Wyoming State Geological Survey

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Open File Report 2002-3

Geologic cross sections of the northern Overthrust Belt and Hoback Basin, Wyoming

by

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Section #3

At the NE end of this section, topography is suppressed in the Snake River Valley. Out of the plane of this section, normal faults probably control the location of the Snake River. Structure in the compressed zone between the Cache and Prospect Faults is conjectural, but a few miles to the SE on Strike, Getty once planned a fairly deep well. UPRC has no seismic here.

Darby sheet structure is shown as restricted to Triassic and younger rocks except in a sub—Absaroka setting. Paleozoic involvement is hypothetical and is based on the observation that along strike the Paleozoic section crops out. The Getty #1—Teton and Shell #23—8 Teton wells are well controlled. A detachment surface in the GypSprings has allowed the Mesozoic section to thicken, and the two wells were drilled into this complex section without realizing that the Nugget would be so deep. The Shell well was over 5,000' low to prognosis at the Nugget level.

East of Grand Valley, the Absaroka structure should be fairly accurate, although the lower Paleozoic may be more complex than shown. West of Grand Valley, the intra—sheet detachment mechanism is dominant. There are two wells on Big Elk Mountain, the Sun #1—Unit and PanAm 1—A USA T. J. Weber. These wells tested one of the valid Paleozoic—cored anticlines. The Sun well flowed 5 MMCFG/D from the Weber. However, it was pure CO2. The Conoco #1—Gentile Valley tested a low relief but large structure at Nugget level. The encountered high bottom hole temperatures and shows of CO2 and methane. Meade plate structure is hypothetical, but some lines in the area do indicate basement depth and Meade sheet thickness.

Conoco #1 Gentile Valley

9—4S—42E Idaho KB 6850

Wayan	240
Stump	4920
Preuss	6145
Twin Creek	6905
Nugget	9268

Pan Am 1-A USA TJ Weber

24—2S- 44E Idaho KB 7985

Thaynes	Spud
Woodside	5495
Dinwoody	5790
Phosphoria	7010
Weber	7390
Amsden	8300
Madison	9070

Sun #1 Unit

23—2S-44E Idaho KB 8125

Thaynes	Spud
Woodside	3110
Dinwoody	3850
Phosphoria	4510
Weber	4900

Shell #23—8 Teton

8—39N-117W Wyoming KB 7766

Twin Creek	4155
Fault to Gannett	4155
Stump	5135
Preuss	5330
Twin Creek	5495
Fault to Twin Creek	7260
Nugget	8750
Ankareh	9240
Thaynes	9590
Fault to Nugget	9950

Getty #1 Teton
8-39N- 117W

Gannett	1350
Stump	2680
Fault to Stump	2760
Preuss	3030
Fault to Twin Creek	4430

Fault to Twin Creek	4650
Fault to Twin Creek	5125
Fault to Gannett	8937

Section #4/4A

The NE end of this section is quite interesting. The Cache Fault is shown with 32,000 feet of vertical displacement over the depressed NW corner of the Hoback Basin. Buttressing by the Cache block has led to initial formation of a back—thrust structure in the autochthon. In addition, the Prospect has overridden and concealed the Cabin Creek fault block, which is never seen in outcrop and was unsuspected until Chevron drilled into it (Section #4B and #4C).

The Bradco #1—Gilcrease was drilled on a very young closure where the critical NE dip is created by roll into the Hoback listric normal fault. Structures created by mid—Tertiary relaxation faults have never yielded any shows in the Overthrust.

The Chevron 1—21 Astoria was a significant well intended to penetrate a local culmination of the sub—thrust Moxa Arch. After penetrating the Prospect fault, the well drilled faulted Mississippian before drilling a normal Devonian—Ordovician—Cambrian section. The well's mud system was 3,000 pounds overbalanced while drilling below the Prospect due to sloughing Cambrian shales uphole. Consequently, no shows were encountered.

