

UNITED STATES DEPARTMENT OF THE INTERIOR
GEOLOGICAL SURVEY

Stratigraphic sequence measured from Jurassic Todilto Limestone
to Cretaceous Dakota Sandstone, west side of San Juan Basin,
near Crystal, San Juan County, New Mexico

By V. P. Byers

Open-File Report 81-242

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

Crystal Section, west side of San Juan Basin,
San Juan County, New Mexico

Measured 7-8/1980 by V. P. Byers; base of measured section, 36°01'52" N.;
108°58'04"W.

This format was designed in the U.S. Geological Survey for use on the North Slope in Alaska, and modified by A. Curtis Huffman, Jr., and others of the USGS for studies in the San Juan Basin. The section reads from bottom to top in a progression similar to that of a geologist's measurement or study of the section in the field.

The following abbreviations and symbols are used on descriptions:

Abbreviations

	THICKNESS OF BEDDING	cm
vtk	Very thickly bedded; massive	>100
tk	Thickly bedded; blocky	30-100
av	Average bedded; slabby	10- 30
tn	Thinly bedded; flaggy	3- 10
vtn	Very thinly bedded	1- 3
l	Laminated; platy, shaly	0.3- 1
tnl	Thinly laminated; papery, fissile	<0.3
h	Homogeneous; massive	
	CROSSBEDDING	
tr	Trough (festoon)	
cu	Convex upward	
hb	Herringbone	
s	Small scale <u>bed sets</u>	<5 cm thick
m	Medium scale	5 cm-2 m thick
l	Large scale	2m-8 m thick

Abbreviations--continued

CROSSBEDDING--continued

vl	Very large scale	>8 m
t	Tabular	
wp	Wedge planar	
f	Fine	
m	Medium	
c	Coarse	
v	Very	
cgr	Coarse grained	
vc	Very coarse	
av	Average	
wr	Well rounded	
ws	Well sorted	
ss	Sandstone	
gr	Grained	
cly	Clay	<1/256 mm
slt	Silt	1/256-1/16 mm
vf sd	Very fine sand	1/16-1/8 mm
f sd	Fine sand	1/8-1/4 mm
m sd	Medium sand	1/4-1/2 mm
c sd	Coarse sand	1/2- 1 mm
vc sd	Very coarse sand	1-2 mm
grnl gvl	Granule gravel	2-4 mm
f pbl gvl	Fine pebble gravel	4-8 mm
m pbl gvl	Medium pebble gravel	8-16 mm
c pbl gvl	Coarse pebble gravel	16-32 mm

Abbreviations--continued

CROSSBEDDING--continued

vc pbl gvl	Very coarse pebble gravel	32-64 mm
cbl gvl	Cobble gravel	64-256 mm
bldr gvl	Boulder gravel	>256 mm

CPS	Counts per second
BG	Background
ND	Not determined/not determinable
NA	Not applicable
gy	Gray
pk	Pink
rd	Red/reddish
brn	Brown
Grn	Green
yl	Yellow
wht	White
or	Orange

Kd	Dakota Sandstone
Jmw	Westwater Canyon Member of Morrison Formation
Jmr	Recapture Member of Morrison Formation
Js	Summerville Formation, undivided
Jsu	Summerville Formation, upper part
Jsl	Summerville Formation, lower part
Jcs	Cow Springs Sandstone
Jt	Todilto Limestone
Je	Entrada Sandstone

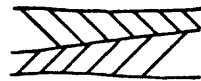
EXPLANATION



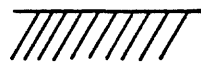
Trough (festoon)



Convex upward



Herringbone



Planar crossbed, nontangential



Planar crossbed, tangential

Sh == == == ==

Shale

Slt :==: ==: ==: ==:

Siltstone

Ss ::::: ::::: ::::: :::::

Sandstone

Cgl ooo ooo ooo ooo ooo

Conglomerate

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Pebbles

Reference cited

Byers, V. P., 1979, Geologic map and sections of the Crystal quadrangle, San Juan and McKinley Counties, New Mexico: U.S. Geological Survey Open-File Report 79-599.

