Geology, Ore Deposits, and Mines of the Mineral Point, Poughkeepsie, and Upper Uncompangre Districts, Ouray, San Juan, Hinsdale Counties, Colorado

by

V. C. KELLEY

COLORADO SCIENTIFIC SOCIETY PROCEEDINGS

VOLUME 14

No. 7

DENVER, COLORADO

1946

COLORADO SCIENTIFIC SOCIETY

W. P. HULEATT, President C. E. Dobbin, Secretary Perry N. Moore, Treasurer

Mail exchanges to Colorado Scientific Society, Denver Public Library, Denver, Colorado

Address communications to:
COLORADO SCIENTIFIC SOCIETY
906 U. S. NATIONAL BANK BLDG.
DENVER 2, COLORADO

Additional copies of this paper cost \$3.50 Subscription price per volume, \$5.00

GEOLOGY, ORE DEPOSITS, AND MINES OF THE MINERAL POINT, POUGHKEEPSIE, AND UPPER UNCOMPAHGRE DISTRICTS, OURAY, SAN JUAN, AND HINSDALE COUNTIES, COLORADO.¹

by

V. C. Kelley²

CONTENTS

Abstract	P	age		Pag
Introduction	Abstract	289		
Geologic map and cross sections 292 Acknowledgments 295 Rock formations 296 Pre-Cambrian rocks 296 Paleozoic and Mesozoic rocks 297 Tertiary bedded rocks 298 Telluride conglomerate 298 San Juan tuff 298 Silverton volcanic series 299 Picayune volcanic group 299 Eureka rhyolite 300 Pyroxene andesite 301 Henson tuff 302 Potosi volcanic series 302 Potosi volcanic series 302 Potosi volcanic series 302 Pre-Tertiary intrusives 303 Laccolith of Canyon Creek 303 Laccolith of Canyon Creek 303 Luacolith of Canyon Creek 303 Structure 305 Polalozoic Mesozoic wedge 305 Folds and faults in the pre-Cambrian rocks 305 Folds and faults in the pre-Cambrian rocks 305 Gulch area 309 Ore Deposite Gulch area 309 Ore Deposite Gulch area 309 Ore Deposite General character of mineral deposits 311 Types and origin of deposits 311 Types and origin of deposits 314 Fissue and cavity fillings 314 Fissue and cavity fillings 314 Fissue and cavity fillings 314 Freeda-chimney and breccia-dike deposits 316	Introduction	291	Ore in denth	394
Acknowledgments 295	Geography	291	Introduction	39
Acknowledgments 295 Rock formations 296 Pre-Cambrian rocks 296 Praleozoic and Mesozoic rocks 297 Tertiary bedded rocks 298 Telluride conglomerate 298 San Juan tuff 298 Silverton volcanic series 299 Picayune volcanic group 299 Eureka rhyolite 300 Pyroxene andesite 300 Pyroxene andesite 301 Henson tuff 302 Pre-Tertiary intrusives 303 Pre-Tertiary intrusives 303 Pre-Tertiary intrusives 303 Laccolith of Canyon Creek 303 Laccolith of Canyon Creek 303 Upper Tertiary intrusives 303 Structure 504 Polaleozoic Mesozoic wedge 305 Tertiary fissures, faults, and tilted beds 307 Creek area 307 Mineral Point-Poughkeepsie Gulch area 309 Ore Deposits 311 Types and origin of deposits 314 Fissue and cavity fillings 314 Freedia-chimney and breccia-dike deposits 316	Geologic map and cross sections	202		
Rock formations 296 Pre-Cambrian rocks 296 Paleozoic and Mesozoic rocks 297 Tertiary bedded rocks 298 Silverton volcanic series 299 Picayune volcanic group 299 Eureka rhyolite 300 Burns latite 300 Pyroxene andesite 301 Henson tuff 302 Potosi volcanic series 302 Intrusive rocks 303 Pre-Tertiary intrusives 303 Laccolith of Canyon Creek 303 Creek area 307 Pelozoic-Mesozoic wedge 305 Pelozoic-Mesozoic wedge 305 General character of mineral deposits 314 Fissue and cavity fillings 314 Breecia-chimney and breccia-dike Preper tinney age and right of deposits 316 Forgest mine 309 Forgest 309 Cintrusive rocks 303 Structure 305 Forgest 306 General 307 General 408 General 408 General 408 General 509 General 508 General 508 General 508 General 508 General 508 General 509 General 608 Gener	Acknowledgments	295	Indications of supergene denos	. 02-
Pre-Cambrian rocks 296 Paleozoic and Mesozoic rocks 297 Tertiary bedded rocks 298 Telluride conglomerate 298 San Juan tuff 298 Silverton volcanic series 299 Picayune volcanic group 299 Eureka rhyolite 300 Burns latite 300 Pyroxene andesite 301 Henson tuff 302 Potosi volcanic series 302 Intrusive rocks 303 Pre-Tertiary intrusives 303 Laccolith of Canyon Creek 303 Laccolith of Canyon Creek 303 Structure 504 Folds and faults in the pre-Cambrian rocks 305 Paleozoic-Mesozoic wedge 305 Tertiary fissures, faults, and tilted beds 307 Creek area 309	Rock formations	296		200
Paleozoic and Mesozoic rocks 297 Tertiary bedded rocks 298 San Juan tuff 298 San Juan tuff 298 Silverton volcanic series 299 Picayune volcanic group 299 Eureka rhyolite 300 Burns latite 300 Pyroxene andesite 301 Henson tuff 302 Potosi volcanic series 302 Intrusive rocks 303 Pre-Tertiary intrusives 303 Laccolith of Canyon Creek 303 Luacolith of Canyon Creek 303 Cupper Tertiary intrusives 303 Structure 305 Folds and faults in the pre-Cambrian rocks 305 Paleozoic-Mesozoic wedge 305 Tertiary fissures, faults, and tilted beds 307 Tertiary fissures, faults, and tilted beds 307 Creek area 307 Creek area 307 Mineral Point-Poughkeepsie Gulch area 309 Ore Deposite 311 Types and origin of deposits 314 Fissue and cavity fillings 314 Breecia-chimney and breecia-dike 40 deposits 316 Introduction 344 History and production 344 General 305 General 305 General 305 Sutton mine 335 Sutton mine 335 Sutton mine 335 Natalia mine and neighboring prospects 336 North Star mine 366 Chrysolite mine 366 Chrysolite mine 366 Connie mine 366 Connie mine 368 Guadaloupe mine 368 Guadaloupe mine 370 Mineral Point-Poughkeepsie 305 Hayden-Comal properties 356 Sutton mine 355 Sutton mine 355 Sutton mine 355 Sutton mine 355 Natalia mine and neighboring prospects 306 Chrysolite mine 366 Chrysolite mine 366 Connie mine 368 Connie mine 368 Guadaloupe mine 370 Mineral Point-Poughkeepsie 305 Hother Cline mine 368 Guadaloupe mine 370 Mineral Point-Poughkeepsie 305 Sutton mine 358 Watton mine 368 Chrysolite mine 368 Connie mine 367 Chrysolite mine 368 Connie mine 368 Connie mine 369 Connie mine 369 Connie mine 369 Connie mine 369 Mother Cline mine 369 Mother Cline mine 369 Connie mi	Pre-Cambrian rocks	206	Mines and prospects	
Tertiary bedded rocks Telluride conglomerate 298 San Juan tuff 298 Silverton volcanic series 299 Picayune volcanic group 299 Eureka rhyolite 300 Burns latite 300 Pyroxene andesite 301 Henson tuff 302 Potosi volcanic series 303 Intrusive rocks 303 Intrusive rocks 303 Pre-Tertiary intrusives 303 Laccolith of Canyon Creek 303 Structure 305 Folds and faults in the pre-Cambrian rocks 101 Paleozoic-Mesozoic wedge 305 Pertiary fissures, faults, and tilted beds Gulch area 307 Creek area 307 Mineral Point-Poughkeepsic Gulch area 309 General General character of mineral deposits 311 Fissue and cavity fillings 314 Breecia-chimney and breccia-dike deposits 316 General 308 General 309 History and production 344 Upper Uncompahgre area 355 Hayden-Comal properties 356 Sutton mine 358 Natalia mine and neighboring prospects 36 Chrysolite mine 37 Mother Cline mine 36 Connie mine 36 Connie mine 36 Chrysolite mine 37 Mother Cline mine 36 Connie mine 36 Connie mine 36 Chrysolite mine 37 Mother Cline mine 36 Connie mine 36 Connie mi	Paleozoic and Mesozoic rocks	207	Introduction	945
Telluride conglomerate 298 San Juan tuff 298 Silverton volcanic series 299 Picayune volcanic group 299 Eureka rhyolite 300 Burns latite 300 Pyroxene andesite 301 Henson tuff 302 Potosi volcanic series 302 Intrusive rocks 303 Pre-Tertiary intrusives 303 Laccolith of Canyon Creek 303 Laccolith of Canyon Creek 303 Structure 305 Folds and faults in the pre-Cambrian rocks 305 Paleozoic-Mesozoic wedge 305 Paleozoic-Mesozoic wedge 305 Tertiary fissures, faults, and tilted beds 307 Creek area 307 Mineral Point-Poughkeepsie Guleh area 309 Ore Deposits 311 General character of mineral deposits 311 Fissue and cavity fillings 314 Fissue and cavity fillings 314 Breecia-chimney and breccia-dike deposits 316	Tertiary bedded rocks	200	History and production	245
San Juan tuff 298 Silverton volcanic series 299 Hayden-Comal properties 335	Telluride conglomerate	208	Unner Uncompahere area	95
Silverton volcanic series 299 Picayune volcanic group 299 Eureka rhyolite 300 Burns latite 300 Pyroxene andesite 301 Henson tuff 302 Potosi volcanic series 302 Intrusive rocks 303 Pre-Tertiary intrusives 303 Laccolith of Canyon Creek 303 Lupper Tertiary intrusives 303 Erricture 305 Folds and faults in the pre-Cambrian rocks 305 Paleozofe-Mesozoic wedge 305 Paleozofe-Mesozoic wedge 305 Tertiary fissures, faults, and tilted beds Gulch area 307 Creek area 307 Mineral Point-Poughkeepsie Gulch area 308 Guenal device of mineral deposits 311 Fissue and cavity fillings 314 Breecia-chimney and breccia-dike Tight August Commal properties 385 Sutton mine 335 Natalia mine and neighboring prospects 326 Chrysolite mine 366 CArtysolite mine 366 Connie mine 366 Connie mine 366 Connie mine 366 Connie mine 367 Silver Link mine 370 Silver Link mine 370 Mountain Monarch mine 371 Eurades mine 377 Other mines 380 Other mine 380 Other Cline mine 380 Other mine 380 Other mine 380 Other mine 380 Other Cline mine 380 Other mine	San Juan tuff	200	Conoral	255
Eureka rhyolite 300 Burns latite 300 Pyroxene andesite 301 Henson tuff 302 Potosi volcanic series 302 Intrusive rocks 303 Laccolith of Canyon Creek 303 Lupper Tertiary intrusives 303 Eureture 305 Structure 305 Pollos and faults in the pre-Cambrian rocks 305 Paleozoic-Mesozoic wedge 305 Paleozoic-Mesozoic wedge 305 Creek area 307 Creek area 307 Mineral Point-Poughkeepsie Gulch area 309 Gulch area 309 Gree Deposits 311 Types and origin of deposits 314 Fissue and cavity fillings 314 Fissue and cavity fillings 314 Fissue and cavity fillings 314 Feecia-chimney and breccia-dike 40 Burns latite 300 Daniel Bonanza mine 355 Natalia mine and neighboring prospects 335 Chrysolite mine 365 Chrysolite mine 366 Connie mine 366 Connie mine 376 Guadaloupe mine 376 Silver Link mine 370 Silver Link mine 370 Mountain Monarch mine 377 Eurades mine 377 Eurades mine 377 Chreek area 309 Other mines 388 Connie mine 370 Mountain Monarch mine 377 Eurades mine 379 Lower Poughkeepsie Gulch area 380 General 380 Maid of the Mist mine 388 Forrest mine 388 Old Lout tunnel 389 Contending mine and neighboring prospects 351 Unmore mine 367 Mother Cline mine 366 Connie mine 366 Connie mine 376 Mountain Monarch mine 377 Eurades mine 377 Eurades mine 379 Cother mines 389 Cother mine 389 Connie mine 368 Connie mine 369 Connie mine 368 Connie mine 369 Connie mine 368 Connie mi	Silverton volcanic series	200	Haydan Comal proportion	986
