U.S. DEPARTMENT OF THE INTERIOR
U.S. GEOLOGICAL SURVEY

MISCELLANEOUS INVESTIGATIONS SERIES
MAP I–2555
Pamphlet accompanies map

EXPLANATION FOR MEASURED SECTION

Depositional environment

- AL Alluvial
- DP Delta plain
- DF Delta front
- PD Prodelta
- IT Intertidal
- SpT Supratidal
- SSbT Shallow subtidal
- SM Shallow marine
- OM Open marine
- ME Marine evaporite

Color

- B Brown
- Bl Black
- G Gray
- Gr Green
- O Olive
- Or Orange
- Pk Pink
- R Red
- Y Yellow
- D Dark
- L Light
- M Medium
- P Pale

Accessory features

- Bioturbation
- Carbonaceous debris
- Carbonate nodule
- Chert
- Convolute bedding
- Flame structures
- Flute casts
- Horizontal burrow
- Indeterminate fossil fragment
- Intraformational clast
- Load casts
- Mudcrack
- Plant fragment
- Root cast
- Vertical burrow
- Vug, filled or empty
- Wood
- A Abundant
- M Mica
- P Pyrite

Carbonate fabric

- M Mudstone
- W Wackestone
- P Packstone
- G Grainstone
- X Crystalline

Brachiopods and molluscs

- ● Dot indicates identified in sample, queried where identification is uncertain

Lithologic symbols

- Calcareous sandstone
- Calcareous shale
- Claystone-shale
- Conglomerate
- Dolomite
- Dolomitic siltstone
- Gypsum
- Interbedded siltstone and sandstone
- Limestone
- Sandstone
- Sandy limestone
- Shaly limestone
- Shelly limestone
- Siltstone
- Covered

Sedimentary Structures

- Current ripples
- Wave ripples
- Ripples of unknown origin
- Climbing ripples
- Wavy nonparallel laminations
- Wavy parallel laminations
- Parallel discontinuous laminations
- Hummocky cross-stratification
- Trough cross-stratification
- Tabular planar cross-stratification
- Low-angle stratification
- Parallel lamination
- Scour and fill
- Wavy bedding
- Flaser bedding
- Lenticular bedding
- Lateral accretion bedding

Carbonate petrography

Descriptive terms

- Alg Algal
- Alt Altered
- Bl Bioclastic
- Calc Calcareous
- Carb Carbonaceous
- Cs Coarse
- Dlst Dolostone
- Dol Dolomitic
- Fn Fine
- Fos Fossiliferous
- Frct Fractured
- G Glauconitic
- Ga Gastropod
- L Lignite
- Lam Laminated
- Lmst Limestone
- Lmy Limy
- Nod Nodule
- OM Organic matter
- Ool Oolitic
- Pel Peloidal
- Py Pyrite
- Sh Shale
- Silic Siliclastic
- Silicf Silicified
- Sir Silica replacement
- Slt Siltstone
- Slty Silty
- Sndy Sandy
- Ss Sandstone
- Str Strongly
- T Trace
- U Unknown
- VFn Very fine
- Wth Weathered
- * Open porosity
- ? Presence or amount of component uncertain

Fabric

- M Mudstone
- W Wackestone
- P Packstone
- G Grainstone
- X Crystalline

Matrix and other constituents

- Cl Clay
- Dmsp Dolomicrospar
- Dsp Dolospar
- Gyp Gypsum
- M Micrite
- Msp Microspar
- Q Quartz
- Si Silica
- Sp Spar

Depositional environment of carbonate sample

- SpT Supratidal
- IT Intertidal
- SSbT Shallow subtidal
- OM Open marine

Clastic petrography

Grain size

- VF Very fine
- F Fine
- M Medium
- C Coarse
- VC Very coarse

Grain-to-grain contact

- F Floating
- CC Concave-convex
- L Long
- P Point
- S Sutured

Sorting

- P Poor
- M Moderate
- W Well

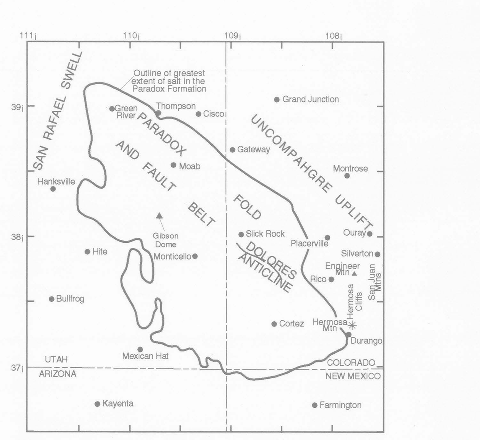


Figure 1. Location map showing the Paradox Basin and surrounding geologic features. Star shows location of Hermosa Mountain measured section.

