



Sedimentary evolution of the Miocene-Pliocene Camp Davis basin, northwestern Wyoming
by Timothy John Olson

A thesis submitted in partial fulfillment of the requirements for the degree of Master of Science in
Earth Sciences

Montana State University

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Abstract:

The late Miocene to early Pliocene Camp Davis Formation of northwestern Wyoming consists of conglomeratic lower and upper members separated by lacustrine limestone, siltstone, and tuff of the middle member. Detailed lithofacies analyses show the lower member (75 to 100 meters) to consist primarily of massive to horizontally stratified pebble to cobble gravel (Gm) and trough cross-stratified granule to pebble gravel (Gt). Deposition occurred in a Scott-type braided stream system characterized by development and aggradation of diffuse gravel sheets and longitudinal bars (Gm) and filling of shallow channel scours (Gt). Paleocurrent data and presence of reworked Precambrian quartzite clasts and distinctive, yet previously unrecognized, Tertiary intrusive clasts suggest deposition by a south to southeastward flowing axial-parallel fluvial system (ancestral Snake River).

The upper member (1500 meters) is dominated by muddy, clast-supported, massive to horizontally stratified pebble to boulder conglomerates (Gm/Dcm and Gm/Dcm-Dmm) deposited by streamflow, sheetflood, hyperconcentrated flood flows and high-strength plastic debris flows. Matrix-supported conglomerate (Gms/Dmm) is typically massive, may be inversely graded, and represents deposition by high-strength plastic debris flows. Low-angle trough crossbedded gravel (Gt) accumulated during shallow scour infilling within shallow bed-load streams and during periods of unconfined sheet-flood. Collectively, these lithofacies suggest deposition on the proximal portion of a hyperconcentrated flood flow-dominated alluvial fan. Clast imbrication measurements indicate a southwestward paleoflow direction. Clasts include Paleozoic and Mesozoic sedimentary and Precambrian crystalline rocks derived from the Hoback and Gros Ventre ranges to the northeast.

The lower and middle members are interpreted to have been deposited in an incipient Camp Davis basin prior to major movement on the Hoback listric normal fault. Upper member deposition was in response to major motion along the Hoback fault which may have occurred later and over a shorter period of time than previously thought.

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Timothy John Olson

This thesis has been read by each member of the thesis committee and has been found to be satisfactory regarding content, English usage, format, citations, bibliographic style, and consistency, and is ready for submission to the College of Graduate Studies.

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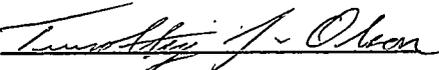
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TABLE OF CONTENTS

	Page
LIST OF TABLES.....	vii
LIST OF FIGURES.....	viii
ABSTRACT.....	x
INTRODUCTION.....	1
Purpose.....	1
Study Area.....	3
Geologic Setting.....	4
Methods.....	6
CAMP DAVIS FORMATION STRATIGRAPHY.....	8
LOWER MEMBER LITHOFACIES.....	12
Massive to Crudely Stratified Conglomerate (GM).....	12
Description.....	12
Interpretation.....	13
Trough Cross-Stratified Conglomerate (Gt).....	14
Description.....	14
Interpretation.....	16
Planar Cross-Stratified Conglomerate (Gp).....	16
Description.....	16
Interpretation.....	17
Trough Cross-Stratified and Scour-Fill Sandstone (St/Ss).....	18
Description.....	18
Interpretation.....	19
Massive to Horizontally Stratified Sandstone (Sm/Sh).....	19
Description.....	19
Interpretation.....	20
Ripple Cross-Stratified Sandstone (Sr).....	21
Description.....	21
Interpretation.....	21
Laminated Siltstone and Mudrock (Fl).....	22
Description.....	22
Interpretation.....	22
LOWER MEMBER DEPOSITIONAL SYSTEM.....	23
Depositional Model.....	23
Paleocurrents.....	25

TABLE OF CONTENTS--Continued

	Page
UPPER MEMBER LITHOFACIES.....	28
Massive to Crudely Stratified, Clast-Supported Conglomerate/Diamictite (Gm/Dcm).....	28
Description.....	28
Interpretation.....	32
Massive, Chaotic, Clast- to Matrix-Supported Conglomerate/Diamictite (Gm/Dcm-Dmm).....	34
Description.....	34
Interpretation.....	35
Massive Matrix-Supported Conglomerate/Diamictite (Gms/Dmm)....	37
Description.....	37
Interpretation.....	39
Minor Lithofacies.....	39
Description.....	39
Interpretation.....	41
UPPER MEMBER DEPOSITIONAL SYSTEM.....	43
Depositional Model.....	43
Paleocurrents.....	45
CONGLOMERATE COMPOSITION.....	47
CAMP DAVIS BASIN EVOLUTION.....	53
REFERENCES CITED.....	57