Bureka rhyolite 300	Picavune volcanic group	200	Sutton mine	256
Burns latte 300 Pyroxene andesite 301 Henson tuff 302 Potosi volcanic series 302 Intrusive rocks 303 Laccolith of Canyon Creek 303 Laccolith of Canyon Creek 303 Upper Tertiary intrusives 303 Structure 305 Folds and faults in the pre-Cambrian rocks 305 Paleozoic-Mesozoic wedge 305 Tertiary fissures, faults, and tilted beds Guleh area 307 Creek area 307 Mineral Point-Poughkeepsie Guleh area 309 Ore Deposits 311 General character of mineral deposits 311 Fissue and cavity fillings 314 Fissue and cavity fillings 314 Breecia-chimney and breceia-dike 46 deposits 306 Chrysolitie mine 366 Chrysolite mine 366 Chrusolite mine 367 Chrusolite mine 357 Chrusolite mine 367	Eureka rhvolite		Daniel Ronange mine	250
Pyroxene andesite 301	Burns latite	300	Natalia mine and neighborin	000
Henson tuff 302	Pyroxene andesite	301	prospects	950
Intrusive rocks 303	Henson tuff	302	Dunmore mine	
Intrusive rocks 303	Potosi volcanic series	302	Chrysolite mine	202
Pre-Tertiary intrusives 303 Laccolith of Canyon Creek 303 Upper Tertiary intrusives 303 Structure 305 Structure 305 Silver Link mine 306 Silver Link mine 307 Minchael Breen mine 372 Mountain Monarch mine 374 Mountain Monarch mine 375 Mountain Monarch mine 376 Mountain Monarch mine 377 Tertiary fissures, faults, and tilted beds 307 Tertiary fissures, faults, and tilted beds 207 Creek area 307 Creek area 307 General Maid of the Mist mine 338 Mountain Monarch mine 376 Mountain Monarch mine 377 Mountain Monarch mine 378 Explortation and prospecting 382 Lower Poughkeepsie Gulch area 386 General Maid of the Mist mine 338 Mother Cline mine 338 Mother Cline mine 376 Mountain Monarch mine 377 Mountain Monarch mine 377 Mountain Monarch mine 378 Mountain Monarch mine 379 Mountain Monarch mine 379 Mountain Monarch mine 379 Mountain Monarch mine 370 Mountain Monarch mine 370 Mountain Monarch mine 370 Mountain Monarch mine 377 Mountain Monarch mine 378 Mountain Monarch mine 378 Mountain Monarch mine 379 Mountain Monarch mine 379 Mountain Monarch mine 379 Mountain Monarch mine 379 Mountain Monarch mine 370 Mountain Monarch mine 379 Mountain Monarch mine 370 Mountain Monarch mine 379 Mountain Monarch mine 370 Mountain Monarch mine 379 Mountain Monarch mine 379 Mountain Monarch mine 370 Mountain	Intrusive rocks	303		
Laccolith of Canyon Creek 303 Upper Tertiary intrusives 303 Structure 305 Folds and faults in the pre-Cambrian rocks 305 Paleozoic-Mesozoic wedge 305 Tertiary fissures, faults, and tilted beds 307 Upper Uncompahare-Canyon Creek area 307 Creek area 309 Ore Deposits 311 General character of mineral deposits 311 Fissue and cavity fillings 314 Breecia-chimney and breccia-dike deposits 316 Cupper Uncompanation of deposits 316 Forest mine 389 Colnie mine 368 Guadaloupe mine 376 Guadaloupe mine 377 Michael Breen mine 377 Mountain Monarch mine 377 Mountain Monarch mine 377 Mountain Monarch mine 377 Cheek area 309 Cher mines 380 Explortation and prospecting 382 Lower Poughkeepsie Gulch area 386 General Maid of the Mist mine 389 Cold Lout mine 389 Cold Lout mine 389 Cold Lout tunnel 396 Cold Lout mine 398	Pre-Tertiary intrusives	303	Mother Cline mine	200
Upper Tertiary intrusives 303 Structure 305 Folds and faults in the pre-Cambrian rocks 305 Paleozoic-Mesozoic wedge 305 Tertiary fissures, faults, and tilted beds 307 Upper Uncompahgre-Canyon Creek area 307 Mineral Point-Poughkeepsie Guleh area 309 General character of mineral deposits 311 Fissue and cavity fillings 314 Breecia-chimney and breecia-dike deposits 316 General 308 Guadaloupe mine 308 Silver Link mine 372 Mochael Breen mine 372 Mountain Monarch mine 374 Eurades mine 375 Eurades mine 376 Cher mines 386 Cher Poughkeepsie Gulch area 386 General 386 General 387 Maid of the Mist mine 389 Old Lout mine 389 Old Lout mine 389 Old Lout unnel 389 Chery-Silver Monarch prospects 311 Fissue and cavity fillings 314 Breecia-chimney and breecia-dike deposits 316 Tempest mine 398	Laccolith of Canyon Creek	303	Connie mine	960
Structure 305 Folds and faults in the pre-Cambrian rocks 305 Paleozoic-Mesozoic wedge 305 Paleozoic-Mesozoic wedge 305 Tertiary fissures, faults, and tilted beds Upper Uncompahgre-Canyon Creek area 307 Mineral Point-Poughkeepsie Gulch area 309 Ore Deposits 311 General character of mineral deposits 311 Types and origin of deposits 314 Fissue and cavity fillings 314 Breccia-chimney and breccia-dike deposits 316 Silver Link mine 377 Michael Breen mine 377 Other mines 387 Lower Poughkeepsie Gulch area 386 General Maid of the Mist mine 386 General Alabama mine 389 Old Lout tunnel 398 Victory-Silver Monarch prospects 303 Poughkeepsie mine 398 Tempest mine 398	Upper Tertiary intrusives	303	Guadalouna mina	900
Folds and faults in the pre-Cambrian rocks Drian rocks Saction of Paleozoic-Mesozoic wedge Beds Upper Uncompahgre-Canyon Creek area Mineral Point-Poughkeepsic Gulch area General character of mineral deposits Types and origin of deposits Breecia-chimney and breecia-dike deposits Wichael Breen mine 372 Mountain Monarch mine 373 Mountain Monarch mine 374 Eurades mine 375 Explortation and prospecting 386 Cher mines 386 Cher Poughkeepsic Gulch area 386 General Maid of the Mist mine 389 Forrest mine 389 Old Lout tunnel 390 Cloud tout unnel 390 Cloud Lout tunnel 390 Cloud Lout tunnel 390 Cloud Lout tunnel 390 Saction 390 Types and origin of deposits 311 Fissue and cavity fillings 314 Breecia-chimney and breecia-dike deposits 316			Silver Link mine	970
Drian rocks 305 Paleozofc-Mesozoic wedge 305 Tertiary fissures, faults, and tilted beds Upper Uncompahgre-Canyon Creek area 307 Mineral Point-Poughkeepsie Guleh area 309 Ore Deposits General character of mineral deposits 311 Types and origin of deposits 311 Fissue and cavity fillings 314 Breecia-chimney and breecia-dike deposits 316 Mountain Monarch mine 377 Eurades mine 378 Other mines 388 Lower Poughkeepsie Gulch area 386 General Maid of the Mist mine 388 Forrest mine 388 Old Lout tunnel 389 Old Lout tunnel 339 Alabama mine 302 Victory-Silver Monarch prospects 393 Breecia-chimney and breecia-dike deposits 316 Tempest mine 398	Folds and faults in the pro-Com-	30.0		
Paleozoic-Mesozoic wedge 305 Tertiary fissures, faults, and tilted beds 307 Upper Uncompahare-Canyon Creek area 307 Mineral Point-Poughkeepsie 309 Ore Deposits 311 General character of mineral deposits 311 Fissue and cavity fillings 314 Breecia-chimney and breecia-dike deposits 316 General deposits 317 Figure 309 Furades mine 377 Other mines 328 Explortaion and prospecting 382 Lower Poughkeepsie Gulch area 386 General Maid of the Mist mine 389 Old Lout mine 389 Old Lout tunnel 389 Old Lout tunnel 396 Victory-Silver Monarch prospects 303 Prospects 303 Furades mine 377 Cher mines 388 Explortaion and prospecting 382 Lower Poughkeepsie Gulch area 386 General Maid of the Mist mine 389 Old Lout tunnel 389 Old Lout tunnel 396 Victory-Silver Monarch prospects 303 Furades mine 377	brian rocks	205	Mountain Monorch mine	971
Tertiary fissures, faults, and tilted beds			Eurodes mine	977
Dec	Tertiary fissures faults and tilted	000	Other mines	200
Upper Uncompahgre-Canyon Creek area 307 Cheek area 307 General Maid of the Mist mine 388 Maid of the Mist mine 389 Forrest mine 389 General Cheek area 309 Forrest mine 389 General Cheek area 311 Old Lout mine 389 General Cheek area 311 Alabama mine 392 Cheek area 393 Cheek area 394 Cheek area 395 Cheek area 395 Cheek area 395 Cheek area 396 Cheek area 397 Cheek area 398 Cheek ar	beds	207	Exploration and prospecting	900
Creek area 307 General 338				
Mineral Point-Poughkeepsie Maid of the Mist mine 386	Creek area	207	Conoral	900
Gulch area 309 Forrest mine 388	Mineral Point-Poughkeensie		Maid of the Miet mine	900
Ore Deposits General character of mineral deposits Types and origin of deposits Types and cavity fillings Brecia-chimney and breccia-dike deposits 311 Old Lout mine 339 Alabama mine 392 Victory-Silver Monarch prospects 393 Poughkeepsic mine 398 Tempest mine 398		eno	Formest mine	900
General character of mineral deposits 311 Alabama mine 392 Types and origin of deposits 314 Victory-Silver Monarch Fissue and cavity fillings 314 prospects 303 Breccia-chimney and breccia-dike Poughkeepsie mine 398 Tempest mine 398			Old Lout mine	900
posits 311 Alabama mine 392 Types and origin of deposits 314 Victory-Silver Monarch Fissue and cavity fillings 314 prospects 393 Breccia-chimney and breccia-dike deposits 316 Tempest mine 398			Old Lout tunnel	200
Types and origin of deposits 314 Fissue and cavity fillings 314 Breccia-chimney and breccia-dike deposits 316 Tempest mine 398			Alahama mino	200
Breccia-chimney and breccia-dike Poughkeepsic mine 398 deposits 316 Tempest mine 398		214	Viatory Cilyan Managah	-3372
Breccia-chimney and breccia-dike deposits Poughkeepsie mine 396 Tempest mine 398	Fissue and cavity fillings	114		909
deposits 316 Tempest mine 398	Breccia-chimney and breccia-dike			
n i i i i i i i i i i i i i i i i i i i	deposits	RIA		