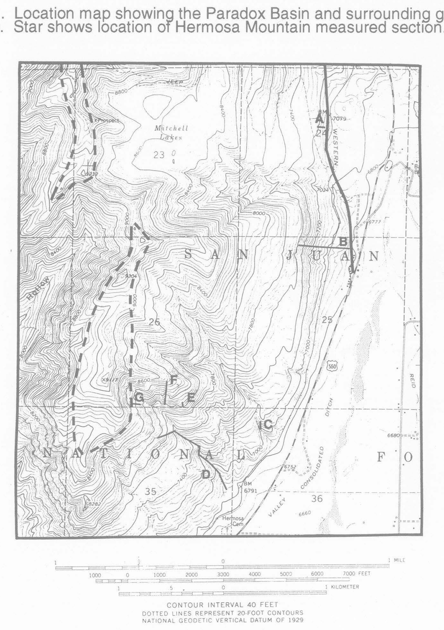
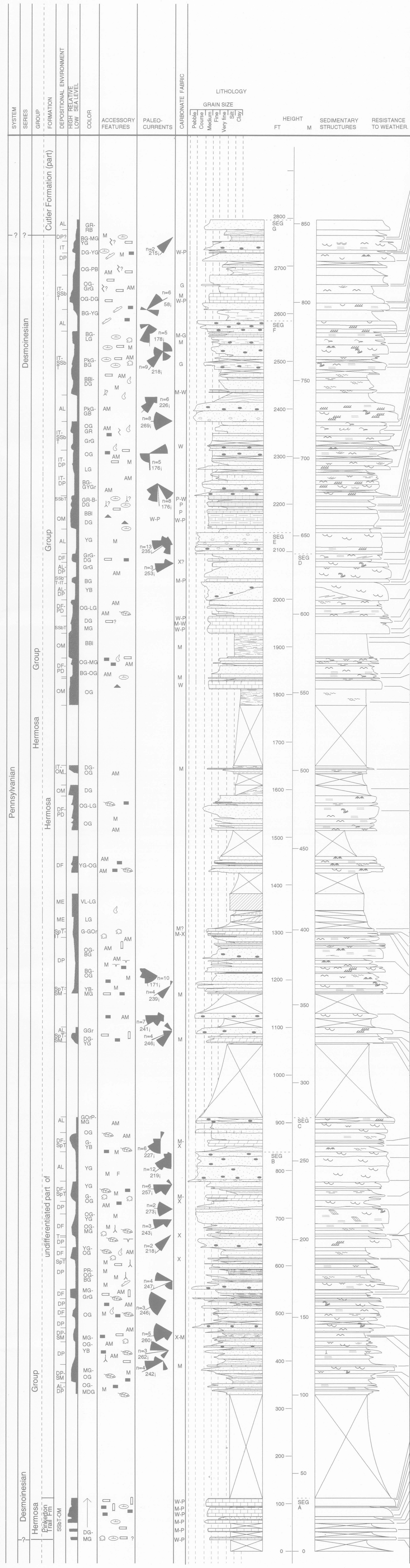


Figure 2. Location map of the Hermosa Mountain measured section, Colo. Segments of the measured section A, B, C, D, E, F, and G shown on the lithologic column. The Hermosa Group lies between the Leadville Limestone (approximate top shown by the solid heavy line) and the Cutler Formation (approximate base shown by dashed heavy line). Base map from the U.S. Geological Survey Hermosa 71/2-minute quadrangle, 1963.



BRACHIOPODS AND MOLLUSCS

Columns 1–29 list brachiopods; columns 30–35 (Edmondia sp. through Permophorus sp.) list molluscs.

