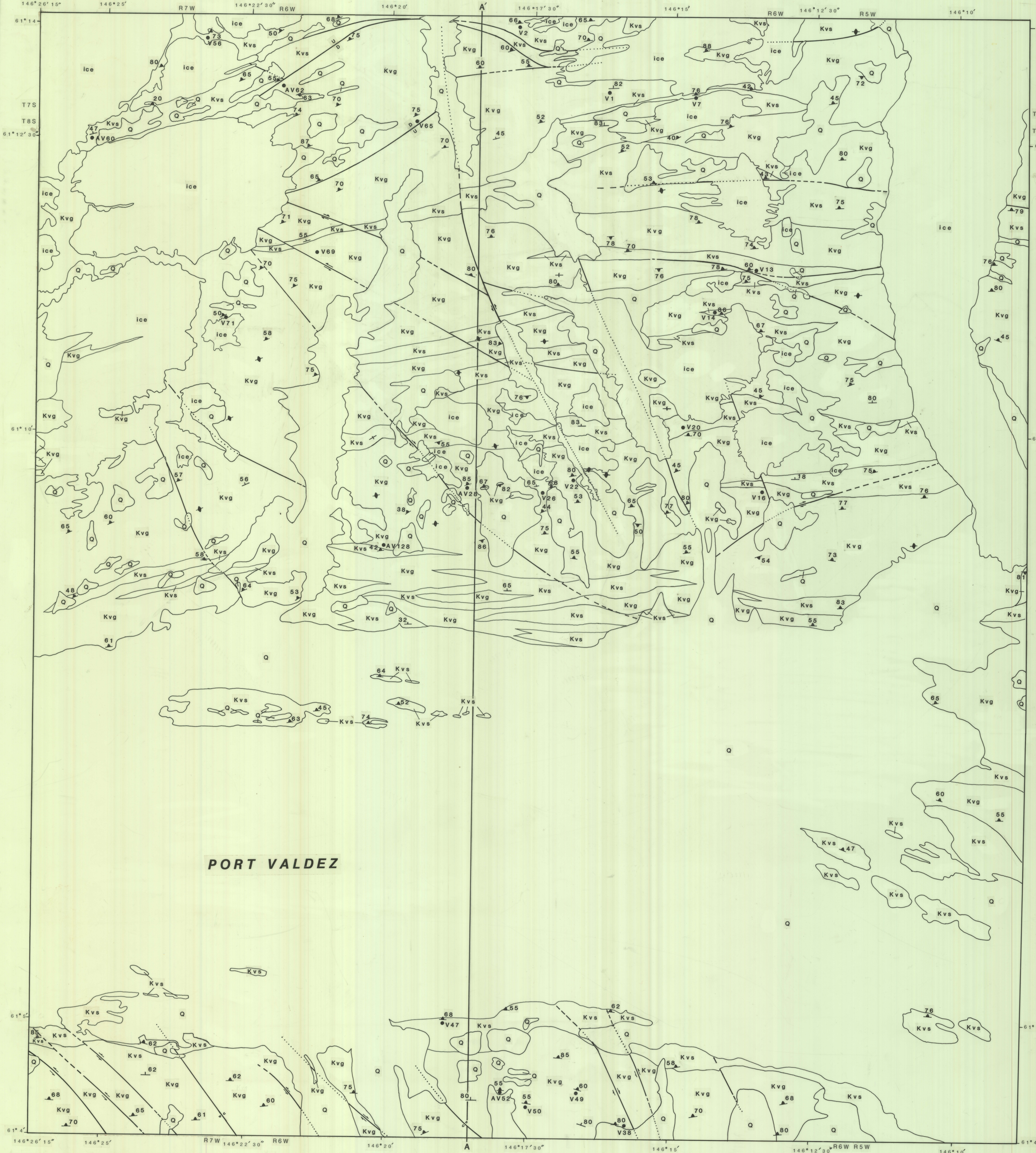


Base from parts of U.S.Geological Survey Valdez A-6NW (1983), A-6SW (1983), A-7NE (1983), and A-7SE (1983) Topographic Quadrangles, Alaska