LIST OF TABLES

Table	Page
1. Formation names, ages and probable source areas for clast lithologies recognized in the lower and upper members of the Camp Davis Formation.....	49

LIST OF FIGURES

Figure	Page
1. Location map showing the distribution of lower and middle members (fine-stippled pattern) and upper member (coarse-stippled pattern) of the Camp Davis Formation in northwestern Wyoming and relation to Mesozoic and Tertiary structural features.....	2
2. Typical exposures of the lower member conglomerates located north of the Hoback River along U.S. Highway 187-189.....	4
3. Outcrops of the upper member conglomerates exposed north of Horse Creek.....	5
4. Structural cross-section through the Camp Davis basin showing relationship of the Hoback listric normal fault to the older Bear thrust.....	6
5. Generalized stratigraphic column for the Camp Davis Formation in northwestern Wyoming.....	9
6. Exposure of lower member showing dominance of massive to crudely horizontally stratified conglomerate (Gm) and trough cross-stratified conglomerate (Gt).....	13
7. Coset comprised of individual, truncated trough cross-stratified conglomerate sets (Gt) overlain and underlain by massive conglomerate (Gm).....	15
8. Trough cross-stratified conglomerate (Gt) set erosionally truncating and overlain by crudely horizontally stratified conglomerate (Gm).....	15
9. Solitary set of pebbly trough cross-stratified sandstone in the lower member.....	18
10. Massive to horizontally stratified sandstone with overlying laminated siltstone and mudrock.....	20
11. Generalized vertical lithofacies profile for lower member of Camp Davis Formation.....	24
12. Composite paleocurrent data from lower and upper members of Camp Davis Formation.....	26

LIST OF FIGURES---Continued

Figure	Page
13. Close-up of crudely stratified conglomerate (Gm/Dcm) from upper member showing poorly-sorted and muddy nature of matrix.....	29
14. Crudely stratified pebble to cobble, clast-supported conglomerate (Gm/Dcm) exposed in upper member along Horse Creek.....	30
15. Well developed imbrication of platy clasts in Gm/Dcm lithofacies.....	31
16. Massive, Chaotic, clast- to matrix-supported conglomerate (Gm/Dcm-Dmm).....	35
17. Massive matrix-supported conglomerate (Gms/Dmm) from upper member exposure along Horse Creek.....	37
18. Close-up of massive matrix-supported conglomerate (Gms/Dmm) showing abundance of mud matrix and floating clasts.....	38
19. Interval of trough cross-stratified conglomerate (Gt) within a sequence of crudely stratified conglomerate (Gm/Dcm) in upper portion of upper member.....	40
20. Generalized vertical lithofacies profile for upper member of the Camp Davis Formation.....	44
21. Composite histograms depicting conglomerate clast composition variation between lower and upper members of Camp Davis Formation.....	47
22. Paleogeographic reconstruction of the Camp Davis basin during lower member deposition (late Miocene-early Pliocene).....	53
23. Paleogeographic reconstruction of the Camp Davis basin during upper member deposition (Pliocene).....	55

ABSTRACT

The late Miocene to early Pliocene Camp Davis Formation of northwestern Wyoming consists of conglomeratic lower and upper members separated by lacustrine limestone, siltstone, and tuff of the middle member. Detailed lithofacies analyses show the lower member (75 to 100 meters) to consist primarily of massive to horizontally stratified pebble to cobble gravel (Gm) and trough cross-stratified granule to pebble gravel (Gt). Deposition occurred in a Scott-type braided stream system characterized by development and aggradation of diffuse gravel sheets and longitudinal bars (Gm) and filling of shallow channel scours (Gt). Paleocurrent data and presence of reworked Precambrian quartzite clasts and distinctive, yet previously unrecognized, Tertiary intrusive clasts suggest deposition by a south to southeastward flowing axial-parallel fluvial system (ancestral Snake River).

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INTRODUCTION

Purpose

Late Tertiary extension, associated with development of the Basin-and-Range structural province, was superimposed upon older thrust terranes of the Sevier orogenic belt in portions of the Cordillera of western North America. Many of the preexisting thrust ramps were reactivated as listric normal faults in response to this extension, forming rapidly-subsiding basins which filled with thick sedimentary sequences (Royse and others 1975; Constenius, 1982). The deposits of these listric normal fault-bounded basins, especially coarse-grained basin margin facies, are generally poorly exposed, thereby preventing detailed stratigraphic, sedimentologic, and provenance studies. Hence, understanding of the depositional and tectonic histories of such basins is typically poor.