SAMPLE NUMBER	SAMPLE NUMBER	Anthracospirifer sp.	Anthracospirifer curvilateralis chavezae Sutherland and Harlow	Antiquatonia sp.	Antiquatonia coloradoensis (Girty)	Antiquatonia cf. A. hermosana (Girty)	Antiquatonia portlockiana (Norwood and Pratten)	Beecheria sp.	Chonetinella sp.	Cleiothyridina orbicularis	Composita sp.	Composita ovata Mather	Composita subtilita (Hall)	Derbyia crassa (Meek and Hayden)	Derbyia hooserensis Dunbar and Condra	Desmoinesia sp.	Echinaria sp.	Kozlowskia montgomeryi Sutherland and Harlow	Kozlowskia splendens? (Norwood and Pratten)	Kozlowskia sp.	Linoproductus sp.	Linoproductus cf. L. platyumbonus Dunbar and Condra	Mesolobus mesolobus	Neospirifer sp.	Neospirifer cf. N. cameratus (Morton)	Orbiculoidea sp.	Punctospirifer sp.	Retaria lasallensis (Worthen)	Retaria cf. R. lasallensis (Worthen)	Sandia sp.	Edmondia sp.	Ianthinopsis sp.	Leptodesma sp.	Limipecten sp.	Myalina sp.	Permophorus sp.
PH91KF105	H91DB36@ 2733'																				●															
PH91KF104	H91DB35@ 2731'																																			
PH91KF103	H91DB34@ 2730'																																			
PH91KF102	H91DB33@ 2726.5'																																			
PH91KF100	H91DB32@ 2659-2660'																																			
PH91KF99	H91DB31@ 2632-2657'																														●					
PH91KF96	H91DB30@ 2585-2605'						●					●	●								●						●?									
PH91KF92	H91DB29@ 2551.5'																																			
PH91KF90	H91DB28@ 2498'																																		●?	
PH91KF89	H91DB27@ 2465'																														●					●
PH91KF88	H91DB26@ 2463'																				●										●					
PH91KF87	H91DB25@ 2433'										●												●									●				
PH91KF83	H91DB24@ 2327'																																			
PH91KF78	H91DB23@ 2188-2195'	●																			●			●										●?		
PH91KF77	H91DB22@ 2182-2187'	●									●																									
PH91KF76	H91DB21@ 2177-2180'		●																												●		●?			●?
PH91KF74	H91DB20@ 2168-2177'		●									●										●			●											●?
PH91KF75	H91DB19@ 2153'			●								●																								
PH91KF73	H91DB18@ 2153'			●							●																									
PH91KF66	H91DB17@ 2036'					●						●																								
PH91KF62	H91DB16@ 1952'			●																	●	●														
PH91KF61	H91DB15@ 1935'	●		●							●																									
PH91KF60	H91DB14@ 1930'										●										●															
PH91KF59	H91DB13@ 1928'			●				●?	●		●					●			●								●									
PH91KF53	H91DB12@ 1803'																				●															
PH91KF45	H91DB11@ 1293.5'																																			
PH91KF32	H91DB10@734'																																			
PH91KF26	H91DB9@626'										●																									
PH91KF21	H91DB8@502'																																			
PH91KF15	H91DB7@391'										●																									
PH91KF12	H91DB6@ 110.5'	●									●																									
PH91KF10	H91DB5@ 96-102'		●		●							●		●?		●?				●																
PH91KF9	H91DB4@89'											●						●																		
PH91KF8	H91DB3@84'				●									●	●?													●								
PH91KF6	H91DB2@66.5'																									●?										
PH91KF5	H91DB1@64'		●							●							●?												●	●?						