TRUE NORTH, MAGNETIC, 26°

Approximate mean declination 1983

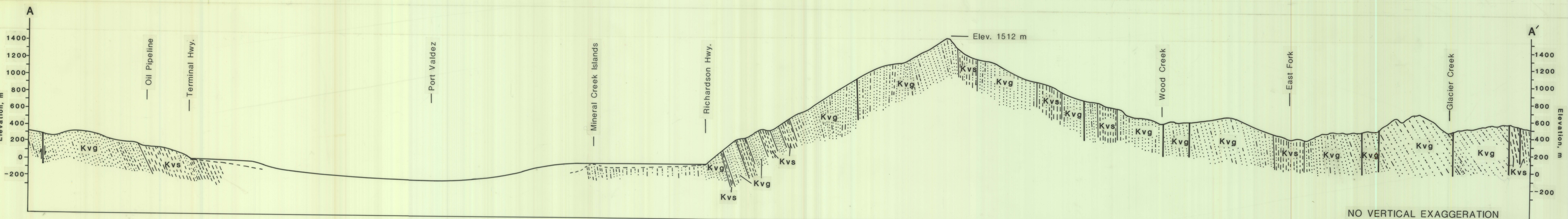
SCALE 1:25,000

CONTOUR INTERVAL 20 METERS

National Geodetic Vertical Datum of 1929

ALASKA Index

Geology by R.G.Updike and C.A.Ulery, 1985-7, with field assistance of R.A.Combellick and J.H.Ewing, and laboratory assistance of K.A.Krause. Chemical analyses by X-ray Assay Laboratories, Don Mills, Ontario, Canada, 1987.



NO VERTICAL EXAGGERATION

BEDROCK GEOLOGY OF THE VALDEZ AREA, ALASKA

by

R.G.Updike and C.A.Ulery

1987

SUMMARY OF THE BEDROCK GEOLOGY

The Valdez Group, which is the bedrock exposed throughout the Valdez Critical Area, is the flysch subterrane of the Chugach Terrane (Plafker and others, 1976; Tysdal and Plafker, 1978) and is generally agreed to be a Late Cretaceous trench-fill sequence which has subsequently accreted to the southern margin of Alaska (Plafker and others, 1977; Zuffa and others, 1980). A Cretaceous age is based upon fossil records reported elsewhere (Jones and Clark, 1973; Tysdal and Plafker, 1978). The comprehensive bedrock geology of the Valdez Quadrangle, including the Valdez Group, is provided by Winkler and others (1981). Although they found a variety of Valdez Group metavolcanic and metasedimentary rocks elsewhere in the region, in the critical area variation is limited to metasedimentary rocks ranging from coarse-grained metagraywacke (or metasandstone) to fine-grained metasiltstone. The various rock textures are often rhythmically intercalated. However, typically one of the end members predominates and the group can be mapped based upon dominant lithology. Sedimentary structures (bedding planes, graded bedding, cross-bedding) are observable. Composition of clasts is predominantly lithic fragments and feldspar, with lesser amounts of quartzose fragments and mafic minerals. The rock is classed as a feldspathic litharenite. Foliation nearly parallels remnant bedding planes, both striking approximately east-west and dipping very steeply north or south, or vertical (see stereonet). One dominant system of joints strikes approximately north-south, perpendicular to the foliation (see stereonet). Foliation and jointing are identical in both map units, however the fine-grained unit, due to weathering, tends to accentuate these structural orientations.

The entire sedimentary package has been deformed under north-south compression to a near-vertical orientation (see cross-section). The combination of a lack of distinctive lithologic horizons and fabric complexity precludes the delineation of folds although tight symmetric folds with near vertical axial planes are suggested. Brittle deformation is represented by three general sets of high angle faults trending approximately east-west, north-south, and N30°W. Reverse and sinistral movement predominate. Metallic mineralization (gold, with minor silver, copper, lead, and zinc) tends to occur disseminated in quartz veins generally parallel to foliation (see stereonet)and in shear zones associated with faults (see Krause, this volume).

Examination of faults and adjacent Quaternary deposits indicate that no compelling evidence for Holocene movement along the mapped faults is apparent. The primary hazard indicated by bedrock mapping is the potential for ground failure due primarily to (a) steep glaciated slopes, (b) steeply dipping planar strata, (c) pervasive planar jointing orthogonal to foliation. Planar slip failures on north-facing slopes and toppling (Sackung) failures on south-facing slopes are indicated. Failures are likely where the finer-textured unit occurs. Differential weathering and erosion results from the metagraywacke unit being more resistant that the metasiltstone unit. Both north and south of Port Valdez there is higher relative abundance of the metasiltstone unit. The physical location of the glacio-marine trough may be in part influenced by this zone of least resistance coupled with a major east-west fault zone. The axes of Valdez Glacier and lower Mineral Creek across lithologic trends may reflect fault zones we could not infer during our mapping.