The Darby sheet now carries Paleozoic rocks to the surface. Between the Darby and Absaroka faults, major splays are developing that will become very pronounced on

following sections. Note that the Absaroka/footwall relationship is abnormal in that the Absaroka fault cuts down—section locally in the direction of transport. This is documented in outcrop on strike to the south, and implies that the normal West to East sequence of fault development did not hold true in this area. This type of relationship is not seen this clearly or at this scale anywhere else in the Overthrust to date. Also note that the Absaroka plate is thinning as it is uplifted by the underlying faults.

The American Quasar Black Mountain Federal #1 drilled an interesting detached structure and deeper structure but not in an optimal crestal location. No shows were reported. Amoco's #1 and #2 Bald Mountain wells were geological failures. They failed to realize that the Bald Mountain Anticline was a detached structure. Further to the west, the intra—sheet detachment mechanism dominates. Meade sheet structure is speculative, but basement depth below the leading edge of the Meade is fairly certain.

Bradco #1 Gilcrease

25-39N-116W Wyoming GR 6050

Gannett	Spud
Preuss	568
Twin Creek	911
Nugget	1806
Ankareh	2179
Dinwoody	3915

Chevron 11—21 Astoria

21-39N-116W Wyoming KB 6280

Nugget	3800
Ankareh	4254
Dinwoody	6009
Phosphoria	6283
Weber	6639
Amsden	7108
Madison	7607
Devonian	9057
Bighorn	9465
Gallatin	9965
Park	10,360

Death Canyon	10,603
Woolsey	11,073
Prospect Fault	11,480
Madison (faulted)	11,480
Devonian	15,295
Bighorn	15,840
Cambrian	16,182

American Quasar #1—Black Mountain

36-3S- 45E Idaho KB 8210

Stump	1600
Preuss	2264
Twin Creek	3368
Nugget	5708
Ankareh	6578
Thaynes	7840
Woodside	10,948
Dinwoody	13,651
Permian	13,651
Weber	14,050

Amoco #1 Bald Mountain

5-45-45E Idaho GR 8220

Twin Creek	2900
Nugget	4725 to TD

Amoco #2 Bald Mountain

6-45-45E Idaho GR 7725

Gannett	3925
Stump	8220
Preuss	8426
Twin Creek	9862
Nugget	12,322
Ankareh	13,120
Thaynes	12,990

Section #4B

This section intersects #4/4A at the Idaho—Wyoming border. At the east end of 4B, the Prospect and Cache faults have separated a bit, and a large backthrust is located in the intervening space which is well documented by seismic. The large drag structure at the leading edge of the Cache can be seen along strike in outcrop. Regardless of whether a plastic or brittle mode of deformation is invoked, the structure in outcrop does appear to

involve folded basement. The backthrust feature has been penetrated by several wells. The deep Superior well found very poor Nugget reservoir quality and was completed as a Cretaceous gas well and probably will be non—commercial. Of interest is the relationship of the Game Hill back thrust and the Cabin Creek blind thrust. The observed implication is that the backthrust is driven by the Cache block, which would be a different mechanism than that observed to create backthrusts near the Land Grant. The Chevron 1—34A was an attempt to confirm oil production found at their #31—33 Cabin Creek well (Section #4C).

Prospect sheet structure is well controlled by the Mobil Camp Davis well. Non—commercial gas was tested from sub—thrust Hilliard. Reservoir quality was the limiting factor. Note that the sub—thrust Moxa Arch is now well—defined. This basement swell has strong expression from this area down to the Uinta Mountains in the south, and influences structural styles over a large part of the eastern Thrust Belt. The Darby thrust ramps down to basement or near—basement, and may or may not join the Prospect in a common root. Seismic does not resolve this, mainly because the lower Paleozoic duplex zone destroys data quality. The Grey's River structure is now well developed, and true magnitude of displacement is concealed by the Cretaceous rocks at the surface. At one time, this fault probably duplexed with the Absaroka fault before erosion exposed the area.