CLASTIC PETROGRAPHY

CLASTIC SAMPLE COMPONENTS-ESTIMATED VOLUME PERCENT

SAMPLE NUMBER	GRAIN SIZE	GRAIN-TO-GRAIN CONTACT	SORTING	QUARTZ	PLAGIOCLASE	POTASSIUM FELDSPAR	SEDIMENTARY ROCK FRAGMENTS	METAMORPHIC ROCK FRAGMENTS	UNIDENTIFIED ROCK FRAGMENTS	CHERT	DETRITAL CARBONATE	CALCITE	DOLOMITE	ANHYDRITE	CLAY	MUSCOVITE/ BIOTITE	HEMATITE	ORGANIC MATTER	POROSITY
PH91KF105	M	CC	M	68	7	5	0	5	0	1	0	0	0	1	1	1	0	1	1
PH91KF101	C	CC	1	35	15	10	0	7	0	0	0	20	0	1	1	1	1	0	1
PH91KF100	F	CC	G	30	5	5	0	0	0	0	0	30	27	0	0	2	0	0	1
PH91KF96	M	CC	M	39	10	5	1	1	0	1	1	1	0	0	20	1	0	0	20
PH91KF94	M	P	M	29	3	30	2	5	0	1	0	20	0	1	0	5	0	1	3
PH91KF90	M	P	M	32	7	15	1	0	0	1	2	30	0	5	5	1	0	32	0
PH91KF88	F	CC	M	30	5	15	5	0	0	1	1	0	20	1	11	10	0	0	1
PH91KF86	VC	S	P	20	5	23	0	30	0	0	0	5	0	0	3	0	0	0	10
PH91KF84	F	CC	M	30	5	15	0	0	0	0	0	5	0	30	5	10	0	0	0
PH91KF83	VC	P	P	20	3	20	0	7	0	1	10	37	0	1	0	1	0	0	0
PH91KF82	F	P	M	30	5	7	5	0	0	0	0	10	25	0	12	5	0	1	0
PH91KF81	F	P	M	40	5	10	5	0	0	0	0	0	10	0	25	5	0	0	0
PH91KF80	C	P	P	46	5	15	1	10	0	0	1	20	0	1	0	1	0	0	0
PH91KF72	C	CC	M	43	10	25	1	5	1	1	0	1	1	0	5	1	0	1	5
PH91KF71	C	S	P	41	7	20	1	15	1	1	0	0	0	1	0	0	0	3	5
PH91KF70	M	CC	P	42	5	20	1	5	0	1	0	0	15	0	5	0	0	1	6
PH91KF69	F	L	M	35	5	10	0	0	0	0	0	5	25	0	0	10	10	0	0
PH91KF65	M	P	M	25	5	30	1	0	1	1	1	0	0	0	25	1	5	0	0
PH91KF64	C	S	P	5	10	30	1	42	0	0	0	1	0	0	5	1	5	0	0
PH91KF56	M	P	M	40	7	5	1	0	0	1	1	3	10	1	28	3	0	0	0
PH91KF50	M	CC	M	48	2	25	1	0	0	1	1	1	0	0	10	1	0	0	10
PH91KF42	M	CC	M	58	15	1	5	5	1	1	0	1	0	0	5	3	0	0	5
PH91KF41	C	CC	P	50	5	10	0	5	0	0	0	12	0	0	5	1	0	1	12
PH91KF34	VC	S	P	10	5	20	3	40	0	1	1	1	0	0	5	0	0	5	8
PH91KF33	VC	S	P	15	5	15	0	30	0	0	8	5	15	0	5	1	0	1	0
PH91KF31	F	CC	M	40	5	25	5	1	1	0	0	1	2	0	7	5	1	1	6
PH91KF27	M	CC	M	40	5	10	5	1	0	0	0	0	20	0	10	5	0	1	0
PH91KF24	F	CC	M	30	3	0	10	1	0	1	0	0	5	0	40	5	0	5	0
PH91KF22		P	P	40	2	1	0	3	1	1	0	0	0	0	40	11	0	1	0
PH91KF21	F	CC	M	45	2	0	5	1	0	0	0	2	20		17	1	0	5	2
PH91KF20	C	CC	P	10	1	0	5	60	1	1	0	0	1	0	13	1	7	0	0
PH91KF14	M	CC	M	40	0	5	5	0	0	0	0	20	0	0	15	10	0	2	0

CARBONATE PETROGRAPHY

CARBONATE SAMPLE MINERALOGY-ESTIMATED VOLUME PERCENT=100 (Calcite through Other); ALLOCHEMS +MATRIX+CEMENT- ESTIMATED VOLUME PERCENT=100 (Algae through Cement)