¹Published by permission of the Director of the Geological Survey, United States Department of the Interior, in cooperation with the State of Colorado through the Colorado State Geological Survey Board and the Colorado Metal Mining Fund.

²Geologist, U. S. Geological Survey, and Professor of Geology, University of New Mexico.

CONTENTS—(Continued)

Exploration and prospecting Upper Poughkeepsie Gulch (La			Page
	400	Lucky Jack mine Ben Butler mine	429
Unner Panghkaansia Gulch (La	t-o	Ben Butler mine	430
Como) area	401	London mine Early Bird mine Sewell mine	432
Como, area	401	Donly Dind mine	421
General	401	Early Bird mine	400
Sixteen-to-One mine	402	Sewell mine	450
Amador mine	402	Red Cloud mineOther mines	436
Saxon mine	404	Other mines	439
Saxon mineAlaska mine	405	Exploration and prospecting _	441
Picket mine	406	California Gulch area	443
Picket mine Seven-Thirty mine	407	Exploration and prospecting California Gulch area General	443
Seven-Thirty little	400		
Red Rogers mine	409	Frisco tunner	445
Bonanza mine	409	vermillion mine	440
Rollo mine	411	Mountain Queen mine	447
Belcher mine	411	Other mines	449
Silver Chord mine	412	Exploration and prospecting _	449
Belcher mine	413	Vermillion mine Mountain Queen mine Other mines Exploration and prospecting Engineer Mountain area Gangral	451
Exploration and prospecting	415	General	451
Mineral Point area	410	Frank Hough mine	459
Mineral Foint area	T10	Dalmette mine	454
General	419	Palmetto mine	404
Brazillian-Monitor mine	420	Wyoming mine Engineer mine	406
Forest Queen mine Bonanza King mine	421	Engineer mine	458
Bonanza King mine	421	Polar Star mine	459
Adelia mineUnion mine	422	Mammoth mine	461
Union mine	423	Syracuse Pride mine	463
Bill Young mine Uncompahgre Chief mine San Juan Chief mine British Queen mine	499	Polar Star mine Mammoth mine Syracuse Pride mine Other mines	463
Uncompalant Chief mine	195	Exploration and prospecting	465
Cheompangre Chief mine	100	Exploration and prospecting _ Future of the districts as a whole	105
San Juan Chief mine	426	Future of the districts as a whole	400
British Queen mine	428		
illi	LUSTF	RATIONS	
Plate 1. Preliminary geologic ma	p of th	ne Mineral Point, Poughkeepsie, ar y, San Juan, and Hinsdale counti (under separate	1d
Unper Uncompangre districts	s. Oura	v. San Juan, and Hinsdale countie	es.
Colorado		(under separate	cover)
Plate 2 Coologie gross sections of	f the M	ineral Point Poughkeensie and Unn	er
The among the districts On we	r Con	ineral Point, Poughkeepsie, and Upp Juan, and Hinsdale counties, Col	0
Uncompangre districts, Oura	y, san	(under separate	oomon)
rado		(under separate	cover)
Figure 1. Relationship of the course of the U. Geologic map of the U.	irse and	the strike of inclined veins	204
Figure 2. Geologic map of the U	pper U	ncompangre area	
Figure 3. Simple controls for or	e shoo		900
fissures		ts caused by displacement on curv	ed soo
		l the strike of inclined veins ncompangre area ts caused by displacement on curv	320
Figure 4. Relation between aver			320
Figure 4. Relation between aver			320
Figure 4. Relation between aver or milled and altitudes of or			320
Figure 4. Relation between aver or milled and altitudes of ore Figure 5. Index map of mines a			320
Figure 4. Relation between aver or milled and altitudes of or Figure 5. Index map of mines a Figure 6. Longitudinal section o			320
Figure 4. Relation between aver or milled and altitudes of ore Figure 5. Index map of mines a Figure 6. Longitudinal section of Figure 7. Longitudinal section of			320
Figure 4. Relation between aver or milled and altitudes of ore Figure 5. Index map of mines a Figure 6. Longitudinal section of Figure 7. Longitudinal section of Figure 8. Plan and section of the			320
Figure 4. Relation between aver or milled and altitudes of or Figure 5. Index map of mines a Figure 6. Longitudinal section o Figure 7. Longitudinal section of Figure 8. Plan and section of the Figure 9. Cross section of the St			320
Figure 4. Relation between aver or milled and altitudes of ore Figure 5. Index map of mines a Figure 6. Longitudinal section of Figure 7. Longitudinal section of Figure 9. Cross section of the Figure 10. Longitudinal section a			320
Figure 4. Relation between aver or milled and altitudes of or Figure 5. Index map of mines a Figure 6. Longitudinal section o Figure 7. Longitudinal section o Figure 8. Plan and section of the Figure 10. Longitudinal section a Figure 11. Geologic map and cros			320
Figure 4. Relation between aver or milled and altitudes of ore Figure 5. Index map of mines a Figure 6. Longitudinal section of Figure 7. Longitudinal section of Plan and section of the Figure 9. Cross section of the Figure 10. Longitudinal section a Figure 11. Geologic map and cros Figure 12. Plan and sections of the Figure 13. Plan and sections of Figure 14.			320
Figure 4. Relation between aver or milled and altitudes of or Figure 5. Index map of mines a Figure 6. Longitudinal section of Figure 7. Longitudinal section of Figure 8. Plan and section of the Strigure 10. Longitudinal section a Figure 11. Geologic map and cross Figure 12. Plan and sections of the Figure 13. Plan and sections of the Figure 14. Plan and sections of the Figure 15. Plan and sections of the Figure 15. Plan and section			320
Figure 4. Relation between aver or milled and altitudes of or Figure 5. Index map of mines a Figure 6. Longitudinal section of Figure 7. Longitudinal section of Figure 9. Cross section of the Sigure 10. Longitudinal section a Figure 11. Geologic map and cross Figure 12. Plan and sections of the Figure 13. Plan and section of the Figure 14. Plan and section of the Figure 15.			320
Figure 4. Relation between aver or milled and altitudes of or Figure 5. Index map of mines a Figure 6. Longitudinal section of Figure 8. Plan and section of the Stigure 9. Cross section of the Stigure 10. Longitudinal section a Figure 11. Geologic map and cross Figure 12. Plan and sections of the Stigure 13. Plan and section of the Stigure 14. Plan and section of the Stigure 15. Plan and section 15. Plan			320
Figure 4. Relation between aver or milled and altitudes of or Figure 5. Index map of mines a Figure 6. Longitudinal section of Figure 7. Longitudinal section of Figure 9. Cross section of the Strigure 10. Longitudinal section a Figure 11. Geologic map and cross Figure 12. Plan and sections of the figure 14. Plan and section of the Figure 15. Plan and section of the Figure 16. Plan and section of the Figure 17. Plan and section of the Figure 18. Plan and section of the Figure 19. Plan and section of th			320
Figure 4. Relation between aver or milled and altitudes of ore Figure 5. Index map of mines a Figure 6. Longitudinal section of Figure 8. Plan and section of the Figure 9. Cross section of the Strigure 10. Longitudinal section a Figure 11. Geologic map and cross Figure 12. Plan and sections of the Figure 13. Plan and section of the Figure 14. Plan and section of the Figure 15. Plan and section of t			320
Figure 4. Relation between aver or milled and altitudes of or Figure 5. Index map of mines a Figure 6. Longitudinal section of Figure 7. Longitudinal section of Figure 8. Plan and section of the Strigure 10. Longitudinal section a Figure 11. Geologic map and cross Figure 12. Plan and section of the Strigure 14. Plan and section of the Figure 14. Plan and section of the Figure 15. Plan and section of the Figure 16. Plan and sections		ecious-metal content of ores shipp spects Between utton mine aniel Bonanza mine an and Roy Neal mines sin group e Dunmore-North Star vein n of the Dunmore lode Between S ter Cline mine loupe mine and Lucky Twenty Between S tain Monarch mine Between S les mine Lout mine and tunnel Between S	= 320 ed = 327 342-43 = 356 = 358 = 359 = 362 662-363 = 367 368-369 874-375 990-391
Figure 4. Relation between aver or milled and altitudes of ore figure 5. Index map of mines a Figure 6. Longitudinal section of Figure 8. Plan and section of the Stigure 10. Longitudinal section a Figure 11. Geologic map and cross Figure 12. Plan and sections of the Figure 14. Plan and section of the Figure 14. Plan and section of the Figure 16. Plan and section of the Figure 16. Plan and sections of the Figure 16. Plan and sections of the Figure 16. Plan and sections of the Figure 16.	rage presented shoots and prosecuted for the Secution versions the Mother Guada e Moune Eurage old	ecious-metal content of ores shipp spects Between utton mine aniel Bonanza mine a and Roy Neal mines ein group e Dunmore-North Star vein n of the Dunmore lode Between er Cline mine loupe mine and Lucky Twenty Between tain Monarch mine Between les mine Lout mine and tunnel Between	320 ed 327 342-43 356 359 361 362 367 368-369 374-375 379 990-391