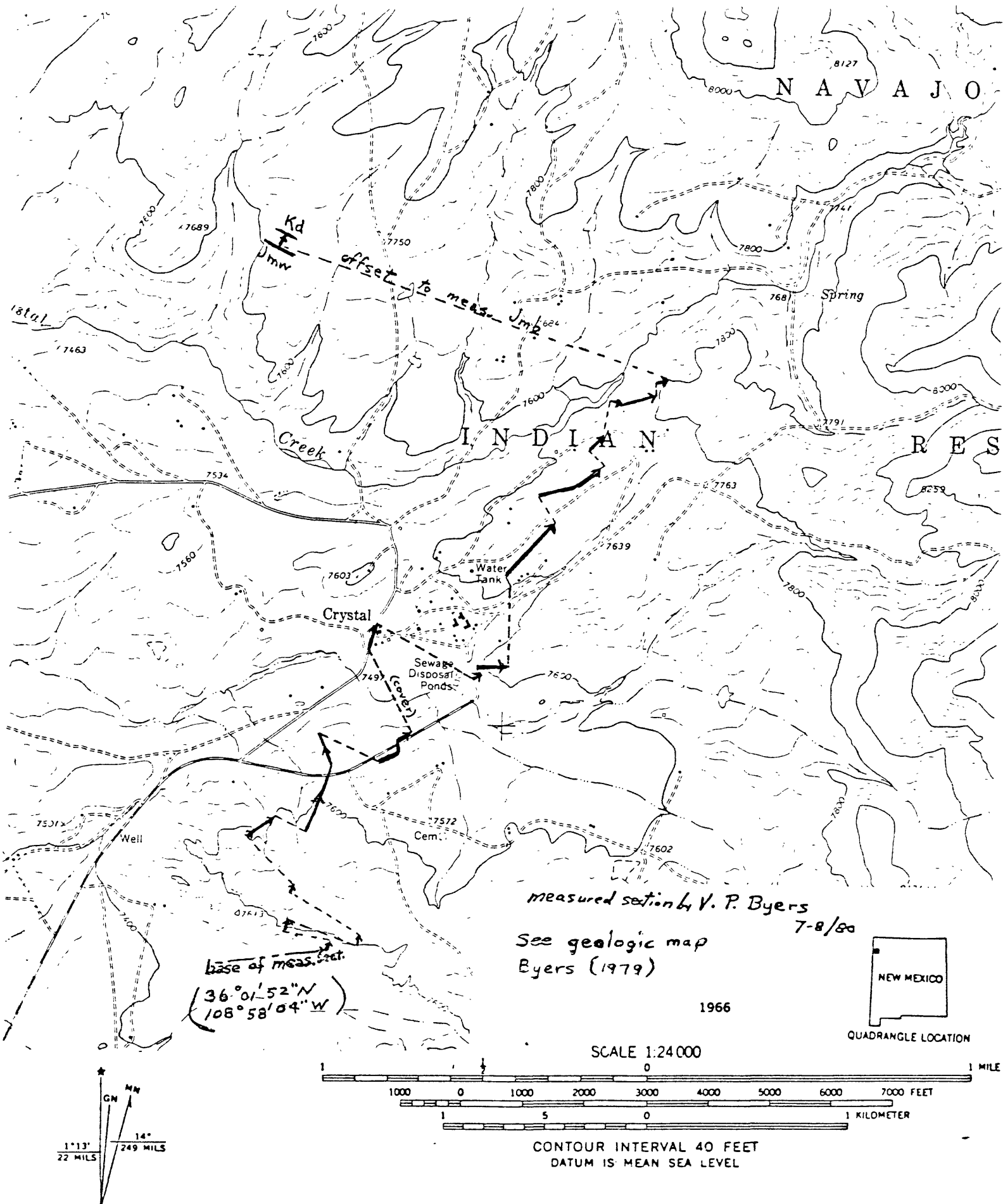


Figure 1.--Index map showing location of Crystal measured section in Crystal quadrangle, New Mexico

[illegible]

It Unit 3a Sample (no #) given to V. Ridgley (8/26/80). Contains alga(?) structures.
 It Unit 2 Sabkha, reworked eolian sandstone
 It Unit 1 Siltstone parting at base of It