SAMPLE NUMBER	DESCRIPTIVE ROCK NAME	FABRIC	CALCITE	IRON CALCITE	DOLOMITE	IRON DOLOMITE	QUARTZ	CLAY	OTHER	ALGAE	FORAMINIFERA	ECHINODERM	SPONGE	BRYOZOAN	BRACHIOPOD	PELECYPOD	OSTRACODE	BIOCLAST	LITHOCLASTS	OTHER	MATRIX, QUARTZ GRAINS, SI, CLAY	CEMENT	DEPOSITIONAL ENVIRONMENT OF CARBONATE SAMPLE
PH91KF107	Fn Silic Lmst nod in Ss matrix	M	45				25	30		T											100 M, Q, Sp, Cl		SpT-IT?
PH91KF106	Fn Silic Lmst nod in Ss matrix	M	90				10			< 1											100 M, Sp, Q		SpT-IT?
PH91KF104	Fos Alg Lmst	Bl W	95					3	2	19	T	1			T	10		7			63 M, Cl		IT
PH91KF103	Fos Alg Lmst	Bl P	95					5		36	3	2		T	25			2			32 M, Cl		IT
PH91KF102	Silic Bl Lmst	Bl W	90				10			4	3	1		2	4	T	1	10			75 Sp, Q		IT
PH91KF99	Silic Bl Lmst	G ?	55				30	5	10 TG	3 ?	T	5		T	2			4			51 Q, M, Cl	35 Sp	IT
PH91KF98	Bl Foss Lmst	Bl W	90 ?					10		7	4		3		15	3 Ga	3	7			58 M, Cl		SSbT
PH91KF97	Silic Foss Lmst	Bl W	90 ?				10	T		8	9		7			9 Ga	1				66 M, Q		SSbT
PH91KF95	Pel Silic Lmst	G	50 ?				50 ?												3	15 Pel	82 M, Q		IT?
PH91KF93	Silic Pel Lmst	M	80 ?		10 ?		10			T									7	25 Pel	68 M, Q		SSbT
PH91KF92	Silic Ool Fos Lmst	Bl Ool P	85		5		10		T	20		T				20 Ga			1	40 Ool	19 M, Q		SSbT
PH91KF91	Silic Lmst	M	75		5		15	T	5 L	2								7			91 M, Q, L		IT-SSbT
PH91KF89	Silic Bl Lmst	G	55				37		8 L	8	2	3		T	10			20		T Ool	43 Q, L	14 Sp	SSbT
PH91KF87	Lmst	Bl M	80					20			T	T		T	4						96 Sp, Cl		IT
PH91KF85	Lam Bl Ss		35				50		15 L	T		1						15			65 Q, L	19 Sp	SSbT
PH91KF83	Cs Silic Bl Lmst	Bl W	45		35		20				1	T		1	20		1	15	2		60 Sp, Q		SSbT
PH91KF79	Fn Ool Pel Lmst	Ool Bl G	89		5		5	1		2		T			T		T		3	85 Ool	6 Q, Cl	4 Msp	SSbT
PH91KF78	Silic Lmst	W	55		10		20	10	5	2	T							3			95 Q, Cl, Msp		OM
PH91KF77	Cs Silic Bl Lmst	Bl P	60				30	8	2		1	12		3	10			25			49 Q, Cl, Sp		OM
PH91KF76	Cs Silic Bl Lmst	Bl P	35		?		20	25	20 T	T	1	18		7	4			5			65 Si, Cl		OM
PH91KF74	Silic Bl Lmst	Bl W	46				5 Si 46 Q	3				1	20	25	T		3	5			46 Q, Si, Cl		OM
PH91KF75	Bl Dol Lmst	Bl W	70		29		T	1	T			3	T	6	1			15			68 Sp	7 Sp	OM
PH91KF73	Fos Lmst	Bl P/G	80					19	1		25	25	T	3	7		T	5	1		34 Msp, Cl		SSbT
PH91KF68	Sndy Lmst	M																					
PH91KF67	Bl Dlst	Pel Bl P	10		85			5	T	1	T	6		1	3	1	1	10	4	2	71 Dmsp, Cl		SSbT-IT
PH91KF66	Bl Lmst	Bl M	85		15				T		4				1			3			92 Msp		SSbT
PH91KF63	Bl Lmst	Bl W	100						T	T	12	1			1	6 Ga	1	10			69 Msp		SSbT
PH91KF62	Lam Lmst	M	75				7		18		T				1			3			96 M, Q		SSbT