Figure 4. Relation between aver or milled and altitudes of ore figure 5. Index map of mines a Figure 6. Longitudinal section of Figure 8. Plan and section of the Stigure 10. Longitudinal section a Figure 11. Geologic map and cross Figure 12. Plan and sections of the Figure 14. Plan and section of the Figure 14. Plan and section of the Figure 16. Plan and section of the Figure 16. Plan and sections of the Figure 16. Plan and sections of the Figure 16. Plan and sections of the Figure 16.	rage presented shoots and prosecuted for the Secution versions the Mother Guada e Moune Eurage old	ecious-metal content of ores shipp spects Between utton mine aniel Bonanza mine a and Roy Neal mines ein group e Dunmore-North Star vein n of the Dunmore lode Between er Cline mine loupe mine and Lucky Twenty Between tain Monarch mine Between les mine Lout mine and tunnel Between	320 ed 327 342-43 356 359 361 362 367 368-369 374-375 379 990-391
Figure 4. Relation between aver or milled and altitudes of ore figure 5. Index map of mines a Figure 6. Longitudinal section of Figure 8. Plan and section of the Stigure 10. Longitudinal section a Figure 11. Geologic map and cross Figure 12. Plan and sections of the Figure 14. Plan and section of the Figure 14. Plan and section of the Figure 16. Plan and section of the Figure 16. Plan and sections of the Figure 16. Plan and sections of the Figure 16. Plan and sections of the Figure 16.	rage presented shoots and prosecuted for the Secution versions the Mother Guada e Moune Eurage old	ecious-metal content of ores shipp spects Between utton mine aniel Bonanza mine a and Roy Neal mines ein group e Dunmore-North Star vein n of the Dunmore lode Between er Cline mine loupe mine and Lucky Twenty Between tain Monarch mine Between les mine Lout mine and tunnel Between	320 ed ed 327 342-43 356 359 361 362 367 368-369 374-375 379 990-391
Figure 4. Relation between aver or milled and altitudes of ore figure 5. Index map of mines a Figure 6. Longitudinal section of Figure 8. Plan and section of the Stigure 10. Longitudinal section a Figure 11. Geologic map and cross Figure 12. Plan and sections of the Figure 14. Plan and section of the Figure 14. Plan and section of the Figure 16. Plan and section of the Figure 16. Plan and sections of the Figure 16. Plan and sections of the Figure 16. Plan and sections of the Figure 16.	rage presented shoots and prosecuted for the Secution versions the Mother Guada e Moune Eurage old	ecious-metal content of ores shipp spects Between utton mine aniel Bonanza mine a and Roy Neal mines ein group e Dunmore-North Star vein n of the Dunmore lode Between er Cline mine loupe mine and Lucky Twenty Between tain Monarch mine Between les mine Lout mine and tunnel Between	320 ed ed 327 342-43 356 359 361 362 367 368-369 374-375 379 990-391
Figure 4. Relation between aver or milled and altitudes of ore figure 5. Index map of mines a Figure 6. Longitudinal section of Figure 8. Plan and section of the Stigure 10. Longitudinal section a Figure 11. Geologic map and cross Figure 12. Plan and sections of the Figure 14. Plan and section of the Figure 14. Plan and section of the Figure 16. Plan and section of the Figure 16. Plan and sections of the Figure 16. Plan and sections of the Figure 16. Plan and sections of the Figure 16.	rage presented shoots and prosecuted for the Secution versions the Mother Guada e Moune Eurage old	ecious-metal content of ores shipp spects Between utton mine aniel Bonanza mine a and Roy Neal mines ein group e Dunmore-North Star vein n of the Dunmore lode Between er Cline mine loupe mine and Lucky Twenty Between tain Monarch mine Between les mine Lout mine and tunnel Between	320 ed ed 327 342-43 356 359 361 362 367 368-369 374-375 379 990-391
Figure 4. Relation between aver or milled and altitudes of ore figure 5. Index map of mines a Figure 6. Longitudinal section of Figure 8. Plan and section of the Stigure 10. Longitudinal section a Figure 11. Geologic map and cross Figure 12. Plan and sections of the Figure 14. Plan and section of the Figure 14. Plan and section of the Figure 16. Plan and section of the Figure 16. Plan and sections of the Figure 16. Plan and sections of the Figure 16. Plan and sections of the Figure 16.	rage presented shoots and prosecuted for the Secution versions the Mother Guada e Moune Eurage old	ecious-metal content of ores shipp spects Between utton mine aniel Bonanza mine a and Roy Neal mines ein group e Dunmore-North Star vein n of the Dunmore lode Between er Cline mine loupe mine and Lucky Twenty Between tain Monarch mine Between les mine Lout mine and tunnel Between	320 ed ed 327 342-43 356 359 361 362 367 368-369 374-375 379 990-391
Figure 4. Relation between aver or milled and altitudes of ore figure 5. Index map of mines a Figure 6. Longitudinal section of Longitudinal section of Longitudinal section of Plan and section of the Stigure 10. Longitudinal section of the Figure 11. Geologic map and cros Figure 12. Plan and sections of the Figure 15. Plan and section of the Figure 15. Plan and section of the Figure 16. Plan and sections of the Figure 19. Plan of the Alabama merchant of the Figure 19. Plan of the Grand Vice Figure 21. Plan of the Grand Vice Plan of the lower tunner or milled properties of the Figure 22. Plan of the lower tunner or milled properties of the Plan of the Grand Vice Plan of the lower tunner or milled properties of the Plan of the lower tunner or milled properties of the Plan of the lower tunner or milled properties of the Plan of the lower tunner or milled properties of the Plan of the lower tunner or milled properties of the Plan of the lower tunner or milled properties of the Plan of the lower tunner or milled properties of the Plan of the lower tunner or milled properties of the Plan of the lower tunner or milled properties of the Plan of the lower tunner or milled properties of the Plan of the lower tunner or milled properties of the Plan of the lower tunner or milled properties of the Plan of the Plan of the Plan of the lower tunner or milled properties of the Plan of the Pla	rage presented and prosection of the S f the D	ecious-metal content of ores shipps spects Between utton mine aniel Bonanza mine a and Roy Neal mines ein group e Dunmore-North Star vein n of the Dunmore lode Between S ter Cline mine loupe mine and Lucky Twenty Between S tain Monarch mine Between S d upper prospect of the Picket mine	
Figure 4. Relation between aver or milled and altitudes of ore figure 5. Index map of mines a Figure 6. Longitudinal section of Longitudinal section of Longitudinal section of Plan and section of the Stigure 10. Longitudinal section of the Figure 11. Geologic map and cros Figure 12. Plan and sections of the Figure 15. Plan and section of the Figure 15. Plan and section of the Figure 16. Plan and sections of the Figure 19. Plan of the Alabama merchant of the Figure 19. Plan of the Grand Vice Figure 21. Plan of the Grand Vice Plan of the lower tunner or milled properties of the Figure 22. Plan of the lower tunner or milled properties of the Plan of the Grand Vice Plan of the lower tunner or milled properties of the Plan of the lower tunner or milled properties of the Plan of the lower tunner or milled properties of the Plan of the lower tunner or milled properties of the Plan of the lower tunner or milled properties of the Plan of the lower tunner or milled properties of the Plan of the lower tunner or milled properties of the Plan of the lower tunner or milled properties of the Plan of the lower tunner or milled properties of the Plan of the lower tunner or milled properties of the Plan of the lower tunner or milled properties of the Plan of the lower tunner or milled properties of the Plan of the Plan of the Plan of the lower tunner or milled properties of the Plan of the Pla	rage presented and prosection of the S f the D	ecious-metal content of ores shipps spects Between utton mine aniel Bonanza mine a and Roy Neal mines ein group e Dunmore-North Star vein n of the Dunmore lode Between S ter Cline mine loupe mine and Lucky Twenty Between S tain Monarch mine Between S d upper prospect of the Picket mine	
Figure 4. Relation between aver or milled and altitudes of ore figure 5. Index map of mines a Figure 6. Longitudinal section of Longitudinal section of Longitudinal section of Plan and section of the Stigure 10. Longitudinal section of the Figure 11. Geologic map and cros Figure 12. Plan and sections of the Figure 15. Plan and section of the Figure 15. Plan and section of the Figure 16. Plan and sections of the Figure 19. Plan of the Alabama merchant of the Figure 19. Plan of the Grand Vice Figure 21. Plan of the Grand Vice Plan of the lower tunner or milled properties of the Figure 22. Plan of the lower tunner or milled properties of the Plan of the Grand Vice Plan of the lower tunner or milled properties of the Plan of the lower tunner or milled properties of the Plan of the lower tunner or milled properties of the Plan of the lower tunner or milled properties of the Plan of the lower tunner or milled properties of the Plan of the lower tunner or milled properties of the Plan of the lower tunner or milled properties of the Plan of the lower tunner or milled properties of the Plan of the lower tunner or milled properties of the Plan of the lower tunner or milled properties of the Plan of the lower tunner or milled properties of the Plan of the lower tunner or milled properties of the Plan of the Plan of the Plan of the lower tunner or milled properties of the Plan of the Pla	rage presented and prosection of the S f the D	ecious-metal content of ores shipps spects Between utton mine aniel Bonanza mine a and Roy Neal mines ein group e Dunmore-North Star vein n of the Dunmore lode Between S ter Cline mine loupe mine and Lucky Twenty Between S tain Monarch mine Between S d upper prospect of the Picket mine	