(37) 151.9	2	fg ss	1/1	lt. brn	thin bedded	med. scale	sub. rounded	ws	no	<1%	<1%	Sandstone, lg	Eolian dune
(7) 149.9	2	vf9 ss	1/1	lt. brn	thin bedded	med. scale	sub. rounded	ws	very weak	<1%	<1%	Sandstone, ferruginous, blocky weathering (light rounded stepping stones); friable. Bedding 0.2'-0.8" thick.	Flat sand area, usual wind whorl
(5.9) 139.1	2	vf9 ss	1/1	lt. brn	thin bedded	med. scale	sub. rounded	ws	no	<1%	<1%	Sandstone, ferruginous beds of rd brn and lt brn and pale or. 1.5' thick. Lt part is x-bedded. Very thin and thinly bedded.	Eolian dune
(18.5) 116.2	2	vf9 ss	1/1	lt. brn	thin bedded	med. scale	sub. rounded	ws	no	<1%	<1%	Sandstone. Good silica sand. Base ripple marked. (O.V.B.T.) Sandstone. Consisting of ferruginous bands mod. rd. brn about 1' thick alternating with light colored (mod. rd. or) bands. About 12 ft (horizontal) lamination. It is a cliff-former. Base of ferruginous bands are wavy and may be rippled. Pencontemporeous 3' slump 6' wide.	ND
(21.5) 94.6	2	vf9 ss	1/1	lt. brn	thin bedded	med. scale	sub. rounded	ws	no	<1%	<1%	Sandstone, planar x-bed to East. Thinly bedded, ripple marked from distance. Sandstone, vf9, subrounded. Three horizontal ferruginous bands (3-5" thick each) of mottled dk rd brn are 12"-15" apart in upper 1/3 of unit. Ferruginous zones are slightly calcareous. Lt. brn ss is not calcareous. At base of unit is thin mottling and moderate red orange. Some iron bands weather to 6" beds.	East
(11.0) 83.4	2	vf9 ss	1/1	lt. brn	thin bedded	med. scale	sub. rounded	ws	no	<1%	<1%	Sandstone, vf9, friable. Fe mottling parallel to bedding. 1/4" of upper 1/3. Many calcite fillings in upper 1/3. Faint banding parallel to bedding. 0.2' thick ferruginous mottled sandy silty sand. Calcareous along top.	ND
(7) 83.4	2	vf9 ss	1/1	lt. brn	thin bedded	med. scale	sub. rounded	ws	no	<1%	<1%	Sandstone, vf9. Typical of banded Summerville in area. 1'-3' mottled rd brn limonitic bands are 3'-5' apart in massive vf9 ss.	ND

Jsl Unit 14 Thickens to 4'-6' 600' to South

Jsl Unit 12 35° dip East; herringbone, medium scale

228.5

Jmr Unit 32 Sample: 80SUBVB32B (middle part) (Submitted for thin sec. 8/28/80)
 Sample: 80SUBVB32A (near base) (Submitted for thin section, 8/28/80)
 Jmr Unit 31 0.7' Sandstone, vfg to m silty, 0.6' upper swirlshad zone [due to bedding plane shippage?], platy fissile, pale rd brn; thickens & thins laterally; 0.1' base is highly calcareous vfg to m silty ss, mottled lt gn gy & pale rd brn. Environment: quiet water w mud precipitated on sandy bottom.
 Transition unit 26 0.5' Marker zone, friable ss, vfg, lt. gn gy, calcareous, <1% heavy, ND feldspar subrd gr., good porosity, good sorting.
 " Unit 25 0.4' Transition zone, silty ss vfg to mg, mod rd brn, unconsolidated, poorly sorted, noncalcareous except along seams, poor porosity.
 Jcs Unit 24 (0-3') Sandstone, vfg to lg, very friable, cohen, thin x-bed, good porosity, very pale orange to pale orange, weathers low, 1% heavy min, <1% feldspar, very calcareous but friable, may be an old soil profile (?) rounded grains, sorting good.

Jsu Unit 21 Sample: 80SUBVB21C submitted for thin section (8/28/80)
 Jsu Unit 20 0.5' Useful marker bed. Silty ss vfg to mod gr., calcareous, heavies <1%, feldspar ND, sorting poor, porosity poor, pale red with minor mod. brn, lacustrine.

