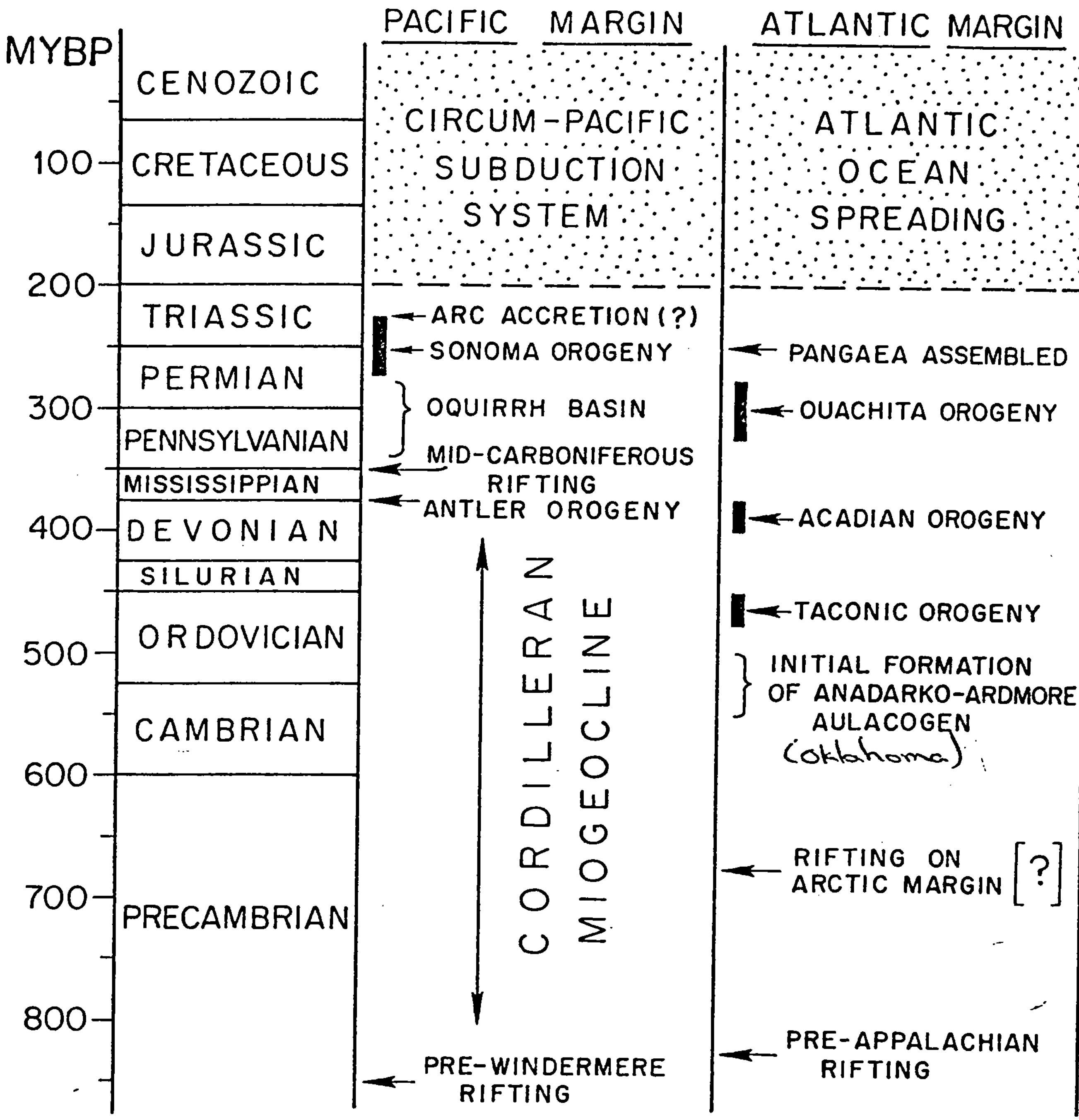
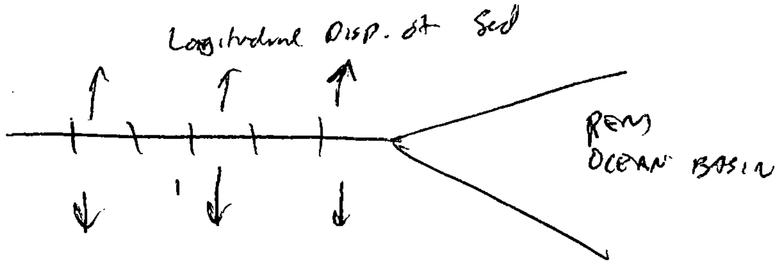