<u>Superior 1-30 Granite Creek</u>

30-39N-113W Wyoming

Mesaverde	5620
Hilliard	11,708
Frontier	13,906
Aspen	14,770
Bear River	15,720
Gannett	16,396
Stump	17,000
Twin Creek	17,482
Nugget	19,654

Chevron 1-34A Federal

34-39N-114W Wyoming

Nugget	3565
Triassic	4004
MesaVerde	7452
Hilliard	13,052
Frontier	15,407

Rainbow 1-35 Federal

35-39N-114W

Hilliard	13,482

Mobil Camp Davis

3-38N-115W Wyoming KB 6290

Devonian	Spud	Gannett	13,235
Bighorn	535		
Cambrian	755		
Devonian	1165		
Bighorn	1990		
Cambrian	2685		
Triassic	2727		
Permian	3730		
Weber	4088		
Amsden	4545		
Madison	5242		
Devonian	6605		
Bighorn	7260		
Cambrian	7765		
Fault to Mesaverde	7825		
Hilliard	8400		
Frontier	10,485		
Aspen	11,575		
Bear River	12,068		

Forest Oil 1-Camp Davis

16-38N-115W

Twin Creek	866
Nugget	1684
Phosphoria	4203
Madison	5463
Devonian	5812
Hilliard	8230
Frontier	9645

Section #4C

This section joins 4/4A and 4B at the Idaho—Wyoming border. At the east end, the Cache-Prospect compression zone has opened up so that the backthrust Game Hill structure is more subdued. Seismic data does show a bit of internal structure in the Cretaceous section, and internal structure in the Cretaceous section, and the Tertiary is very thick. The Chevron #31—33 USA Cabin Creek well tested oil from the blind thrust block Madison at 62 BOPD with 812 MCFGPD. It appears that high water saturations prevented commercial production. The blind thrust is not visible on our seismic data. Note that the backthrust is carrying less section than in #4B.

The True Gray's River #44—25 tested the Paleozoic—cored Grey's River Anticline, but the well location was too far east. An interpreted, a bedding plane fault mechanism is required to mask the large Paleozoic—level displacement. Seismic data has confirmed this interpretation. The bedding plane fault has not been observed in outcrop, however. Note that the Absaroka fault cuts down section locally. This relationship has been mapped along strike to the south.

33-37N-114W Wyoming GR 8039

Twin Creek	721
Nugget	2024
Ankareh	2450
Fault	3332
Nugget	4511
Ankareh	4733
Thaynes	5395
Woodside	5852
Phosphoria	6860
Weber	7123
Madison	8054
Fault to	

Mesaverde	8935

True #44—25 Grey's River

25—37N-117W

Twin Creek	Spud
Nugget	1520
Ankareh	2108
Thaynes	2748
Woodside	4450
Fault to Triassic	5480
Fault to Triassic	6550
Fault to Triassic	8518
Nugget (O.T.)	8950
Fault to Triassic	9850
Fault to Ankareh	10,050
Thaynes	10,418
Woodside	11,360
Dinwoody	11,900
Permian	12,300
Weber	12,580
Amsden	13,080
Madison	13,775

Section #5

The well-developed backthrust seen on preceeding sections has now become a zone of disturbance confined to the Mesa Verde and Hilliard. A deeper Triassic—cored pop—up feature is seen on migrated seismic lines and was apparently the target for the Chevron #1—7 Federal.

At this point, the geometry of the blind Cabin Creek thrust sheet is conjectural. Whether the Cabin Creek fault surface or Cliff Creek fault surface is the true Prospect fault becomes a question of semantics. The lowest (easternmost) fault of significant displacement carrying Paleozoic rocks should be given the Prospect name.

The major Darby—block splays are now well developed. They have uplifted the Absaroka block so that it is now almost eroded back to the Grand Valley Fault. This is the "Stewart Peak Recess". Almendinger's PH.D dissertation from the University of Wyoming provides a good discussion of this area.

Backthrusts on the Absaroka ramp, cored with Triassic, are well developed. The Sun #1 Tincup Mountain is another example of money spent without understanding the intra—sheet detachment style operative in Idaho. The Phillips #1—Stoor was drilled on a broad, low—relief structure. Neither well found significant shows.

Meade plate structure is problematical. Seismic data is very poor and well control is non—existent.