The two map units described below could not be distinguished on the basis of major oxide or trace element chemical analyses, as reported herein. Similarly, thin section examination of 105 samples disclosed that rock variations are essentially due to rock texture and degree of recrystallization.

Kvs Fine-grained metasedimentary rocks. Medium to dark gray and black siltstone, sandy siltstone, mudstone, and argillite. Thin planar bedding; even or splintery rock cleavage; planar to wavy foliation; distinct planar joints nearly orthogonal to foliation/bedding. Often criss-crossed by fine discontinuous quartz veinlets both parallel and oblique to foliation. In thin section, ductile deformation of matrix (micas, chlorite, calcite, quartz) around more rigid components (feldspar, lithic clasts, quartz, mafic minerals) with micro-shears and kink folds common. Often uniform or wavy simultaneously across entire thin sectionalong foliation, acute to bedding.

Kvg Coarse-grained metasedimentary rocks. light to medium gray metagraywacke (metasandstone). Thin to massive bedding (up to a few meters); weak foliation nearly parallel to bedding; blocky joint pattern nearly perpendicular to bedding; occasional sedimentary structures preserved (cross-bedding, graded-bedding, cut-and-fill). Framework clasts are moderately to poorly sorted, subangular to angular, and chiefly include lithic fragments, feldspar, chert, quartz, and micas. Authigenic minerals are micro-crystalline silica, calcite, clay, albite, and epidote. Thin quartz veinlets and pods are aligned primarily along joint and foliation trends.

Quaternary deposits resultant from various glacial, periglacial, fluvial, marine, and ground failure processes are mapped as " Q " on our map. See Combellick, this volume, for surficial geology studies.

GEOLOGIC MAP SYMBOLS

Geologic unit contact, approximately located

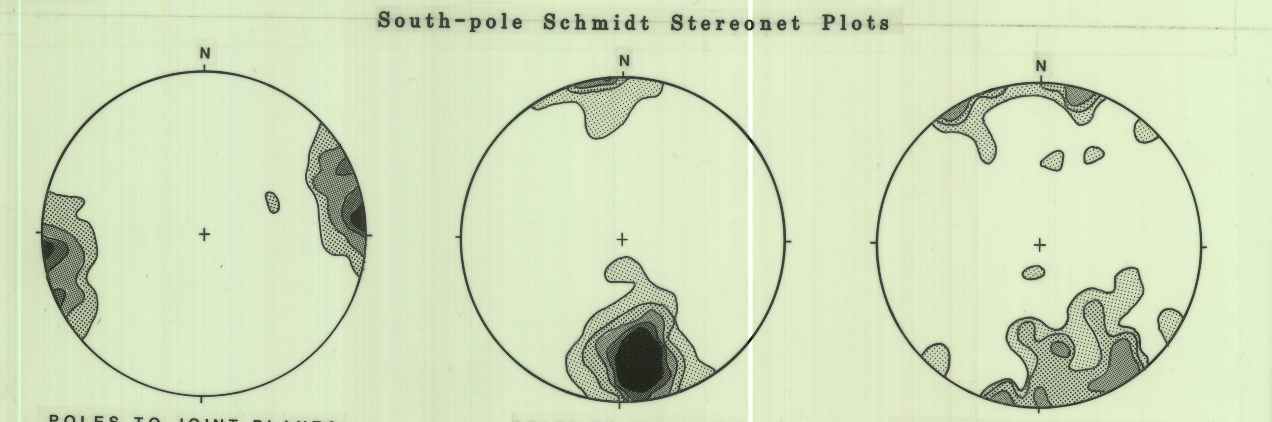
High-angle fault -- Dashed where approximate, dotted were concealed; U, upthrown side; D, downthrown side; arrows show relative movement