[illegible]

Jmr	Unit 34	Sample: 80SUBVB34CY (submitted for thin section 8/28/80)
Jmr	Unit 33	Ferruginous stain
Jmr	Unit 32	Sample: 80SUBVB32 C.C. (near top) (submitted for thin section 8/28/80)

<p>(22') 4</p> <p>fg to mg ss</p> <p>thin bedded med. scale x-bed.</p> <p>None</p> <p>ps, sr, pebbles, ss</p> <p>slightly calcareous</p> <p>19%</p> <p>19%</p> <p>Base has many clay pebbles. Unit has many channel and scour fills. Scours 3' into channel fill. Channel fill 20' wide by 2' thick.</p> <p>Fluvial, braided (?) streams Higher energy than unit 43.</p> <p>N50°E to N70°E</p>	<p>(28') 18</p> <p>thin beds: vf9 to fg ss</p> <p>Coarsely lam. to thin to av. bed</p> <p>None</p> <p>ps to ms</p> <p>slightly calcareous</p> <p>2-3%</p> <p>19%</p> <p>More bedded, vf9 to mg, thicker bedded, beds are near top, and have subrounded grains, with coarse to very coarse, chert pebbles and clay granules and pebbles. Thin beds, vf9 to fg, & subrounded grains, do not have chert pebbles. Unit has fewer clay pebbles than unit 42. Lighter (pale or.) part is 1-2" lams. Strong horz. lams. unlike unit 42</p> <p>ND</p>	<p>(20.5') 14</p> <p>vf9 to fg ss</p> <p>Massive appearance but in upper part may be low & x-lam. to thin bedded. Lower part low & x-bed in lower part. Grades up into</p> <p>None</p> <p>Poor sort, subangular</p> <p>slightly calcareous</p> <p>1-4%</p> <p>19%</p> <p>Sandstone, vf9 to fg, upper 2' contains common clay pebbles, & calcite boxwork in clay. Chert pebbles med. to v. coarse. Subangular chert throughout unit, smaller in size than in unit 40. Calcite "ribs" (1-3' x 2") Base is wavy, and sharp in places, and locally vf9 is argill. base. Sample #12</p> <p>Low to med. energy fluvial channel</p> <p>ND</p>	<p>(4.6') 4</p> <p>vf9 to mg ss</p> <p>Thin horz. lams. Massive appearance but in upper part may be low & x-lam. to thin bedded. Lower part low & x-bed in lower part. Grades up into</p> <p>None</p> <p>poor sort, subangular</p> <p>Large ly. con</p> <p>19%</p> <p>19%</p> <p>Sandstone vf9 to mg, chert pebbles to v. coarse but smaller and less in amt. than unit 39. Abundant clay pebbles in middle part. Channel & scour at basal contact. Sharp & irregular med. to low</p> <p>N60°E</p>
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Jmr Unit 48 Sample: 80SUBVB48CY (submitted for thin section. 8/28/80); occasionally medium grained, thin ferruginous sandstone zone at base

Jmr Unit 46 Sample: 80SUBVB46CY (submitted for thin section. 8/28/80); mottled color

Jmr Unit 45 Sample: 80SUBVB45CY (submitted for thin section. 8/28/80)

Depth (ft)	Stratigraphic Unit	Grain Size	Color	Bedding	Remarks	Notes
538.8 - 538.4	SS, vf9 to f9, slope-flower, incompetent.	ND	ND	ND	Quiet	
538.4 - 538.0	Sandstone, vf9 to f9, very friable. Midway in unit is a line of dominant chert 8" from base is thin line of dk rd. brn. dominant clay pebbles. 5-10" clayst. gells along base & suborg. clayst. & pebbles.	2%	1%	None	Sort good.	Quiet
538.0 - 537.6	Sandstone, vf9 to f9, 5-6" irreg. 99% concretely, masses of calcite, more flaring into & calc. than grounding up. Sparsely & va chert & rd. brn. clayst. pebbles.	5%	1%	None	Sort good.	Quiet
537.6 - 537.2	Sandstone, vf9 to f9, well-indurated resistant unit. Makes "bumpy sidewalk" & road by Crystal trading post.	5%	1%	None	Sort good.	Slow-moving water
537.2 - 536.8	Thickness is 66' if dip 9.5° is assumed, which agrees with 5' thick ss exposure in the gully. Exposure of 5' ss has a lateral extent of 80'. If dip averages 3° in this interval, thickness may be 20'.					