Figure 4. Relation between aver or milled and altitudes of ore figure 5. Index map of mines a Figure 6. Longitudinal section of Longitudinal section of Longitudinal section of Plan and section of the Stigure 10. Longitudinal section of the Figure 11. Geologic map and cros Figure 12. Plan and sections of the Figure 15. Plan and section of the Figure 15. Plan and section of the Figure 16. Plan and sections of the Figure 19. Plan of the Alabama merchant of the Figure 19. Plan of the Grand Vice Figure 21. Plan of the Grand Vice Plan of the lower tunner or milled properties of the Figure 22. Plan of the lower tunner or milled properties of the Plan of the Grand Vice Plan of the lower tunner or milled properties of the Plan of the lower tunner or milled properties of the Plan of the lower tunner or milled properties of the Plan of the lower tunner or milled properties of the Plan of the lower tunner or milled properties of the Plan of the lower tunner or milled properties of the Plan of the lower tunner or milled properties of the Plan of the lower tunner or milled properties of the Plan of the lower tunner or milled properties of the Plan of the lower tunner or milled properties of the Plan of the lower tunner or milled properties of the Plan of the lower tunner or milled properties of the Plan of the Plan of the Plan of the lower tunner or milled properties of the Plan of the Pla	rage presented and prosection of the S f the D	ecious-metal content of ores shipps spects Between utton mine aniel Bonanza mine a and Roy Neal mines ein group e Dunmore-North Star vein n of the Dunmore lode Between S ter Cline mine loupe mine and Lucky Twenty Between S tain Monarch mine Between S d upper prospect of the Picket mine	
Figure 4. Relation between aver or milled and altitudes of ore figure 5. Index map of mines a Figure 6. Longitudinal section of Longitudinal section of Longitudinal section of Plan and section of the Stigure 10. Longitudinal section of the Figure 11. Geologic map and cros Figure 12. Plan and sections of the Figure 15. Plan and section of the Figure 15. Plan and section of the Figure 16. Plan and sections of the Figure 19. Plan of the Alabama merchant of the Figure 19. Plan of the Grand Vice Figure 21. Plan of the Grand Vice Plan of the lower tunner or milled properties of the Figure 22. Plan of the lower tunner or milled properties of the Plan of the Grand Vice Plan of the lower tunner or milled properties of the Plan of the lower tunner or milled properties of the Plan of the lower tunner or milled properties of the Plan of the lower tunner or milled properties of the Plan of the lower tunner or milled properties of the Plan of the lower tunner or milled properties of the Plan of the lower tunner or milled properties of the Plan of the lower tunner or milled properties of the Plan of the lower tunner or milled properties of the Plan of the lower tunner or milled properties of the Plan of the lower tunner or milled properties of the Plan of the lower tunner or milled properties of the Plan of the Plan of the Plan of the lower tunner or milled properties of the Plan of the Pla	rage presented and prosection of the S f the D f the D f the S f the D	ecious-metal content of ores shipps spects Between utton mine aniel Bonanza mine a and Roy Neal mines ein group e Dunmore-North Star vein n of the Dunmore lode Between S ter Cline mine loupe mine and Lucky Twenty Between S tain Monarch mine Between S d upper prospect of the Picket mine	
Figure 4. Relation between aver or milled and altitudes of ore figure 5. Index map of mines a Figure 6. Longitudinal section of Longitudinal section of Longitudinal section of Plan and section of the Stigure 10. Longitudinal section of the Figure 11. Geologic map and cros Figure 12. Plan and sections of the Figure 15. Plan and section of the Figure 15. Plan and section of the Figure 16. Plan and sections of the Figure 19. Plan of the Alabama merchant of the Figure 19. Plan of the Grand Vice Figure 21. Plan of the Grand Vice Plan of the lower tunner or milled properties of the Figure 22. Plan of the lower tunner or milled properties of the Plan of the Grand Vice Plan of the lower tunner or milled properties of the Plan of the lower tunner or milled properties of the Plan of the lower tunner or milled properties of the Plan of the lower tunner or milled properties of the Plan of the lower tunner or milled properties of the Plan of the lower tunner or milled properties of the Plan of the lower tunner or milled properties of the Plan of the lower tunner or milled properties of the Plan of the lower tunner or milled properties of the Plan of the lower tunner or milled properties of the Plan of the lower tunner or milled properties of the Plan of the lower tunner or milled properties of the Plan of the Plan of the Plan of the lower tunner or milled properties of the Plan of the Pla	rage presented and prosection of the S f the D f the D f the S f the D	ecious-metal content of ores shipps spects Between utton mine aniel Bonanza mine a and Roy Neal mines ein group e Dunmore-North Star vein n of the Dunmore lode Between S ter Cline mine loupe mine and Lucky Twenty Between S tain Monarch mine Between S d upper prospect of the Picket mine	
Figure 4. Relation between aver or milled and altitudes of ore figure 5. Index map of mines a Figure 6. Longitudinal section of Longitudinal section of Longitudinal section of Plan and section of the Stigure 10. Longitudinal section of the Figure 11. Geologic map and cros Figure 12. Plan and sections of the Figure 15. Plan and section of the Figure 15. Plan and section of the Figure 16. Plan and sections of the Figure 19. Plan of the Alabama merchant of the Figure 19. Plan of the Grand Vice Figure 21. Plan of the Grand Vice Plan of the lower tunner or milled properties of the Figure 22. Plan of the lower tunner or milled properties of the Plan of the Grand Vice Plan of the lower tunner or milled properties of the Plan of the lower tunner or milled properties of the Plan of the lower tunner or milled properties of the Plan of the lower tunner or milled properties of the Plan of the lower tunner or milled properties of the Plan of the lower tunner or milled properties of the Plan of the lower tunner or milled properties of the Plan of the lower tunner or milled properties of the Plan of the lower tunner or milled properties of the Plan of the lower tunner or milled properties of the Plan of the lower tunner or milled properties of the Plan of the lower tunner or milled properties of the Plan of the Plan of the Plan of the lower tunner or milled properties of the Plan of the Pla	rage presented and prosection of the S f the D f the D f the S f the D	ecious-metal content of ores shipps spects Between utton mine aniel Bonanza mine a and Roy Neal mines ein group e Dunmore-North Star vein n of the Dunmore lode Between S ter Cline mine loupe mine and Lucky Twenty Between S tain Monarch mine Between S d upper prospect of the Picket mine	
Figure 4. Relation between aver or milled and altitudes of ore figure 5. Index map of mines a Figure 6. Longitudinal section of Longitudinal section of Longitudinal section of Plan and section of the Stigure 10. Longitudinal section of the Figure 11. Geologic map and cros Figure 12. Plan and sections of the Figure 15. Plan and section of the Figure 15. Plan and section of the Figure 16. Plan and sections of the Figure 19. Plan of the Alabama merchant of the Figure 19. Plan of the Grand Vice Figure 21. Plan of the Grand Vice Plan of the lower tunner or milled properties of the Figure 22. Plan of the lower tunner or milled properties of the Plan of the Grand Vice Plan of the lower tunner or milled properties of the Plan of the lower tunner or milled properties of the Plan of the lower tunner or milled properties of the Plan of the lower tunner or milled properties of the Plan of the lower tunner or milled properties of the Plan of the lower tunner or milled properties of the Plan of the lower tunner or milled properties of the Plan of the lower tunner or milled properties of the Plan of the lower tunner or milled properties of the Plan of the lower tunner or milled properties of the Plan of the lower tunner or milled properties of the Plan of the lower tunner or milled properties of the Plan of the Plan of the Plan of the lower tunner or milled properties of the Plan of the Pla	rage presented and prosection of the S f the D f the D f the S f the D	ecious-metal content of ores shipp spects Between utton mine aniel Bonanza mine a and Roy Neal mines ein group e Dunmore-North Star vein n of the Dunmore lode Between er Cline mine loupe mine and Lucky Twenty Between tain Monarch mine Between les mine Lout mine and tunnel Between	