Chevron #1—7 Federal

7-36N 114W Wyoming KB 7659

Hoback	Spud
Fault	9900
Fault	11,540
Hilliard	12,186
Frontier	14,210

Sun #1 Tincup

6-5S 45E Idaho KB 8033

Gannett	4500
Stump	6734
Preuss	7342
Twin Creek	8492
Preuss	9292
Gannett	9680
Stump	9725
Preuss	10,212
Twin Creek	11,054
Nugget	13,654
Arkareh	14,348
Thaynes	15,440

Phillips #1 Stoor A

29-5S 44E Idaho GR 6755

Gannett	4382
Stump	7960
Preuss	8270
Salt	9595
Twin Creek	9865
Nugget	12,360
Ankareh	13,128
Thaynes	13,720

Section #6

The sub-thrust Moxa Arch is a major feature on this section. The autochthonous Paleozoic section extends intact over the crest. Regional seismic data confirms this interpretation. Note that the Prospect block now does not carry Cambrian and that the Prospect is tied to the Darby fault. Regional strike lines have confirmed these interpretations. The Exxon Telephone Pass well is significant. It was drilled attempting to prove deep Paleozoic gas production on trend with the Big Piney—La Barge accumulation. Adequate reservoir was not found. Well location problems prevented a more crestal location.

The Sun #1-Prater Mtn. demonstrated that the Absaroka does cut down—section in the direction of transport, just as is seen in outcrop. Fresh water was recovered from the deep Paleozoic section in this well. Whether a valid closure was drilled is unknown. Seismic data on which this well was based was extremely poor.

Backthrusting off of the major Absaroka ramp is quite pronounced. The intra—sheet detachment mechanism has thickened the Mesozoic section on most of the Absaroka block

so that the Paleozoic section is very deep and masked by shallow structure. The Phillips 1-Idaho State A penetrated Mississippian rocks, crossed the Meade thrust, and TD'd in Permian of the Absaroka block. Their proximity to a structural crest is unknown. Depth to basement was determined from seismic. The Madison over Twin Creek relationship in the Phillips well is the same as seen in outcrop on strike to the south over 30 miles away. This may be generally true for much of the Meade plate.

Pacific Transmission #24—24 PTS Federal

24-35N-115W Wyoming GR 9754

Wasatch	Spud
Mesaverde	7974
Frontier	13,630

Phillips #lB Lookout Mtn. Unit

25-35N-115W Wyoming KB 9625

Tertiary	Spud
Mesaverde	7595
Hilliard	10,600

True #34-18 Deadman

18-35N-115W Wyoming KB 9134

Aspen	Spud
Twin Creek	3205
Nugget	4175
Ankareh	4730
Thaynes	4990
Woodside	5680
Dinwoody	6240
Phosphoria	6550
Weber	6875
Amsden	7370
Madison	7755
Prospect Fault	8480
Ankareh	8480
Thaynes	8950
Fault	9782

Exxon #1 Telephone Pass

25-35N-116W KB 9169 Wyoming

Stump	4372
Twin Creek	4810
Nugget	5808
Ankareh	6426
Permian	8218
Weber	8490
Madison	9410
Devonian	10,570
Prospect Fault	10,835
Triassic	10,835
Thaynes	11,655
Woodside	12,880
Fault to Twin Creek	13,240
Nugget	13,725
Ankareh	14,540
Permian	18,028
Weber	18,240
Madison	19,250

True #24-14 Middle Ridge

14-35N-117W Wyoming KB 7842

Gannett	Spud
Preuss	740
Twin Creek	1050
Nugget	2272
Ankareh	2900
Thaynes	3650

Sun #1 Prater Mtn

15-35N-118W Wyoming KB 7902

Cambrian	Spud
Absaroka Fault	790
Aspen	790
Bear River	2050
Gannett	3328
Stump	3815
Preuss	3922
Twin Creek	4190
Nugget	5132
Ankareh	5572
Thaynes	5828