Unit 56, 0.6' sandy mudstone, dk mod. brn (5YR 3/4), pinches out within 10 m to SE.
15" claystone pebbles at base. Unit includes silt & clay. Envir. is very quiet water.
Poor sort, subrounded.

Depth (ft)	Color	Grains	Bedding	Over- age bed.	None	Sort non- poor, (CaO ₃)	10% at top (mag- ne- tite)	1% (mag- ne- tite)	Notes	ND
597.8 (4.5')	light gray	vfq to cg ss	thin to thick bedded	None	Sort poor, (CaO ₃)	10% at top (magnetite)	1% (magnetite)	Sandstone, vfq to coarse, variable, some beds coarser, friable. Coarsens upward. Pebbles at top. Weathers to moderate to gentle slope. Few qtz grains (authigenic qtz) bar (1% or less). Subangular, subrounded. Some beds are fg to vfq. Upper middle part very thin bedded, platy, lam.	Sample #BOSUBVB65CY (Submitted for thin sec. 8/28/80)	ND
595.3 (24.5')	light gray	fg to cg ss	indistinctly laminated	None	Sort poor, (CaO ₃)	5% (all are sr)	2%	Sandstone, silty, vfq to mg; not exposed (dug out). Sandstone, fg to cg, friable. Very coarse chert pebbles. Few fine interbedded fine ss. Grades to finer grains upward. Then unit 62.	Over-bank Swift ND	ND
568.8 (7')	light gray	fg to cg ss	thin bedded	None	Sort poor, (CaO ₃)	10% (all are sr)	2%	Sandstone, fg to vfq, pebbles & granules, arkosic, friable. Unit has (shallow) trough & x-bed. Groundmass generally fine. Has more clay partings along scab of laminae, horis. Lt. brn rounded qtz - 1st fine ss. SS, silty, friable, vfq to 3rd thin bedded of 1st, gray, locally mottled w gray. Silty claystone. Sandstone, with some silty laminae. Thick lam. are gray, rd. Resistant ledge. Some	High energy to N60E N65E	ND
566.1 (4.2')	light gray	fg to cg ss	thin bedded	None	Sort poor, (CaO ₃)	10% (all are sr)	2%	Sandstone, with some silty laminae. Thick lam. are gray, rd. Resistant ledge. Some	High energy to N60E N65E	ND

Unit 60 0.9' Silty claystone, gy rd to dk. red. brn sort good, sr, non-lac

COUNTY... San Juan

Unit 74 Sample: 80SUBVB74CY (Submitted for thin section 8/28/80.)

Unit 72 Sample: 80SUBVB72CY (Submitted for thin section 8/28/80.)

Locality	Sample	Depth (ft)	Stratigraphic Unit	Color	Texture	Bedding	Grains	Matrix	Notes
861.4 (1)	860.4	3.5	clay-stone	dk. brn	fine	thin	fg to mg	ss	Uppermost 2' pinches out N 20° E
867.4 (3)	867.4	3	clay-stone	dk. brn	fine	thin	fg to mg	ss	Uppermost 2' pinches out N 20° E
838.2 (19.2)	838.2	3	clay-stone	dk. brn	fine	thin	fg to mg	ss	Uppermost 2' pinches out N 20° E
826.2 (1)	826.2	2	clay-stone	dk. brn	fine	thin	fg to mg	ss	Uppermost 2' pinches out N 20° E
825.2 (4)	825.2	2	clay-stone	dk. brn	fine	thin	fg to mg	ss	Uppermost 2' pinches out N 20° E
821.2 (16)	821.2	2	clay-stone	dk. brn	fine	thin	fg to mg	ss	Uppermost 2' pinches out N 20° E
805.2 (4.5)	805.2	2	clay-stone	dk. brn	fine	thin	fg to mg	ss	Uppermost 2' pinches out N 20° E
800.7 (4.5)	800.7	2	clay-stone	dk. brn	fine	thin	fg to mg	ss	Uppermost 2' pinches out N 20° E