This study provides an example from northwestern Wyoming of the potential depositional and tectonic complexities which may exist in late Tertiary basins of the northern Rocky Mountain region. Excellent northeast dipping exposures of the late Miocene to early Pliocene Camp Davis Formation are present along the west flank of the Hoback Range in northwestern Wyoming (Figure 1). These exposures provide a unique opportunity to study in detail the sedimentology, stratigraphy, and provenance of late Tertiary coarse-grained basin-fill, in order to gain a better understanding of the tectonic and sedimentary evolution of a

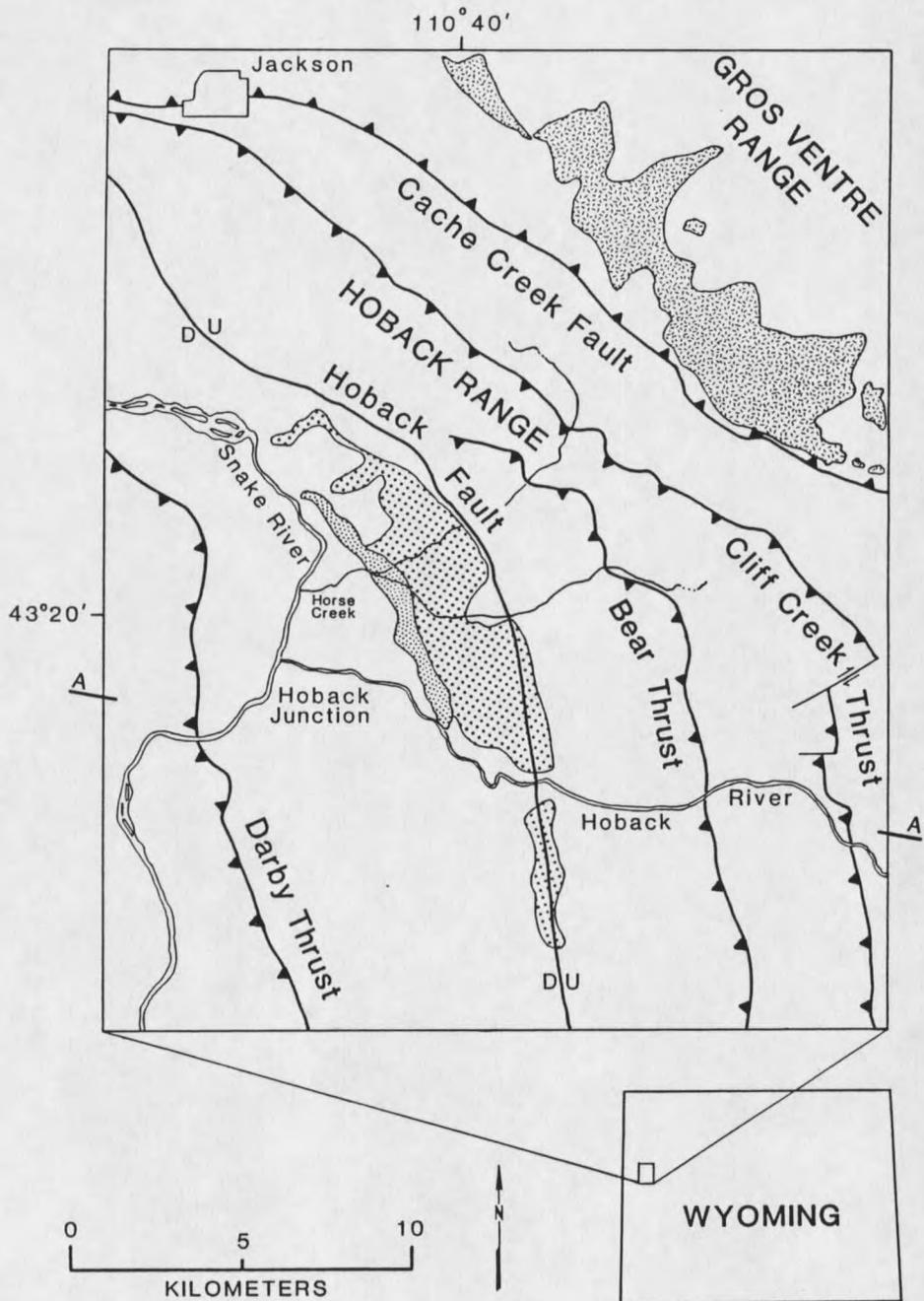


Figure 1. Location map showing the distribution of lower and middle members (fine-stippled pattern) and upper member (coarse-stippled pattern) of the Camp Davis Formation in northwestern Wyoming and relation to Mesozoic and Tertiary structural features. Dip of the Camp Davis is to the northeast. Area of dashed pattern in Gros Ventre Range denotes exposures of Precambrian crystalline rock.