Woodside	6670
Di nwoody	7170
Permian	7690
Weber	7995
Amsden	8905
Mad i son	9392
Devon ian	11,018
Bi g horn	11,610
Cambrian	12,240
Firetrail Fault	12,375
Woods ide	12,700
Di nwoody	13,070
Pe rmian	13,670
Weber	13,940

Phillips 1-Idaho State A

16-6S-44E Idaho KB 6715

Dinwoody	800
Phosphoria	1370
Weber	1923
Madison	2473
Meade Fault	4725
Preuss	4725
Twin Creek	7608
Nugget	10,120
Ankareh	10,880
Thaynes	11,625
Woodside	14,010
Dinwoody	15,110
Phosphoria	15,773

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Geologic cross-sections of the northern Overthrust Belt

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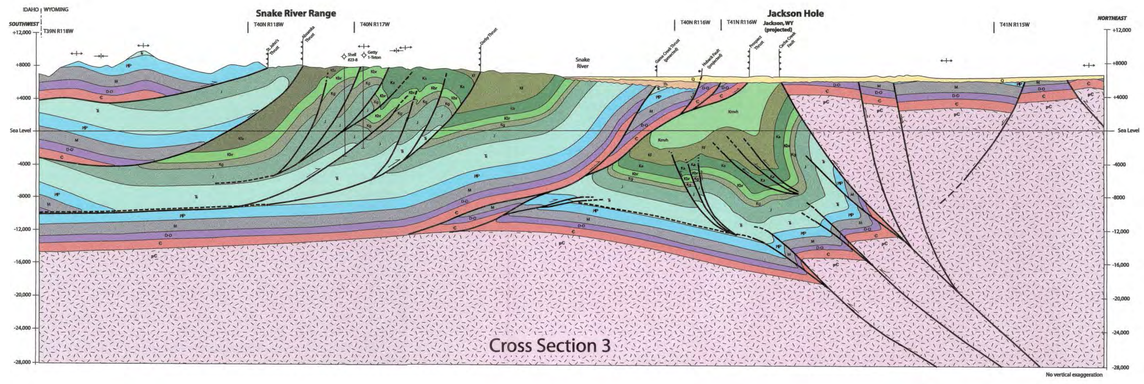