PH91KF61	Fos Lmst	Bl W/P	75				5 Si	20		T ?	3	14		17	12		1	20			33 M, Cl		SSbT
PH91KF60	Fos Lmst	Bl P	89					10	1 Py		2	40		10	7		1	10			30 M, Cl		SSbT
PH91KF58	Lam Silic Lmst	M	50				19	30	1									30			70 M, Q, Cl		OM
PH91KF57	Lmy Ss	M	49				50	1	T Py									20		3 Pel	77 M, Q, Cl		OM
PH91KF55	Fn Silic Lmst	M	80				20														100 M, Q		OM
PH91KF54	Bl Lmst	Bl W	100			T		T	T	T?	2	6	6	7	10	2	1	20			42 M	4 Sp	OM
PH91KF53	Lam Carb Slt	M	46		3		20	30	1				10					30			60 Q, Cl, M		OM
PH91KF52	Lam Dol Slt	M	3		85		5	2	5 U												100 Q, Cl, Dmsp, U		IT?
PH91KF49	Strongly Altered Lmst	M ?	88				T	7	5											17*	83 Msp		IT-SpT
PH91KF48	Calcrete Hardpan ?	M ?	72				15		13 U											12*	88 Msp, Q, U		SpT
PH91KF46	Dlst	M	1		97	1			1	T									25		75 Dmsp		IT-SpT
PH91KF47	Calc Dlst	M	25		70			4	1	2										2*	96 Dmsp, Cl		SpT
PH91KF45	Dlst	M	2		92		2	1	3 Py									2			98 Dmsp		SpT
PH91KF44	Sndy Slty Dlst																						
PH91KF43	Calc Dlst	M	5		95							<3									97 Dmsp		SpT
PH91KF40	Dlst	M			100																100 Dmsp		IT
PH91KF38	Dlst	X	7		93			T				1									99 Dsp		SpT
PH91KF36	Calc Dlst	M	7		88	3		2	T												100 Dmsp		SpT
PH91KF35	Fn Dlst	X		98					2?												100 Dmsp		SpT
PH91KF32	Dlst	X	5		95													2			98 Dsp		SpT
PH91KF29	Lmst	X	98					2 OM												5*	95 Sp		IT-SpT
PH91KF30	Lmst Hardpan	Wth	100																				SpT
PH91KF28	Frct Dlst	X	2		98		T														100 Dsp		IT
PH91KF26	Dlst	X			100															3 Pel	97 Dsp		SpT
PH91KF25	Slty Dol Lmst	X	95		5															8*	92 Sp		SpT
PH91KF19	Dlst	X			99		1 Si					T									100 Dsp		SpT
PH91KF17	Calcrete?																						SpT
PH91KF15	Dol Lmst	M	85		15	T	T	T	T Gyp						2			3			95 M		SpT
PH91KF12	Bl Lmst	Bl W	99				1 Si			T	4	7	10	2	3			20			54 M		SSbT
PH91KF11	Calc Slt	Bl W	10	69	3	2	1 Si T Q	15	T		4	7	3	T	1			30			55 Cl, M		SSbT
PH91KF9	Fos Lmst	Bl W	98				1 Si	1	T Py		4	3	10	T	2		T	15 Pel			66 Sp		OM-SSbT
PH91KF8	Silic Bl Lmst	Bl W	93	2			1 Si 3 Q		1 Py		4	6	2	1	4			20 Pel		4	59 M		OM-SSbT
PH91KF7	Spongiostrome	Bl W/P	70		T	3	27 Si					1	49					18			32 Si, M		OM
PH91KF5	Calc Sh ?	Bl W/P	40	5		12	3 Si	40	T Py	?		T	10		3 Pel			5			82 Si, Cl, M		OM
PH91KF3	Bl Lmst	Bl P	78	2	16	1	1 Si	2	T	1	1	25	20	4	5			20		T	24 M,Cl		SSbT
PH91KF2	Bl Lmst	Bl W	71	2	5	2	18	1	1		T	5		T	3		T	5			87 Sp,Q		SSbT
PH91KF1	Cs Bl Silic Lmst	Bl W	50	T	T		45	T	5		2	40			4			3		1	50 Q, M		SSbT