ABSTRACT

The adjoining Mineral Point, Poughkeepsie, and Upper Uncompandere districts lie in a high and rugged part of the San Juan Mountains, covering an irregular area of about 25 square miles. Altitudes range from 8,300 to 13,450 feet.

In the deeper canyons of the northwest part, a folded pre-Cambrian basement of quartzite and slate is exposed. The smooth westward-sloping surface of these rocks is overlain by a relatively thin, westward dipping wedge of sandstones, shales, conglomerates, and limestones which range in age from Devonian to Jurassic. Overlying these and forming most of the mountain ridges are the crudely bedded, essentially horizontal strata of the San Juan tuff. The San Juan tuff and breccias, which are Miocene (?), are 1,500 to 2,500 feet thick. About 1,000 feet of andesite and latite overlie the San Juan tuff in Hayden Mountain. The southeast area comprising Poughkeepsie Gulch and Mineral Point is composed of the Silverton volcanic series which is Miocene. The rocks of this series consist of a thick, slightly tilted, complex accumulation of rhyolite, latite, and andesite flows, tuffs, and breccias. Interfingering and some contemporaneity exist between the flows and breccias of the Silverton volcanic series and the San Juan tuff.

Pre-volcanic intrusive rocks consist of a quartz monzonite laccolith of early Tertiary age and diabase dikes of uncertain age. Most of the intrusive bodies, however, are either contemporaneous with or younger than the volcanic rocks. They consist of plugs and domes of latite, plugs and dikes of rhyolite, dikes of andesite, and dikes and sills of quartz latite porphyry.

The principal mineral deposits are fissure fillings, but the deposits in general may be divided into three classes: (1) fissure and cavity fillings, (2) breccia chimney and breccia dikes, and (3) replacement deposits.

In the northwest area several pre-volcanic fissures have served as the ore channels for much more numerous fissures that are confined to the overlying volcanic rocks. In the Mineral Point and Poughkeepsie districts the principal fissure sets have a northeasterly course, but an interrupted and less prominent easterly set is also present. The northeasterly fissures usually dip steeply to the southeast and have normal displacements which increase generally on successive fissures to the southeast. The fissures and veins developed thereon, are very much split, branched, and interconnected. Multiple or complex lodes are over 100 feet wide for stretches of several hundred feet. Several of the more persistent vein zones are over five miles long.

The veins average between $2\frac{1}{2}$ and 3 feet in width, and many are strongly marked with gouge walls. The deposits have a high quartz content and contain chiefly argentiferous base-metal ores accompanied by pyrite. The gold content is generally low. Some ore shoots contain tungsten or bismuth. Besides quartz the gangue may also include kaolin, sericite, barite, rhodochrosite, rhodonite, and locally hematite or fluorite. The high-grade ore shoots generally are composed of argentite, ruby silver, brittle silver, or gray copper. They have not been appreciably enriched by supergene processes.

Compared to the nearby Silverton, Red Mountain, and Ouray districts, the output from these veins has been small. In part this contrast is because the deposits are fewer and the ore of lower grade, but for many of the deposits of the Mineral Point and Poughkeepsie Gulch districts the low output record is attributable to inaccessibility. The future of the Mineral Point and Poughkeepsie Gulch districts depends on development and mining through long low-level tunnels. About 125 miles of veins have been mapped and more than 100 mines and prospects are described.

INTRODUCTION

This report is to accompany and supplement the preliminary geologic map and cross sections of the Mineral Point, Poughkeepsie, and Upper Uncompander Districts, Ouray, San Juan, and Hinsdale Counties, issued in 1943 by the Geological Survey, U. S. Department of the Interior, in cooperation with the Colorado State Geological Survey Board and the Colorado Metal Mining Fund.

GEOGRAPHY

The Mineral Point, Poughkeepsie, and Upper Uncompahgre districts, which adjoin one another, are in the San Juan Mountains of southwestern Colorado at about latitude 37°58'N. and longitude 107°38'W. The map represents an area of about 25 square miles extending from Bear Creek Falls about a mile south of Ouray, southeastward nearly to Animas Forks, a distance of seven miles. It covers the headwaters of the Uncompangre River at Mineral Point and in Poughkeepsie Gulch, the headwaters of the Animas River in the North Fork of Animas River and in California Gulch, and a small part of the headwaters of Henson Creek north of Engineer Mountain. It also includes Red Mountain Creek between Ironton Park and the Uncompangre River, and a short stretch of Canyon Creek, as well as parts of Hayden, Abrams, Brown, Hurricane, Tuttle, Houghton, and Engineer mountains. Altitudes in the area range from 8,300 to 13,450 feet. The entire area lies within the Uncompangre National Forest

The region is one of heavy winter snows which considerably hamper mining activity in the higher parts from late fall to late spring. The summers are typified by afternoon thunder-storms and much rainfall. The region is exceedingly rugged with steep slopes and many sheer cliffs. The lower parts of the Uncompangre River and Canyon Creek are in

gorges, and the numerous small glacial lakes and cirque basins in the high areas are rimmed by sharp ridges and hornlike peaks. The cirque basins are commonly filled deeply with talus and rock glaciers which hide some veins for long distances. Water is abundant and the rocks are so saturated as to make much very heavy ground where lodes are wide and soft or where the wall rock is much altered and permeable. Thin glacial moraine, residual soil, and snowslide mud, all more or less grown over by grass and bush, cover other areas. In many places these masses are steadily creeping, and where tunnels to deposits have been driven in such ground the portals are soon caved unless often repaired.

Although the lower Canyon Creek and Upper Uncompahgre areas are among the most accessible parts, Mineral Point and especially Poughkeepsie Gulch are perhaps the least accessible parts of the Silverton quadrangle. The Mineral Point district is accessible by road either from Silverton or Ouray. The Silverton road is generally less difficult to travel but somewhat longer. During the summer of 1942 the road over Engineer Pass connecting the Mineral Point and Henson Creek districts was repaired. The rest of the districts are accessible only by good trails.

GEOLOGIC MAP AND CROSS SECTIONS

In connection with various uses of the geologic map, (pl. 1) and the cross sections (pl. 2) certain guiding remarks should be made especially for those who lack experience in interpreting geologic maps.

On the geologic map about one-half of the area is covered by an alluvium pattern. This includes many kinds of mantle or rock debris and soil generally moved some distance from its bed-rock source. The boundaries of this material are well-defined in some places, thereby permitting accurate mapping; in other places, however, the boundaries are not clearly defined and the interpretation on the map is correspondingly uncertain. In some places, because

of its thinness or its occurrence in scattered patches, the alluvial cover has not been shown. In a few areas, as on the east side of Hayden ridge or the south base of Engineer Mountain, landslide blocks are mapped as part of the alluvium. Where such blocks are not too much broken, veins may still be intact within them and may even contain ore bodies which could be mined more or less continuously to the base of the slide block. In most places, however, much shattering, discontinuity of veins, and heavy ground should be expected in landslide material. Along the south slope of Engineer Mountain several veins are shown by dotted lines extended through the alluvial pattern. In some places where uncertainty exists more than one possibility of vein connections or extensions are indicated by dotted lines; these features remain to be proved or disproved by further development

The courses of the veins are mapped on plate 1. The names along the veins are those of patented claims, each name being placed nearly midway between the end lines of the claim. With veins that are inclined the course of the outcrop may be considerably different from the direction of a drift along the vein and the difference becomes increasingly great as the dip of the vein decreases and the slope of the terrain becomes steeper. The difference between the course or trend of a vein (to which the side lines of a claim should be parallel) and the strike of the vein (the direction of drifting) is one that is naturally confusing to inexperienced observers. On a steep slope, two nearby veins of opposite dip may actually course or trend toward each other as if to intersect, and drifts on the two veins at the same level may diverge. This is true of the Sutton and Denver veins which are described under the Sutton mine. The situation is accentuated by steep slopes and gentle vein dips. Although slopes are unusually steep in these districts the veins also are mostly steep to vertical. An example of the relationship between the course and the strike of a vein is given in figure 1.

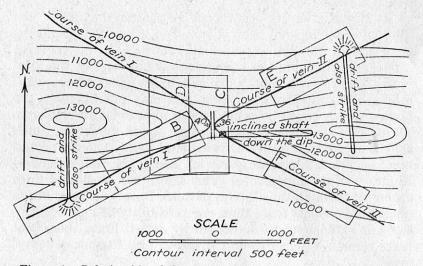


Figure 1. Relationship of the course and the strike of inclined veins.

Both veins I and II strike nearly N, as shown by dip and strike symbols in the saddle at their apices and by the drifts on claims A and E. Note that the courses diverge from the strikes by about 45 degrees and that the course of vein I on claims A and B is the same as and in line with that of vein II along claim E. Claims C and D suggest other methods of holding parts of the veins; however, C includes the apex of each vein, and its owner would have apex rights to the part of the vein underlain by B. Of course, the outcrops on claims E and F belong to the same vein.

These remarks apply strictly only to veins uncurved in either the strike or the dip directions. Generally the veins are considerably curved locally, but large or abrupt changes in direction or dip are uncommon and the principles explained above usually apply. On the geologic map many dips but only few strikes of veins are shown; however, the direction of a drift along a vein shows its strike rather accurately. The direction of dip is also shown by the position of the drift (black) to the outcrop (red). Veins on which there are no dip arrows are vertical or nearly so.

On the geologic cross sections (pl. 2) the attitudes of the veins are only apparent; that is, they are the traces of the veins as they intersect the plane of the cross section. If this plane is perpendicular, or very nearly perpendicular, to the strike of the vein, then the attitude in which the vein is shown is its true attitude. Veins that are rather oblique to the plane of the cross section are plotted with attitudes or apparent dips that are somewhat less than their true dips. The apparent dip departs farther from the true dip and becomes more gentle as the vein departs from an attitude perpendicular to the cross section. The true dip of an inclined vein shown in cross section can usually be determined by reference to the geologic map, but the relationship of true dip to apparent dip is as follows:

$$\tan D = \frac{\tan A}{\sin B}, \text{ where }$$

D= true dip, A= apparent dip (shown in cross section), and B= angle between planes of vein and cross section.