80 Foliation attitude -- Respectively, strike and dip of inclined; vertical

70 Bedding attitude -- Respectively, strike and dip of inclined; vertical

V22 Geochemical analysis locality

South-pole Schmidt Stereonet Plots



POLES TO JOINT PLANES
Contours: 2, 4, 8, 12%
per 1% area, max. 14%

POLES TO FOLIATION
Contours: 1, 3, 6, 9, 12%
per 1% area, max.18%

POLES TO QUARTZ VEINS
Contours: 2, 4, 6%
per 1% area, max. 8%

Major Oxide Analyses, X-ray Fluorescence, in percent

I.D.	DESCRIPTION	SIO2	AL2O3	CAO	MGO	NA2O	K2O	FEO	MNO	TIO2	P2O5	LOI	SUM
V1	Sandy siltstone	68.2	13.8	1.23	2.20	3.54	1.64	5.71	0.13	0.68	0.20	2.62	100.1
V2	Siltstone w/ qtz folds	62.5	16.5	0.83	2.75	1.78	2.80	7.66	0.12	0.87	0.24	3.93	100.2
V7	Siltstone w/ qtz pods	66.8	14.2	2.20	2.27	1.16	2.67	5.92	0.14	0.69	0.20	3.70	100.1
V13	Coarse graywacke	67.0	13.4	2.58	3.25	3.04	2.04	5.13	0.09	0.61	0.16	2.47	100.0
V14	Uniform fine siltstone	64.0	15.7	2.16	2.61	2.67	3.14	5.78	0.11	0.77	0.21	2.70	100.1
V16	Uniform coarse graywacke	67.0	13.2	3.68	3.03	3.37	1.78	4.71	0.09	0.61	0.16	2.39	100.2
V20	Fine siltstone	64.3	14.9	2.83	2.37	3.42	1.81	5.92	0.13	0.74	0.18	3.39	100.2
V22	Recryst. graywacke	69.0	12.5	2.61	1.97	3.03	1.86	4.83	0.09	0.64	0.16	3.08	99.9
V26	Distorted siltstone	67.0	15.3	0.79	2.17	2.91	2.23	5.33	0.07	0.74	0.18	3.16	100.1
V38	Fine recryst. graywacke	65.3	14.6	3.23	2.07	4.53	1.38	4.73	0.10	0.65	0.22	3.08	100.1
V47	Sandy siltstone, altered	56.4	18.1	1.53	4.42	3.85	2.16	8.46	0.13	0.94	0.26	3.62	100.1
V49	Silty graywacke	65.7	14.7	1.25	2.59	4.12	1.29	6.62	0.13	0.77	0.19	2.70	100.2
V50	Silty graywacke	66.2	14.0	2.43	2.56	3.06	1.87	5.80	0.10	0.72	0.20	3.08	100.2
V56	Fine graywacke	62.4	15.6	2.03	3.65	2.87	2.24	6.74	0.11	0.80	0.21	3.39	100.3
V65	Recryst. graywacke	69.9	13.4	1.04	2.07	4.30	0.99	5.36	0.09	0.68	0.19	2.08	100.2
V69	Uniform graywacke	66.3	14.4	1.05	2.73	3.39	1.80	6.33	0.12	0.78	0.21	2.85	100.1
V71	Coarse siltstone	60.4	18.2	0.93	2.49	2.65	3.15	6.71	0.08	0.91	0.25	4.00	100.0
AV28	Uniform graywacke	67.0	13.8	2.61	2.81	3.35	1.94	5.01	0.11	0.68	0.16	2.31	100.0
AV52	Siltst./grayw. interbeds	62.4	16.0	3.23	2.65	2.82	2.86	7.13	0.12	0.84	0.20	2.00	100.5
AV60	Altered siltstone	69.0	14.0	0.51	2.11	2.74	2.14	5.62	0.07	0.65	0.19	2.77	100.0
AV62	Recryst. silty graywacke	71.9	12.9	1.01	1.67	3.72	1.39	4.16	0.08	0.60	0.18	2.31	100.1
AV128	Foliated graywacke	68.0	14.0	0.96	2.43	3.53	1.71	5.70	0.10	0.73	0.19	2.62	100.1

Trace Element Analyses
X-ray Fluorescence, in ppm

I.D.	CR	RB	SR	Y	ZR	NB	BA
V1	118	55	369	10	130	20	705
V2	135	104	264	39	136	10	1080
V7	108	96	292	24	124	24	1000
V13	148	60	370	10	136	27	1100
V14	113	116	478	13	107	22	1500
V16	152	66	479	10	113	20	948
V20	102	86	445	15	129	23	802
V22	97	65	251	18	129	12	803
V26	107	90	315	31	167	19	872
V38	84	51	553	28	173	25	743
V47	186	74	470	33	157	19	1010
V49	115	52	481	19	128	25	599
V50	119	65	412	20	139	13	996
V56	168	91	496	18	148	20	1150
V65	124	45	391	14	125	15	455
V69	133	70	329	32	154	19	687
V71	140	125	298	17	189	30	1200
AV28	161	72	526	40	165	14	1140
AV52	112	110	518	12	153	24	1270
AV60	105	81	156	25	118	18	850
AV62	88	52	410	23	143	10	622
AV128	120	61	282	25	138	25	795

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