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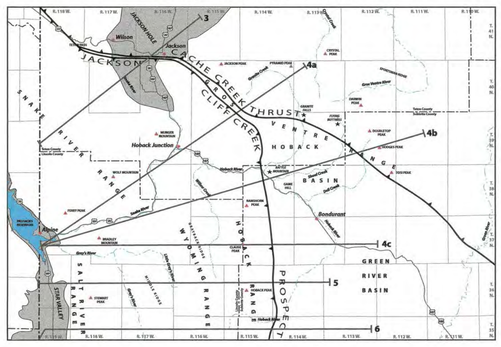
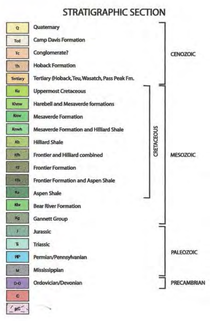
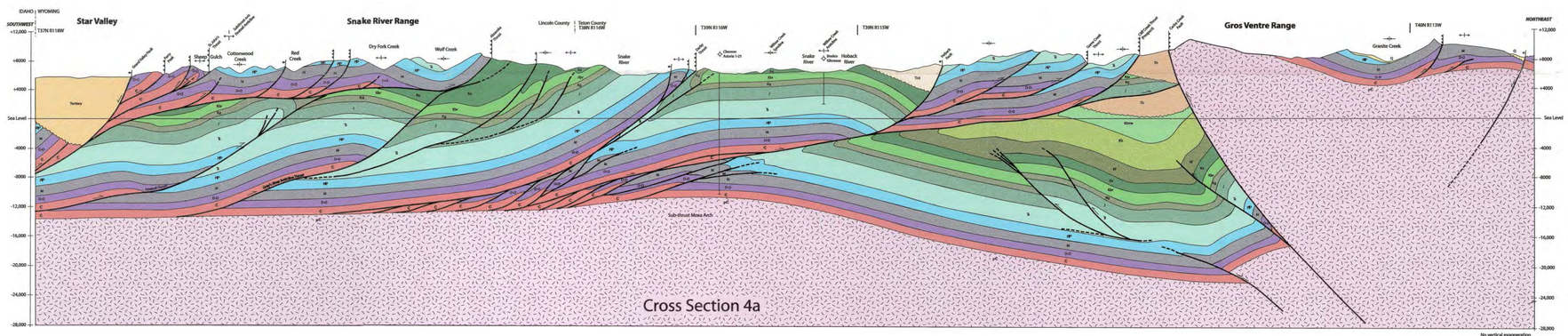
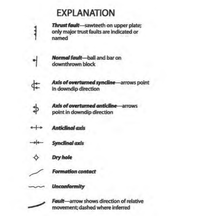
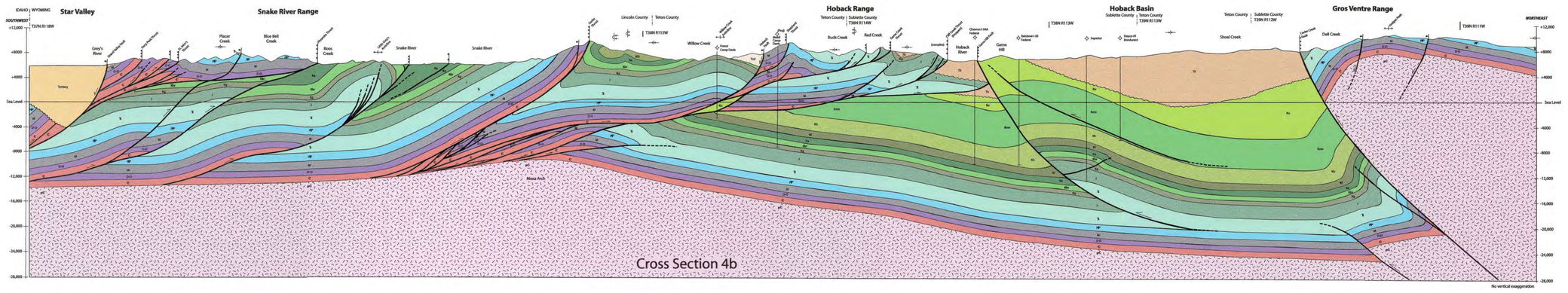






Cross Section 4a





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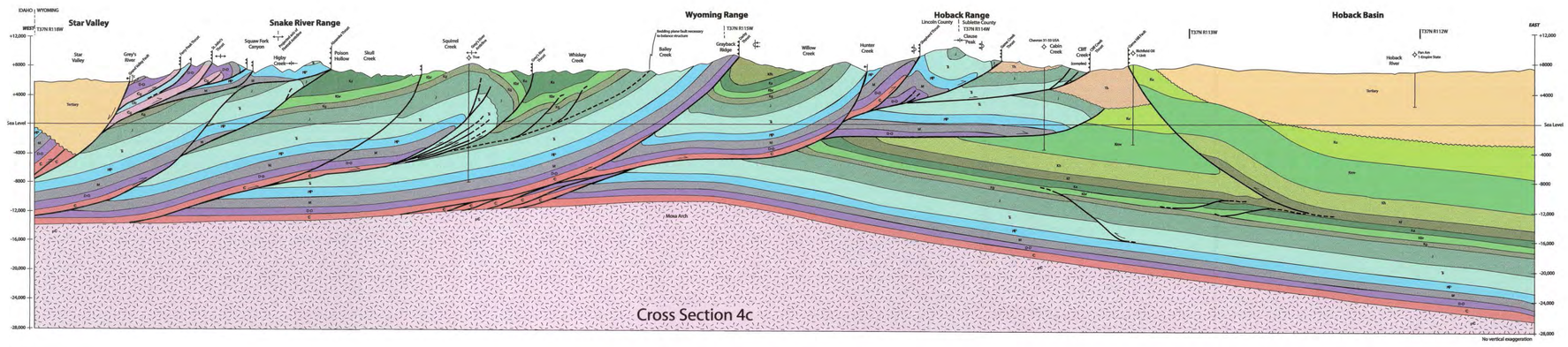