COMMENTS

Highest carbonate unit in the Hermosa Group is at 2755-2762 ft (840-842 m) and consists of amalgamated siliciclastic limestone nodules containing minor algal material, shrinkage cracks, and fenestral fabric indicating an inter- to supratidal depositional environment. The base of the Cutler Formation is placed at the top of this carbonate unit. Units within the Cutler are characteristicly grayish red to reddish brown and of continental origin. Carbonate within the Cutler consists of carbonate nodules of pedogenic origin.

Carbonate unit from 2726-2733 ft (831-833 m) consists of 1 ft (30 cm) thick wackestone beds and lenses of limestone nodules interbedded with mudstone. Algae, including phylloid algae, is abundant but has low diversity suggesting deposition in shallow, restricted waters. Sandstone unit overlying this carbonate unit has a sharp scour base and abundant mudstone and limestone ripup clasts as large as 2.4 in. (6 cm) in the basal part.

Sample PH91KF99 is from a medium- to coarse-grained sandy limestone bed at 2659-2661 ft (810-811 m). This bed has a sharp contact with the underlying finer grained sandstone unit. The texture, lack of sorting, biotic distribution, and glauconitization of the sandy limestone bed indicates transport and reworking, probably during a storm event, and deposition below wave base.

Carbonate unit from 2622-2642 ft (799-805 m) contains very thin interbeds of limy mudstone in the lower part; the middle part is a shaly limestone that grades upward into a sandy limestone at the top of the unit. Biotic assemblage in the lower part indicates an open marine depositional environment; biotic abundance decreases upward through the unit.

Measured section offset about 1000 ft (305 m) to south at the top of the laterally extensive, brownish-gray, coarse-grained, channel sandstone unit at 2562-2585 ft (781-788 m).

Carbonate unit from 2550-2553 ft (777-778 m) is a bioclastic, oolitic packstone-grainstone depositied in a shoaling, high-energy environment. Pennsylvanian carbonate deposition within this environment was rare at the Hermosa Mountain locality. Carbonate unit from 2553-2560 ft (778-780 m) contains interbeds of siltstone and sandstone in the lower part; the upper part is characterized by absence of biota suggesting a restricted marine environment.

Pebbly sandstone unit from 2373-2410 ft (723-735 m) contains pebbles of quartz, granite, feldspar, chert, and siltstone that average 0.2-0.4 in. (0.5-1 cm) and are as large as 1.2 in. (3 cm) in the longest dimension. Sandstone unit geometry and sedimentary structures indicate deposition in low-sinuosity rivers.

Sandstone units between 2218-2373 ft (676-723 m) locally contain fossil fragments and sedimentary structures indicative of deposition in intertidal to shallow subtidal environments.

Interval from 2188-2218 ft (667-676 m) consists of interbedded clastics and carbonates. Abundance of clastic detrital material in carbonate results in part from concentration by pressure solution. Superficial ooids at top of the uppermost carbonate bed in this interval indicates proximity to a shoal.

Carbonate unit from 2150-2188 ft (655-667 m) contains fabric characteristics and faunal assemblages that indicates deposition in open marine, at times deep water, conditions below wave base.

Pebbly sandstone complex from 2110-2140 ft (643-652 m) is the "Grit bed" of Wengerd and Matheny (1958). Pebbles of quartz, feldspar, granite, sandstone, shale, and limestone are as large as 4 in. (10 cm) and average 0.8-1 in. (2-3 cm) in the longest dimension. Pebbles occur in lenses or concentrated at base of trough cross sets. Pebbles are slightly less abundant in upper part of the unit. This sandstone complex is composed of amalgamated, tabular, scour-based channel-fill units and can be traced northward for at least 25 mi (40 km) across the Hermosa Cliffs.

Carbonate unit from 2035-2043 ft (620-623 m) is dolomitized in the upper part and shows a shallowing upward depositional enivronment.

A large scour surface with possibly as much as 20 ft (6 m) of relief is within the sandstone interval from 2000-2032 ft (610-619 m). Magnitude of scour suggests paleovalley incisement and subsequent fill at this location.

1965 ft (599 m) is approximate base of strata equivalent to the Honaker Trail Formation.

Carbonate-dominated interval from 1928-1964 ft (588-599 m) contains two distinct carbonate units. The lower unit from 1928-1946 ft (588-593 m) is composed of interbedded limestone and brownish-black shale. The thickness of both limestone and shale beds decreases upward. The upper unit from 1946-1964 ft (593-599 m) consists of limestone and thin interbeds of siltstone; the limestone becomes progressively sandier toward the top. Both of these carbonate units locally show evidence of extensive mechanical and chemical compaction that produces a post-deformational packstone texture. All of the carbonate, except the uppermost part, was deposited in an open-marine environment below wave base; the uppermost beds formed within wave-base.

Laminated siliciclastic limestone unit from 1880-1928 ft (573-588 m) is composed of nearly equal parts clastic and carbonate material.

Limestone unit from 1810-1830 ft (552-558 m) contains a diverse biotic assemblage, chert nodules as large as 0.5 ft (15 cm), and locally bioturbated fabric.

Calcareous shale from 1777-1810 ft (542-552 m) contains nearly equal amounts of clastic and carbonate material. This unit contains first appearence of appreciable amounts of biotic material after deposition of the Pinkerton Trail Formation. Calcareous shale deposited in an open marine environment.

Blocks of gypsum occur within covered interval from 1380-1425 ft (421-434 m).

Common slumping and cover in gypsum-bearing interval prohibits examination of evaporite textures and bedding characteristics. Interbeds of dolomitic mudstone and and claystone are within the gypsum units.