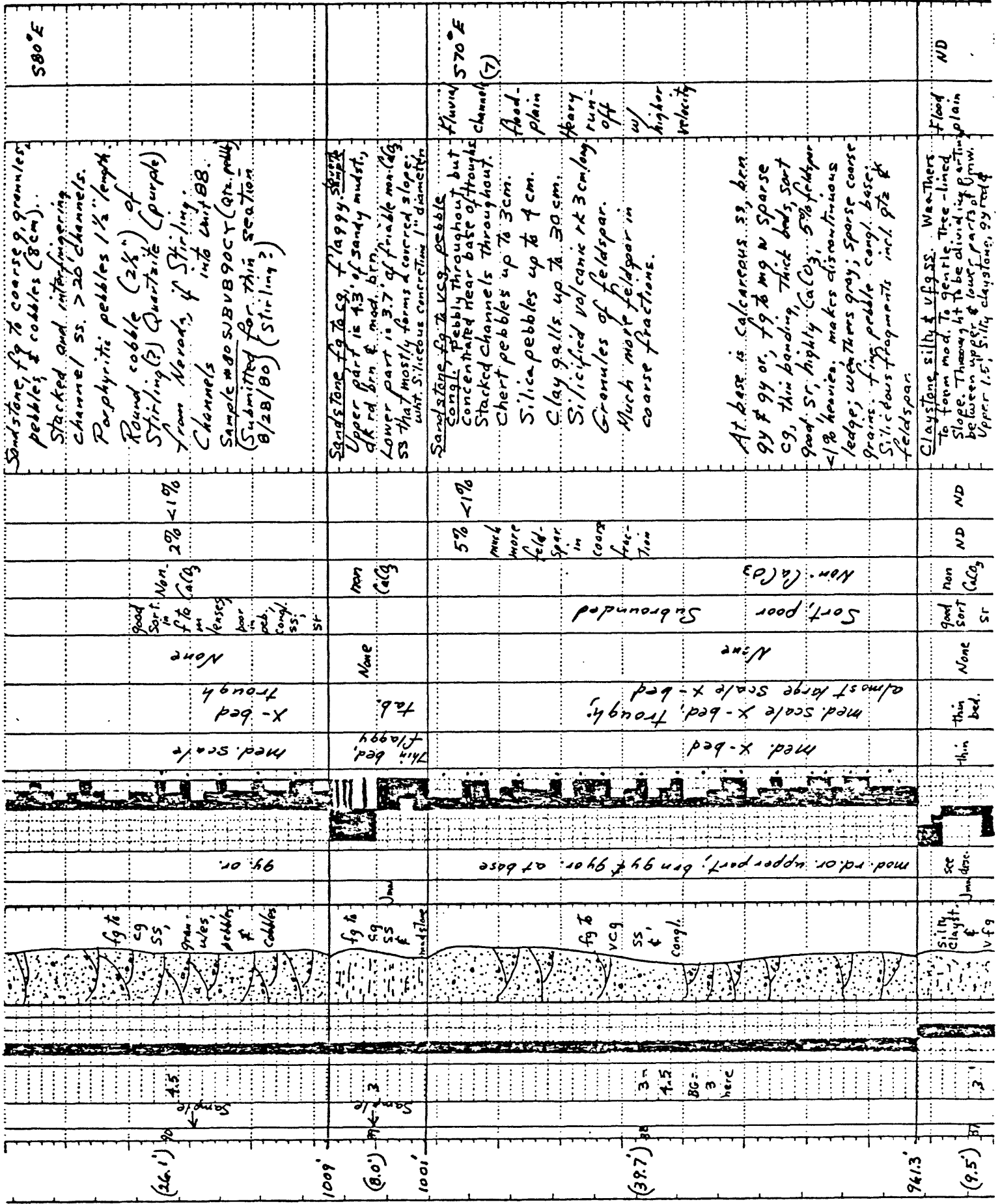
Unit 83 Jmw Pbbles in one count: Pink rhyolite, 4; "Bull" quartz, 1; quartzite, 1;
 Silicified rhyolitic volcanic, 4; chert, 4; K-feldspar, 1 (K-feldspar, chert,
 quartzite, and silicified volcanics comprise most of granules).

