	0.53	44.4 ± 1.3	Metz, 1975
DOMAIN 2	14	78MS514	Kag	Foliated quartz monzodiorite	Hornblende	0.620 0.627	1.183 1.075	0.59 0.51	122 ± 6	
DOMAIN 2	15	79BS069B	Khc	Biotite hornfels	Biotite	5.56 5.60	10.21	0.90	123 ± 4	Hornfels adjacent to mineralized peridotite dike at Spirit Mountain prospect
DOMAIN 2	16	79BS071	Kag	Amphibolite	Hornblende	0.106 0.118	0.225	0.33	135 ± 10	Mineralized
DOMAIN 2	17	79BS077	Kag	Hornblendite	Hornblende	1.112 1.112	2.471	0.89	148 ± 4	Mineralized
DOMAIN 2	18	79WK248A	Kag	Hornblende-biotite-epidote granodiorite	Hornblende	0.930 0.934	1.775	0.74	128 ± 4	Sheared and altered
DOMAIN 2	19	79BS046	Kag	Trondjhemite	Muscovite	10.57 10.56	20.97	0.90	133 ± 4	Sheared
DOMAIN 2	20	78MS512	Khc	Muscovite schist	Muscovite	9.41 9.31	15.63 14.81	0.92 0.91	110 ± 5	
DOMAIN 2	21	79BS064	Khc	Biotite schist	Biotite	5.07 5.07	3.609 3.792 3.691	0.49 0.82 0.85	50.0 ± 1.0	Average of three
DOMAIN 2	22	78WK30	Jgl	Hornblende gabbro	Hornblende	0.0604 0.0612	0.411 0.414	0.35 0.33	419 ± 21	K_2O by isotope dilution
DOMAIN 2	23	79WK253B	Jgl	Hornblendite	Hornblende	0.258 0.254 0.253 0.252	0.7250	0.42	188 ± 8	
DOMAIN 2	24	Bernard Creek	Jgl	Hornblende gabbro	Hornblende	0.127	0.327	0.51	171 ± 5	Hoffman (1974)

Table 1. (Continued)

Domain	Map Number	Sample Number	Map Unit	Rock Type	Mineral Dated	K_2O 2/	$^{40}Ar^* \times 10^{-10}$ (mole/gm)	$^{40}Ar^*/^{40}Ar_{tot}$ 3/	Apparent Age (m.y.)	Reference or Comment 4/
DOMAIN 3	25	78MS505A	Jmp	Layered leucogabbro	Hornblende	0.0782 0.0790	0.182	0.33	154 ± 5	K_2O by isotope dilution
DOMAIN 3	26	78MS504	Jmp	Hornblende leucogabbro	Hornblende	0.128 0.130	0.324	0.39	167 ± 8	K_2O by isotope dilution
DOMAIN 3	27	78WK83	Jmp	Hornblende gabbro	Hornblende	0.113 0.112	0.280	0.44	166 ± 8	K_2O by isotope dilution
DOMAIN 3	28	78MS508A	Jmp	Hornblende-biotite-quartz gabbro	Hornblende	0.413 0.417 0.474 0.471	1.041 1.129 1.132	0.56 0.65 0.85	165 ± 8	Mineral pair
DOMAIN 3					Biotite	3.98 3.93 4.00 3.87	10.16 10.23 10.13	0.89 0.82 0.89	171 ± 5	Mineral pair
DOMAIN 4	29	79PW008	Tif	Muscovite granite	Muscovite	9.37	7.058	0.87	51.6 ± 1.5	Altered
DOMAIN 4	30	79BS095	Kvv	Chlorite-muscovite phyllite (meta-tuff)	Whole Rock	0.765 0.739	0.588	0.59	53.5 ± 1.6	
DOMAIN 4	31	79WK112B	Jgb	Blueschist	Crossite	0.715 0.651 0.695 0.689	1.729	0.85	167 ± 7	
DOMAIN 4	32	79WK118A	Jgb	Blueschist	Crossite	1.711 1.712 1.664 1.668	4.455	0.83	175 ± 5	
DOMAIN 4	33	79Ce120	Jgb	Muscovite schist	Muscovite	6.19	14.33	0.90	154 ± 5	
DOMAIN 4	34	79WK123B	Jgb	Blueschist	Crossite	0.353 0.360	0.597	0.74	113 ± 5	Strongly sheared
DOMAIN 4	35	79WK124	Jgb	Actinolite-muscovite schist	Actinolite	0.260 0.260 0.256 0.258	0.472	0.50	123 ± 6	Strongly sheared
DOMAIN 4	36	79WK310	Jgb	Blueschist	Crossite	0.541 0.535	1.113	0.78	138 ± 4	Strongly sheared; in block along Klutina fault
DOMAIN 4	37	79WK441A	Jgb	Blueschist	Crossite	0.349 0.350	0.795	0.76	152 ± 5	Separate klippen
DOMAIN 4	38	79WK100A	Jgb	Lawsonite blueschist	Crossite	0.647 0.642	1.613	0.79	166 ± 5	Block in melange
DOMAIN 4	39	78MS500A	Ja	Hornblende-plagioclase pegmatite pod	Hornblende	0.140 0.138	0.574	0.40	267 ± 8	K_2O by isotope dilution
DOMAIN 4	40	79WK98	Jlg	Quartz gabbro	Clinopyroxene	0.021 0.024	0.055 0.067	0.09 0.17	185 ± 19	K_2O by isotope dilution