ACKNOWLEDGEMENTS

Much information was given freely by many of the residents and operators in the Ouray and Silverton regions. The assistance especially of E. W. Creel, Annie and Kenneth MacLennan, William McCullough, Ernest Miller, Walter Wheeler, Belle Hersinger, E. E. Eggleston, J. E. Jarrett, Frank Bell, J. E. Carney, Art Walker, Dan C. McNaughton, E. E. Rathbun, Nick Collins, Gustavus Sessinghaus, and Joseph D. Pender is gratefully acknowledged. Mr. Caswell Silver served as field assistant in 1940 and 1941. For much advice in mapping problems and aid in preparation of the maps and report, the author is greatly indebted to W. S. Burbank, under whose general supervision the work was done. To Mr. G. F. Loughlin, who edited the manuscript, appreciation is extended for many suggestions, especially in connection with the problem of ore in depth. The geologic map in Canyon Creek is from the unpublished works of W. S. Burbank and F. M. Chase. For office space, certain equipment, and minor contributory research funds the writer is grateful to the University of New Mexico.

ROCK FORMATIONS PRE-CAMBRIAN ROCKS

The Uncompangre formation comprises all the pre-Cambrian rocks of the region. It consists of alternating quartzite and slate units which, in the highly tilted limb exposed in Uncompangre Canyon between Bear Creek Falls and the north slope of Abrams Mountain, aggregate about 7.000 feet in thickness, as shown in the following table:

	사용 가는 사용하다 하는 것은 사용 사용 사용 가는 사용하다 하는 사용 사용하는 사용을 가지 않는 것이 없는 것이 없는 것이 없는 것이 없는 것이다.	
	Lithologic Units of the Uncompangre Formatic	n
NO		FEET
5.	Quartzite, white, sugary-grained, and evenly bedded.	350
4.	Slate, black and greenish-black with common varvelike, dark and light laminations (Bear Creek locality)	750
3.	Quartzite, evenly bedded with common small-scale (one foot) cross-bedded layers; prominent white quartzite at the top becoming red and brownish-red and more argillaceous with interbedded slates toward the bottom. (Sutton Mill locality)	2,900
_		2,300
2.	Slate, arenaceous, and intercalated quartzite	

beds near the top and the bottom; some chlorite, mica, and chiastolite schist; drag-folded zones. 1.700 (State Bridge locality)

1. Quartzite and conglomerate, gray to red-gray; conglomerate near the top and near the exposed lower beds. (Dunmore mine locality)

1.300 +

An additional thickness of about 1,700 feet of quartzite and slate lies above and north of this section in the area adjacent to Ouray. The base is not exposed, but it probably grades downward into the Vallecito conglomerate of the Needle Mountains group.

The upper surface of the Uncompangre formation is regular where it is overlain by the Paleozoic sedimentary rocks, and moderately irregular where it is overlain by the Telluride conglomerate or the San Juan tuff. The unconformity at the base of the Telluride conglomerate or the volcanic rocks slopes irregularly to the northwest. In detail its higher parts follow the hard quartzite units and its lower parts follow the soft slate. The relief of the surface is about 1,100 feet, and rather abrupt changes are common. The position of this surface determines the bottom of many fissure veins.

PALEOZOIC AND MESOZOIC ROCKS

The principal area of Paleozoic and Mesozoic rocks is in Canyon Creek where they occupy the lower part of the canyon and lie beneath the Telluride conglomerate. The Cutler formation (Permian), composed of red sandstone, shale, and conglomerate, forms the bottom of the canyon and is overlain by Mesozoic rocks which crop out as bands in both walls of the canvon. The Mesozoic rocks lie with small angular unconformity over the Paleozoic rocks. The Hermosa formation (Pennsylvanian) is covered by San Juan tuff, and only a small outcrop of sandstone, limestone, and shale of the Molas formation (Pennsylvanian) occurs in the Uncompangre Canyon on Ralston Creek. As a whole the Paleozoic and Mesozoic formations consist of red, white, and buff thin-bedded sandstones and shales, with lesser units of conglomerate, marl, and limestone. Brief lithologic descriptions of the formations are given under explanation on the geologic map (pl. 1); detailed lithologic descriptions have been published by Burbank.3

The Leadville limestone (Mississippian) and possibly the Ouray limestone (Devonian) underlie parts of the alluvial patch along Ralston Creek, but they, like most of the other Paleozoic and Mesozoic formations, are of greater distribution and occurrence in the Uncompange district at Ouray. The favorable aspects of the Leadville-Molas con-

³Burbank, W. S., Revision of geologic structure and stratigraphy in the Ouray district of Colorado, and its bearing on ore deposition; Colorado Sci. Soc. Proc., vol. 12, pp. 157-180, 1930.

tact, and the Ouray limestone for ore channels have been pointed out by Burbank.⁴

TERTIARY BEDDED ROCKS Telluride Conglomerate

The Tertiary bedded rocks are volcanic except for the small quantity of Telluride conglomerate in the northwestern part of the districts.

In the Upper Uncompahgre and Canyon Creek areas the Telluride conglomerate is an alluvial-fan formation. It accumulated largely on a flat terrain of Mesozoic and Paleozoic rocks which existed to the west of the pre-Cambrian upland in middle Tertiary time. In Canyon Creek the conglomerate forms a nearly continuous bed about 50 feet thick at the base of the San Juan tuff. In Uncompahgre Canyon it is mostly in isolated thinner patches which formed in canyons, on hillsides, and near cliffs. It is largely composed of angular quartzitic cobbles, pebbles, or sand, but occasionally contains some granite, schist, or slate debris. In places it has been mixed with San Juan tuff and locally in Uncompahgre Canyon it is transitional upward into the San Juan tuff.

San Juan Tuff

The San Juan tuff is a coarse angular accumulation of volcanic fragments held in a matrix of sandy or tuffaceous volcanic material. It is largely a fanglomerate derived by subaerial erosion of flows, tuffs, and breccias of the Silverton volcanic series. Some tuffs and pyroclastic breccias are in the formation just as some alluvial beds are in the Silverton volcanic series. The composition of the material ranges from rhyolite to andesite just as do the volcanic rocks of the Silverton volcanic series. The lower part of the San Juan tuff interfingers with the Eureka rhyolite and several flows of the Burns latite. Occasional isolated andesite flows occur in the upper part of the formation on Hayden

⁴Burbank, W. S., Structural control of ore deposition in the Uncompangre district, Ouray County, Colo.; U.S. Geol. Surv. Bull. 906-E, p. 241, 1940.

Mountain.⁵ The thickness and generally horizontal attitude of the formation can be seen in several cross sections of plate 2. A tuff bed 10-20 feet thick can be identified at about 10,000 feet altitude in Hayden and Abrams mountains and in the cliffs between the Silver Link and Michael Breen mines. Burbank⁶ made a rough lithologic separation of the formation into the lower Canyon Creek member and the upper Sneffels member. In this region the horizon between the two members is at an altitude of about 10,700 feet.

Silverton Volcanic Series

Considerable change in interpretation of units from that of the Silverton folio has been made at Mineral Point and in Uncompandere Canyon north of Mount Abrams. Nevertheless, the correlations with units in the adjoining areas and hence designation within formerly established formations is still uncertain. Regrouping of units and establishment of new formation hames may be warranted in the future but is not undertaken extensively in this report.

Picayune volcanic group.—The rocks overlying the San Juan tuff on Hayden Mountain have been previously designated as units of the Picayune volcanic group. In general these rocks consist of a lower group of andesite flows, flow breccias, and breccias, and an upper group of latite and rhyolite flows, flow breccias, and tuffs. The lower group consisting of andesites may be roughly compared to the andesites on Mount Abrams near the Guadaloupe mine, and the upper group of rhyolite and latites may be compared to the similar rocks which are present in the upper part of Mount Abrams. The andesites of Hayden Mountain lie with a pronounced erosional unconformity on the San Juan tuff, and the contact drops somewhat abruptly to the south along the west side of Ironton Park toward Full Moon Gulch where, however, some interfingering is suggested between

⁵By mistake these were not labeled on plate 1, but should be marked Tsja as indicated in the explanation. They are correctly labeled on plate 2.

⁶Burbank, W. S., Revision of geologic structure and stratigraphy in the Ouray district of Colorado and its bearing on ore deposition: Colorado Sci. Soc. Proc., vol. 12, pp. 186-190, 1930.

the lower andesite and the San Juan tuff. The lower andesites of Mount Abrams appear to interfinger with the San Juan tuff in a very similar manner in a southward sloping contact north and south of Hendrick Gulch. It also appears quite probable that the lower part of the hornblende latite flows and tuffs of the Picayune, shown just south of Hendrick Gulch on the Red Mountain-Sneffels-Telluride map⁷, belong to the Eureka rhyolite.

To avoid confusion the rocks on Hayden are designated as Picayune to correspond to the overlapping and adjoining area on the Red Mountain-Sneffels-Telluride map.

Eureka rhyolite.—The Eureka rhyolite crops out in two areas—(1) in the lower part of Poughkeepsie Gulch, and (2) around the base and flanks of Houghton Mountain extending into the north fork of the Animas River and California Gulch. It is a greenish-gray rock that is more or less crudely bedded and jointed parallel to its top and base. The base of the formation is not exposed in this region. The top is clearly distinguished around Houghton Mountain where it contrasts with the somber brown of the overlying Burns latite. The formation is composed of rhyolite-latite flows, breccias, and welded tuffs. Veins and fissures are less branched and split than in the overlying Burns latite.

Burns latite.—Included in the Burns latite are four units of rather contrasting type or character. Each unit mostly occupies separate but adjoining areas. These units are

- (4) rhyolite-latite of Mount Abrams.
- (3) banded latite of south of Mineral Point.
- (2) amygdaloidal gray andesite of Engineer Mountain.
- (1) andesite of Mineral Point.