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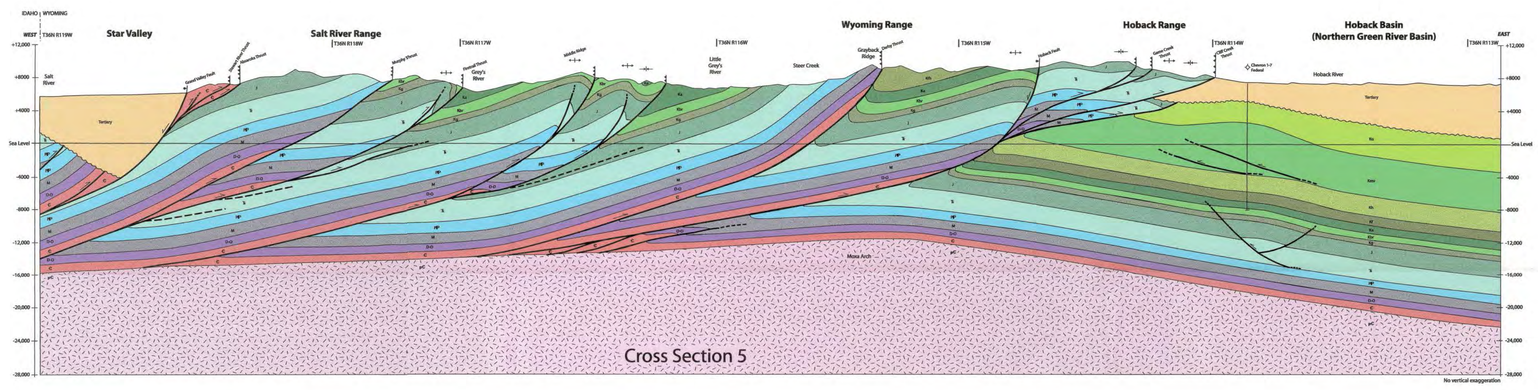

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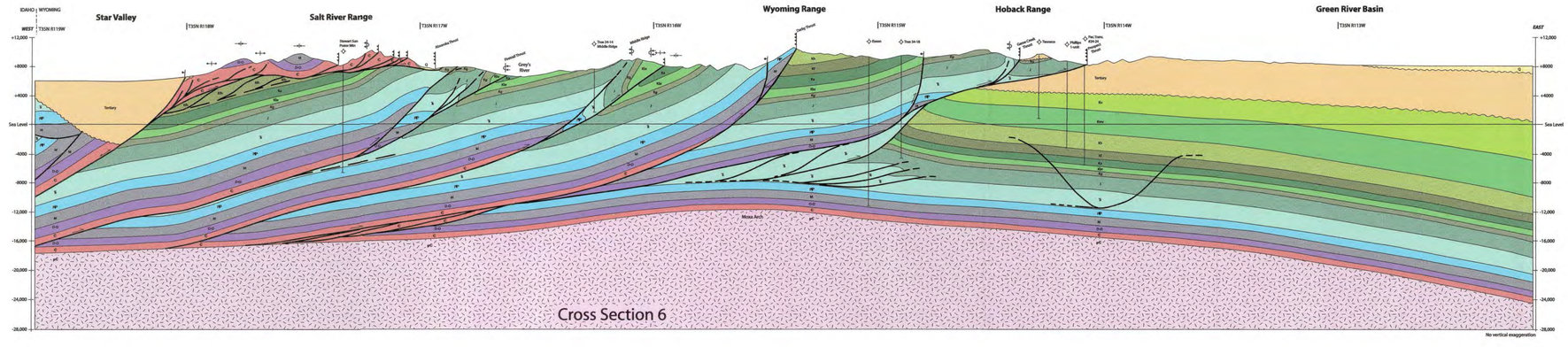

Cross Section 6

Geologic cross-sections of the northern Overthrust Belt, Hoback Basin, and Green River Basin Wyoming

by
Lance Cook

2002