

LATE CENOZOIC EROSIONAL HISTORY
OF THE
RATON MESA REGION

by

William S. Levings

ProQuest Number: 10795920

All rights reserved

INFORMATION TO ALL USERS

The quality of this reproduction is dependent upon the quality of the copy submitted.

In the unlikely event that the author did not send a complete manuscript and there are missing pages, these will be noted. Also, if material had to be removed, a note will indicate the deletion.



ProQuest 10795920

Published by ProQuest LLC (2018). Copyright of the Dissertation is held by the Author.

All rights reserved.

This work is protected against unauthorized copying under Title 17, United States Code
Microform Edition © ProQuest LLC.

ProQuest LLC.
789 East Eisenhower Parkway
P.O. Box 1346
Ann Arbor, MI 48106 – 1346

A thesis submitted to the Faculty and the Board of Trustees of the Colorado School of Mines in partial fulfillment of the requirements for the degree of Doctor of Science.

Signed: William S. Levings
William S. Levings

Golden, Colorado

Date: May 4, 1951, 1951

57748

Approved: F. M. Van Tuyl
F. M. Van Tuyl

Truman H. Kuhn
Truman H. Kuhn

7/10/57

CONTENTS

	<u>Page</u>
Abstract	1
Introduction	4
Location and Extent of the Area	4
Purpose and Scope of Investigation	4
Acknowledgments	7
Previous Geologic Studies	8
Methods of Investigation	13
Geography	17
General Features of Topography and Drainage	17
Climate and Vegetation	22
Natural Resources and Industries	24
Geologic Setting	27
Stratigraphy	28
Pre-Triassic Rocks	28
Upper Triassic Rocks	31
Dockum Group	31
Jurassic Rocks	32
Morrison Formation	33
Lower Cretaceous Rocks	33
Purgatoire Formation	33
Upper Cretaceous Rocks	34
General Statement	34

	<u>Page</u>
Stratigraphy (continued)	
Dakota Sandstone	35
Graneros Shale	36
Greenhorn Limestone	36
Carlisle Shale	37
Niobrara Formation	38
Pierre Shale	39
Trinidad Sandstone	39
Vermejo Formation	40
Tertiary Rocks	40
General Statement	40
Raton (Paleocene) Formation	41
Ogallala (Pliocene) Formation	41
Quaternary Rocks	51
General Statement	51
Alluvium	51
Landslides	52
Igneous Rocks	52
General Statement	52
Extrusive Rocks	53
Group 1	55
Group 2	61
Group 3	62
Intrusive Rocks	64

	<u>Page</u>
Structure	67
Major Structural Features	67
Foothills Belt	67
Trinidad-Raton Basin	68
Sierra Grande Uplift	69
Apishipa Uplift	72
Minor Structural Features	73
Time of Movements	75
Geomorphology	79
Relationship of Major Physiographic Provinces	79
Significant Regional Geological Events . .	81
Geomorphic Development	93
High-level Gravels	99
Distribution and Character	100
Origin	108
High-level Surface	114
Origin	114
Age	123
Pleistocene Pediments	134
San Miguel Surface (Colorado)	134
Beshoar Surface (Colorado)	135
Barela Surface (Colorado)	138
San Miguel Surface (New Mexico)	141
Beshoar Surface (New Mexico)	141

	<u>Page</u>
Geomorphology (continued)	
Barela Surface (New Mexico)	143
Origin	143
Correlations	151
Summary of Conclusions	156
Appendix I	158
Appendix II	177
Photomicrographs of Selected Thin Sections . . .	185
Bibliography	191

ILLUSTRATIONS

<u>Figures</u>		<u>Page</u>
1	Index map showing the relationships of regional physiographic subdivisions . .	5
2	Table of formations exposed in north-eastern New Mexico and southeastern Colorado	29
3	Cross-section from the foothills of the Rocky Mountains to the Kansas state line	30
4	Ogallala algal limestone, Union County New Mexico	47
5	Part of the south rim of Barilla Mesa north of Yankee, New Mexico	56
6	East rim of Bartlett Mesa	58
7	South rims of Horseshoe and Barilla Mesas	59
8	Volcanic cone, Bartlett Mesa	60
9	Towndrow Peak	60
10	Basalt sheet and underlying gravels on Johnson Mesa	96
11	High-level gravels, Barilla Mesa . . .	102
12	Rock-frequency chart at pebble-count localities	104
13	Gravel deposit at Manco Burro Pass . .	102
14	Huerfano formation, Apishipa Pass, Colorado	110
15	Huerfano formation, Apishipa Pass, Colorado	110
16	Spanish Peaks and pediment	113

<u>Figure</u>		<u>Page</u>
17	Stereopair of the Ogallala caprock beneath recent lava flows	127
18	Stereopair of the Ogallala caprock beneath recent lava flows	128
19	Gravels in roadcut between Trinidad and Engle	131
20	San Miguel pediment. Beshoar surface in foreground	136
21	San Miguel and Beshoar pediments . . .	136
22	Beshoar pediment south of Garcia . . .	137
23	Gravel capping Beshoar pediment	137
24	Barela and Beshoar pediments east of San Miguel	139
25	Northward convergence of pediments in Colorado	139
26	San Miguel and Beshoar pediments, New Mexico	142
27	Beshoar and Barela pediments west of Black Mesa	144
28	Pediment and terraces along the Cana- dian River	145
29	Pediments north of La Veta, Colorado. .	153
30	Pediments north of La Veta, Colorado. .	153
31	Gravels overlying the Raton formation at Mills Divide	155

<u>Plates</u>		<u>Page</u>
1	Areal geologic map of portions of southern Colorado and northern New Mexico	Pocket
2	Map of parts of the Raton Mesa region, Colorado and New Mexico, showing the relative ages, location, and areal distribution, of pediments and older erosion surfaces	Pocket
3	Panoramic view of the Trinidad, Colorado area	Pocket
4	East-west cross section transverse to the Raton coal basin	35a
5	Section from Barilla Mesa to Round Mesa, Raton Quadrangle showing relationship of different lava flows . . .	54a
6	Profile through Apishipa Pass, Colorado and Barilla Mesa, New Mexico... .	111a
7	East-west cross section through the Park Plateau and Barilla Mesa	39a
8	Preliminary contour map of the base of the Ogallala formation, Union County, New Mexico	Pocket
9	East-west section through Trinidad, Colorado to the Colorado-Kansas state line	124a
10	Northwest-southeast cross section showing the relationship of the Ogallala caprock to the high-level gravels . .	Pocket
11	Sketch map showing the association of the Ogallala formation and recent basalt flows in Union County, New Mexico	126a
12	Characteristic drainage pattern of the Ogallala formation	129a
13	Isopach map of the Ogallala formation in southeastern Colfax County, New Mexico	129b

<u>Plates</u>		<u>Page</u>
14	Restored stream profiles of pediments.	Pocket
15	Profiles showing accordant elevations of pediments	140a
16	Profile along pediments north of La Veta, Colorado	152a

The original material for this dissertation includes a significant number of oversized pages. The full text can be viewed by accessing the supplement file.