The younger latitic units are separated from the andesites mostly by pronounced erosion surfaces. The latites are not in contact with each other and appear to have been

⁷Burbank, W. S., Structural control of ore deposition in the Red Mountain, Sneffels, and Telluride districts of the San Juan Mountains, Colo.; Colorado Sci. Soc. Proc., vol. 14, plate 1. 1941.

derived from different centers of eruption. Together the latite units constitute what was mapped as the Burns latite in the Silverton folio. However, the two are rather distinct. The Mount Abrams unit is in part rhyolitic and is composed of rhyolite-latite flows, flow breccias, and welded tuffs. It seems to have been derived entirely from the intrusive plugs and vents of Mount Abrams and thus is simply a local facies of the Burns. The latites south of Mineral Point and those at the head of Poughkeepsie and California gulches are almost entirely flows. They have a flow structure which in places is remarkably formed into vertical or nearly vertical narrow bands over large areas; in fact, on the flat glacial surface east of the Old Lout and Maid of the Mist mines this banding is strongly suggestive of an intrusive mass such as a great shallow dome, but because of its continuity with the surrounding horizontally banded latites the mass is included with these clearly extrusive rocks. In the Tuttle Mountain area south of Mineral Point and in Poughkeepsie and California gulches, the Burns latite group rests directly upon the Eureka rhyolite and is overlain by the pyroxene andesite. The group does not appear to have extended as far north as Engineer Mountain except perhaps locally in the area off the base map north of the Benack mine

The andesite of Mineral Point and the overlying unit in Engineer Mountain were formerly mapped as part of the younger pyroxene andesite unit. However, the detailed mapping around Mineral Point has shown clearly that the banded latites overlie the andesite of Mineral Point. The gray amygdaloidal andesite unit of Engineer Mountain consists partly of breccias and coarse-bedded tuffs.

Veins are much more branched and split in the banded latites than in the andesites. No mineral deposits are developed in the rhyolite-latites of Mount Abrams.

Pyroxene andesite.—The pyroxene andesite is found on the ridges of Engineer Mountain, on the high ridges and peaks around the upper part of Poughkeepsie Gulch, and on Hayden Mountain. At Engineer Mountain it is the boldly outcropping dense andesite of the high cliffs whose base lies about at the lower 4-level Polar Star tunnel. It is locally amygdaloidal at the top where it is in contact with the Henson tuff. The pyroxene andesite unit of the Poughkeepsie area is composed of irregularly intermixed andesite flows and tuffs. In some sections the andesites are predominant, and in others the tuffs are predominant. The tuffs are sandy, well-stratified, green or brown, and very similar to the Henson tuff with which they may in part be correlated. Irregular lobes of andesite occur locally in the tuff. In the Duco area, the lower part of the formation is principally andesite flows, and the upper part is principally sandy tuffs and some breccias.

Henson tuff.—The Henson tuff occupies much of the top of Engineer Mountain ridge. It is a sandy, green to brown, well-stratified tuff which contains thin lapilli beds. The formation on Engineer Mountain dips north-northwest and extends down into the head of Palmetto Creek and onto American Flats where it becomes thicker. On Engineer Mountain it is scarcely thicker or more prominent than the similar if not identical tuffs of the pyroxene andesite in Tuttle and Brown Mountains.

Potosi Volcanic Series

The only outcrop of the rhyolite of the Potosi volcanic series is on Engineer Mountain and the ridge to the north which forms the divide between Bear Creek and Palmetto Creek. On Engineer Mountain the Potosi is a dense fine-grained flow which is quite white owing to much alteration. The top is not exposed on Engineer Mountain, but along the ridge northwest of the Frank Hough mine the white flow is overlain by fluidal latite flows which are probably a part of the Alboroto quartz latite.⁸

^{*}Cross. W., and Larsen, E. S., A brief review of the geology of the San Juan region of southwestern Colorado; U.S. Geol. Survey Bull. 843, pl. 10, 1935.

Intrusive Rocks Pre-Tertiary Intrusives

The principal pre-Tertiary intrusive rocks are dikes of andesite or diabase in the quartzites and slates of the Uncompangre formation near the Uncompangre River and Red Mountain Creek. These dikes, which are up to 60 feet in width, are usually much sheared, brecciated, or altered. In the smaller bodies shearing and alteration have converted the original massive rock into a shaly or slaty dark-brown variety. The only other intrusive body of possible pre-Tertiary age is a granitic sill about 15 feet thick which occurs in the slates near the junction of Curran and Red Mountain Creeks, but this intrusive might be of early Tertiary age and related to the Canyon Creek laccoliths.

Laccolith of Canyon Creek

The rock of this laccolith is a light-gray or greenish-gray quartz monzonite porphyry with a maximum thickness of more than 500 feet. The laccolith is of late Mesozoic or early Tertiary age and is related to the similar laccoliths at Ouray. The upper surface of the laccolith was exposed and eroded before the deposition of the Telluride conglomerate, as it is unconformably overlain by Telluride conglomerate and San Juan tuff. Mineral deposits that are directly associated with this body may be of late Mesozoic or early Tertiary age. Their character has been described by Burbank.⁹

Upper Tertiary Intrusives

The intrusives of this group are principally dikes, plugs, and sills. Quartz latite porphyry occurs in only two places. Near Duco a long, narrow dike with occasional small branching sills has invaded the tuff and breccia of the pyroxene andesite unit. On Engineer Peak, quartz latite porphyry forms a thick sill which overlies the white rhyolite of the Potosi.

Op. cit. Bull. 906-E, pp. 236-239.

The andesite intrusives are dikes of two varieties. The prominent andesite dike of Hayden Mountain is a dark rock similar to the andesite flows of that area. Flow structures of the dike indicate lateral emplacement from east to west. The other andesite dike is a green fine- to medium-grained tuffaceous-appearing rock with platy structure. It occurs east of the Eurades mine.

The latite intrusives are plugs or plug-dike forms, and a few have cone-sheet offshoots from them. All the latite intrusives are in the general vicinity of Mount Abrams. One small plug near the head of Hendrick Gulch flares upward and feeds into the overlying rhyolite-latite flows. The top and center of Mount Abrams is a large funnel-shaped plug which flares upward as though it may have welled into a crater or formed as a large plugdome. Most of these intrusives have marginal contacts of breccia. It is possible that some parts of the vertically banded latites mapped with the rocks of the Burns latite are intrusive.

East of the Old Lout and Maid of the Mist mines vertically banded latites form a great horseshoe-shaped body which is nearly 4,000 feet in diameter. The vertically banded rock in this body, which may be a great plugdome, flattens in all directions into the Burns latite flows.

Rhyolite is the youngest intrusive in the area; it forms irregular dikes and plugdikes. The rhyolite is white to gray, highly banded, and platy. The dikes usually pinch and swell considerably, and some fissures are discontinuously filled with them. The dikes also turn sharply in their courses and fill en echelon or parallel fissures. They commonly occupy fissures with veins and are then usually much pyritized and sericitized although they contain little or no ore. The dikes on Engineer Mountain commonly have distinct borders of pitchstone. At one time the mistaking of the pitchstone for pitchblende caused considerable excitement and claim staking. On Denver Hill and along the north flank of Houghton Mountain the rhyolite along the Sewell fissure has widened into an elongate plugdike.

STRUCTURE

FOLDS AND FAULTS IN THE PRE-CAMBRIAN ROCKS

The quartzites and slates of the Uncompangre formation are folded into a broad anticline which pitches 40°-50° in a N.65°W. direction (see fig. 2). The dips on the limbs range from 40° to 90° but are most commonly between 55° and 70°. Two zones of slate are rather uniformly drag folded, as shown on plate 1. A set of fan-shaped tension fractures is present in the fold; because of the pitch of the fold these fractures diverge in the direction of pitch and dip toward the core of the fold. These fractures are more numerous near the crest of the fold. Some are filled with dikes or veins or both. A few of the fractures are faults: the Dunmore fissure which lies near the crest of the fold has offset the beds on the north side about 4,500 feet west of those on the south side. This displacement appears to have been largely strike slip or horizontal and the white quartzite in contact with slate near the Sutton mill is the same bed as the one in contact with slate on the highway one-quarter mile south of the Dunmore ore bin. In plate 2, section B-B' the vertical offset is shown to be 2,800 feet. The actual slip on the fault could not have been less than this amount, but may have been more than 4,500 feet.

The divergent fissures are mineralized especially where the walls are quartzite, but a few large veins extend through the slate bands. Numerous bedding-plane displacements have occurred, and the younger beds on either limb have slipped westward and upward toward the axis. Little or no ore deposition occurs on bedding-plane faults. Post-volcanic adjustments on the divergent fractures and bedding planes controlled the formation of many of the fissures and faults in the overlying San Juan tuff.

PALEOZOIC-MESOZOIC WEDGE

The Paleozoic and Mesozoic formations are prominent and extensive to the north and west, but in this area they have been bevelled off between the smooth westward-tilted

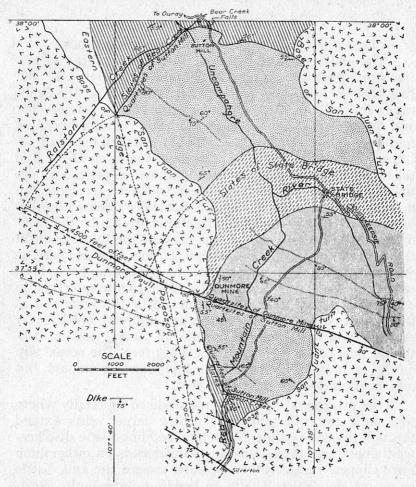


Figure 2. Geologic map of the Upper Uncompander area, showing the projected offset of pre-Cambrian and later formations on the Dunmore fault.

surface on the pre-Cambrian rocks and the irregular base of the horizontal overlying Tertiary formations under the north end of Hayden Mountain. They thus form a wedge whose thin edge probably lies along a nearly north line under the east side of Hayden Mountain and extends toward