Unit 82 Jmw Sandstone, pebbly, ledge former, fine, mg to vc, H. brn. 5YR6/4, weathers gray;
 av. bed, poorly sorted, CaCO₃, common granules and sm. pebbles and rare angular
 1" peb, sm pebbles and granules largely feldspar. Matrix of rock 10% feldspar. 19%
 25. min. High energy fluvial.
 = Unit 80 Jmw Samples: 80SUBVB00AC1 & 80SUBVB00B0CY (Submitted for thin sec. 8/28/80)
 Unit 78 Jmr Calcareous sandstone, f9 to med. 9, gy. or. mottled w v pale or., good sorting,
 subrounded grains.

Unit 77 Jmr Sample: 80SUBVB77CY (Submitted for thin section. 8/28/80)

Locality	Stratigraphic Unit	Thickness (ft)	Color	Bedding	Grain Size	Sorting	Remarks
951.0'	9y red purple, middle 3', lt. gray sand, vfg, w sorted, lower 5', sandy mud, dk brown (not bentonitic)	55.0'					
(52.1)	Sandstone, fg to mg, & mg to very coarse g; channels throughout; channels into units 85 & 84, and is indistinguishable from unit 83. Broad channels greater than 20' VC and granules and pebbles. The welded pink rhyolite clast has flattened pumice. Lt grn qtz, vf ss, at top. Upper 5' forms slope, fg to vf g ss. No granite, just porphyritic rhyolite & pink rhyolitic welded tuff (over) observed. Pebbles are chert (30%) 9 1/2 (15%) & feldspar (50%), rhyolites & others (5%) in lower part. In upper part pebbles are rare, granules common.	52.1'					
899.8'	Near top is another zone of discontinuous qz calc. ledges. Sample #805JBVB86CY (p. 16) Submitted for this sec. 8/20/80	7.2'					
(7.2)	Sandstone, fg to cg, w rare granules. Up to 3' x 10' concretionary masses cemented w CaCO3. Lower part weathers to slope & has CaCO3. Upper part weathers to large "concretionary" masses.	7.2'					
892.4'	Sandstone, silty at base, grading up into sandy mudstone.	2.1'					
(2.1)	Sandstone, fg to cg, upper part med. to v coarse w/ pebble congl. Uppermost 2' ss, fg to mg, tabular, 9y. or, sort good, sr, ledge-former. In upper part sparse granules & pebbles of quartzite, much chert, Jasper, mostly K-feldspar. Pebbles up to 1 1/2" of silicified	2.1'					
890.6'		3'					
(29.2)		25.5'					

Unit 86	Jmw	Detrital pebble, pink rhyolite (under microscope) is probably ash flow tuff from widespread ash flow sheet, probably with a volume of 500 cubic miles, large outcrop area; eroded from the western continental margin, Great Basin, of Utah or Nevada (pre-Jm in age, could be T ₂ , as some feldspars are altered) during up lift of Great Basin, precursor to Nevadan orogeny.
Unit 84	Jmw	also lake pond / splay



Imw Unit 89

Sample: 80SUBVB89CY (concretionary, $\pm 2"$ diameter)
Submitted for thin section 8/28/80

[illegible]

Subangular

Unit 94 Jmb

Sandstone, silty, f9 to v f9, & m9, & sandy mudstone, somewhat clayey. Sub to r, few
Color: white to pink. 94 5YR8/1 & along strike lt grn gray (bentonitic).
Mottled with dusky y l grn in upper 2'. Sparse rounded sand grains.

Unit 93 Jmb

(Dex. cont.) lithologic change from ss to sandy mudstone. Has to be dug out. Weathers to gentle slope.
Color: mudstone, dk rd brn; sandy mudstone, dk rd brn; ss, wht to dusky y l grn along strike.

Unit 92 Jmw

Along strike, weathers to pale brn grading up to white or lt. gray in slope.