listric normal fault-bounded basin. Specifically, in order to clarify our understanding of the history of the Camp Davis basin, this study addresses the following questions.

1. In which depositional environment(s) were the conglomerates of the Camp Davis Formation deposited?
2. What is the provenance of the two conglomeratic members of the Camp Davis Formation?
 - a. From what direction(s) were the coarse clastics transported?
 - b. What lithologies, or more specifically, which stratigraphic units were eroded to provide the coarse clastic fraction of the conglomerates?
3. What do the sedimentologic and provenance data from the lower and upper member conglomerates tell us about the tectonic evolution of the Camp Davis basin?

From a more general perspective, this study also emphasizes the importance of detailed lithofacies and sedimentologic investigations for obtaining a more complete picture of the history of an evolving sedimentary basin.

Study Area

The study area is located approximately 19 kilometers south of Jackson, Wyoming and is entirely on the Camp Davis, Wyoming 7.5 minute quadrangle. Although the Camp Davis Formation has been mapped for 25 kilometers on the west flank of the Hoback Range (Dorr and others, 1977, Figure 2), outcrops in much of that area are nonexistent to poor. Consequently, outcrops were examined only in the Hoback Junction area between Horse Creek to the north and the Hoback River to the southeast. Lower member conglomerates are well exposed in prominent light gray cliffs east and north of the Snake and Hoback rivers, respectively

(Figures 1 and 2). The upper member is exposed in reddish-brown cliffs on the north side of Horse Creek (Figures 1 and 3). All outcrops are accessible by foot from either U.S. Highway 187-189 or a private dirt road along Horse Creek.

Geologic Setting

The Camp Davis Formation was deposited in a narrow basin on the downthrown block of the Hoback listric normal fault. Blackwelder (1911) first recognized the Hoback fault, which was later named and mapped by Nelson and Church (1943). Eardley and others (1944) extended the trace of the fault about 32 kilometers south of the Hoback River. Love and Albee (1972) mapped the approximated trace of the fault north to the southern flank of Boyles Hill southwest of the town of Jackson.

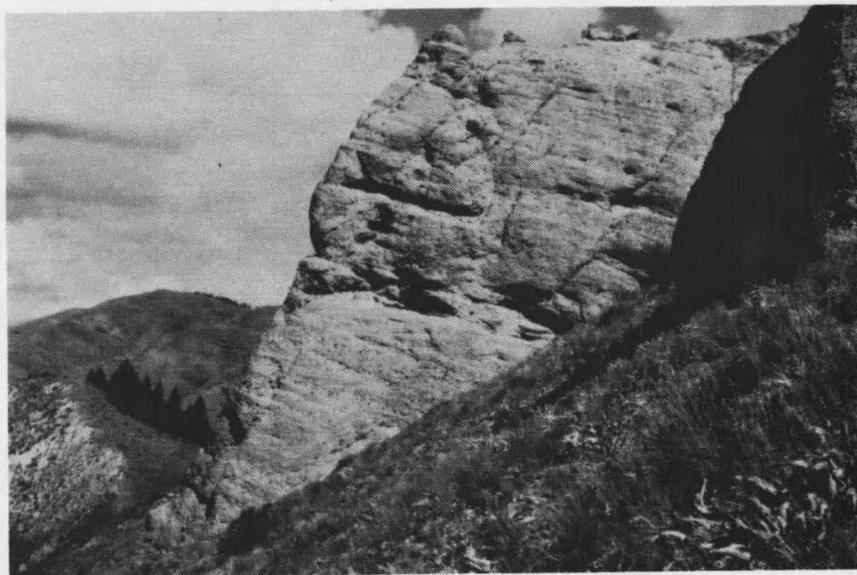


Figure 2. Typical exposures of the lower member conglomerates located north of the Hoback River along U.S. Highway 187-189. Unit strikes northwest and dips northeast due to rotation toward the Hoback listric normal fault.