Carbonate unit from 1293-1306 ft (394-398 m) is dolostone and strongly altered limestone that contains caliche, and algal laminations, glaebules, brecciation, possible rhyzoliths, replacement of evaporite nodules, rare echinoderm fragments, and fenestral and moldic porosity. Unit was deposited in a supratidal environment. Sample H91DB11 from 1293.5 ft contains unidentified brachiopods.

Clastic interval from 1180-1275 ft (360-389 m) is composed of amalgamated deltaic channel and overbank deposits.

Carbonate unit from 1068-1080 ft (326-329 m) is dominantly dolostone and minor limestone with an interbed of mudstone. Faint algal banding, globular structures that may be caliche globules, and rare echinoderm? fragments are locally present in the carbonate unit.

Measured section offset about 0.4 mi (0.6 km) to south along top of laterally persistant sandstone unit.

Carbonate unit from 850-862 ft (259-263 m) is dominantly dolostone with local limestone interbeds; faint algal laminations and fenestral porosity indicate a supratidal environment.

Channel sandstone complex with its base at 780 ft (238 m) contains boulders of dolomite as long as 2.5 ft (80 cm) in longest dimension. Scour base of complex shows as much as 5 ft (1.5 m) of relief. The sandstone complex is composed of three stacked channel units. Channel margin of lowest sandstone unit is about 0.6 mi (1 km) to south. Past this depositional edge, the stratigraphically equivalent interval contains two vuggy, 3 ft (1-m) thick, petroliferous-smelling dolomite sequences separated by slope-forming clastic beds. Measured section offset about 0.6 mi (1 km) to south at top of sandstone complex.

Dolomite unit from 736-748 ft (224-228 m) is locally calcitic and contains interbeds of siltstone and sandstone. Equivalent beds lateral to sample PH91KF32 contains pelloids and shrinkage cracks. Sample H91DB10 contains thin-shelled, unidentified small bivalves.

Channel sandstone unit with its base at 690 ft (210 m) contains lateral-accretion bedding that dips to northwest.

Carbonate unit at 661-665 ft (210-203 m) is dolostone and limestone that contains a hardpan. The entire unit shows evidence of intertidal to supratidal depositional environments. Sample PH91KF28 contains rare brachiopod fragments.

Dolomitic limestone at 615 ft (187 m) is strongly altered, locally has very high porosity and common vugs, and at the top of the unit contains breccia having small clasts. Inferred depositional environment is supratidal.

The fine- to very fine grained sandstone units commonly internally composed of multiple fining-upward sandstone beds overlain by very thin beds of mudstone, which indicate deposition in prodelta environments during storm events.

Sample H91DB8 at 502 ft (153 m) from carbonate nodules within a calcareous sandstone, is devoid of fossils.

Interval from 445-455 ft (136-139 m) contains interbedded limestone, sandy limestone, dolostone, shale and dolomitic sandstone. Syndepositional caliche and hardpan layer less than 1 foot (.3 m) thick developed in this interval.

At top of Segment A, section offset about 1 km to south to best exposures of overlying section. The Pinkerton Trail Formation is completely covered in the area of Segment B. Measurement of Segment B began at the top of the Leadville Limestone.

Outer shelf depositional environments are interpreted for the carbonate beds of the Pinkerton Trail Formation. Beds are dominantly mud supported, have low faunal diversity, and bioclastic debris is generally thin shelled and of pelagic origin. Locally beds contain a high monospecific concentration of calcareous and siliceous sponges.

Uppermost carbonate beds in Pinkerton Trail Formation have strong petroliferous smell.

Throughout Pinkerton Trail Formation, beds of sandstone, siltstone, carbonaceous shale, and mudstone locally are present between carbonate beds.

CHART SHOWING LITHOLOGY, MINERALOGY, AND PALEONTOLOGY OF THE PENNSYLVANIAN HERMOSA GROUP AT HERMOSA MOUNTAIN, LA PLATA COUNTY, COLORADO

By
Karen J. Franczyk, Germaine Clark, Douglas C. Brew, and Janet K. Pitman
1995

INTERIOR—GEOLOGICAL SURVEY, RESTON, VIRGINIA—1995

Any use of trade names in this publication is for descriptive purposes only and does not imply endorsement by the U.S. Geological Survey

For sale by U.S. Geological Survey Information Services, Box 25286, Federal Center, Denver, CO 80225

Manuscript approved for publication June 16, 1995