1/ Mineral concentrates for K and Ar analyses were prepared by crushing and grinding, then concentrating separate size fractions by electrostatic and magnetic methods and by the use of heavy liquids. R. J. Miller and Ronny Miyoaka of the U. S. Geological Survey and Diane Duvall of the University of Alaska prepared the mineral concentrates. Whole-rock greenstone samples were prepared by crushing and sieving to between 0.15 and 0.25 mm (60 and 100 mesh) by C. L. Connor and L. B. Gray of the U. S. Geological Survey.

2/ Potassium content was analyzed by flame photometry, using a lithium metaborate fusion technique in which the lithium serves as an internal standard (Ingamells, 1970). Analysts were Paul Klock, Byron Lai, M. Taylor, and J. M. Baldwin of the U. S. Geological Survey. Six concentrates of minerals that were very low in potassium were analyzed by isotope dilution techniques at Teledyne Isotopes by Louie Casabona.

3/ Argon was extracted and anlyzed by standard methods of isotope dilution and mass spectrometry (Dalrymple and Lanphere, 1969) at the U. S. Geological Survey and by Geochron Laboratories. Analysts at the Geological Survey were C. L. Connor, L. B. Gray, S. E. Sims, and M. L. Silberman. The constants used in calculation of the ages were: $\lambda_\beta = 4.962 \times 10^{-10}\ yr^{-1}$; $\lambda_\varepsilon = 0.581 \times 10^{-10}\ yr^{-1}$; $^{40}K/K = 1.167 \times 10^{-4}$ mole/mole.

The plus=minus (±) figures represent estimated analytical uncertainty of the combined K and Ar analyses, and vary from 3 to approximately 10 percent, depending upon the atmospheric argon correction (Dalrymple and Lanphere, 1969) and upon reproducibility of the potassium analyses.

4/ Ages from published references have been recalculated according to revised constants above

Table 2. Radiolarian collections from the Valdez quadrangle

Locality Number	Diagnostic Genus/Genera	Age
1	Crolanium Parvicingula Archaeodictyomitra	Albian - Cenomanian (mid-Cretaceous)
2, 3	Mirifusis	Late Jurassic - Early Cretaceous (Barremian)
4	Archaeodictyomitra?	Jurassic - Cretaceous
5, 6, 7, 8, 9, 10, 11	Archaeodictyomitra, Praeconocaryomma?	Jurassic - Cretaceous (Late Jurassic or Early Cretaceous)
12	Praeconocaryomma?	Jurassic - Cretaceous (Jurassic?)
13	Theoperiids gen. aff. Hsuum	Jurassic (Late Jurassic?)
14	Conoptum?	Late Triassic or Early Jurassic?
15	Capnoduce	Late Triassic
16	Gorgansium	Triassic
17	Theoperiids	Mesozoic (Triassic?)
18, 19, 20, 21	Theoperiids	Mesozoic

Identifications by C. D. Blome, D. L. Jones, and B. L. Murchey of the U. S. Geological Survey