Figure 6 -Diagram to illustrate approximate relative timing of key events on Pacific and Atlantic margins of North America. Time scale generalized after Lambert (1971).

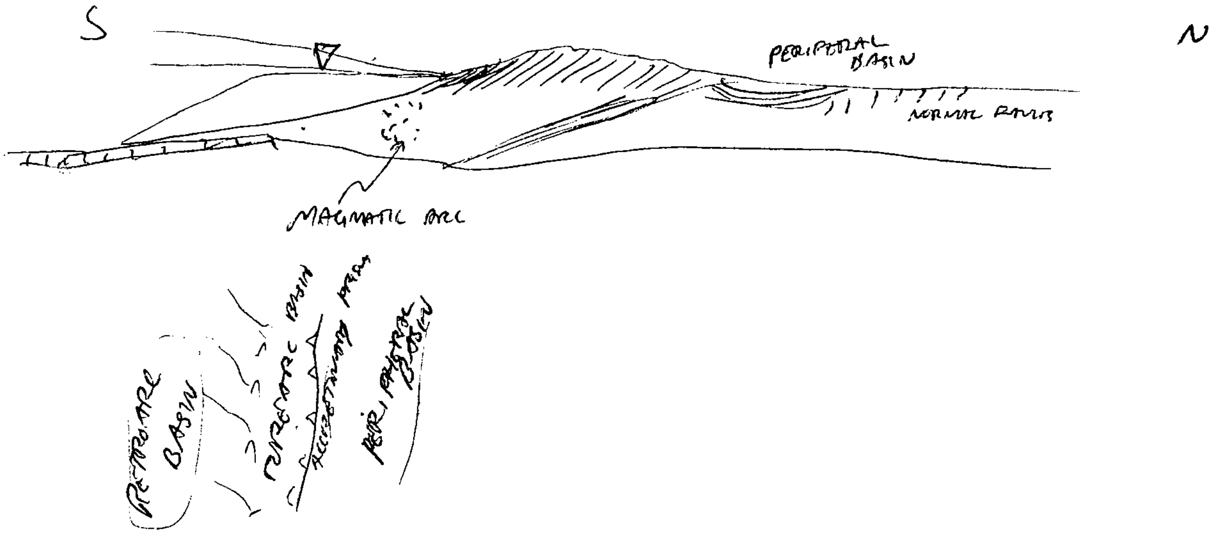
Circum-Pacific Subduction. The Koipato Group, which rests unconformably on the Havallah sequence of the Golconda allochthon, has been interpreted as the earliest vestige of a continental-margin magmatic arc established on the continental edge by polarity reversal following arc accretion (see Fig. 5, bottom) during the Sonoma Orogeny (Burchfiel and Davis, 1972, 1975; Silberling, 1973, 1975). However, it is possible for elements of a magmatic arc to rest depositionally on previously deformed strata of its own subduction complex (Matsuda and Uyeda, 1971). As only the overlying Star Peak Group definitely spans the suture belt to rest depositionally upon both the Golconda allochthon and the older Antler orogen, it seems possible that the Koipato Group is in fact part of the allochthon. In this case, it would represent part of the colliding Permo-Triassic island-arc terrane. The initial representatives of the succeeding continental-margin magmatic arc would then be Lower Jurassic volcanics and volcaniclastics (Stanley and others, 1971) with their associated

For Mon: KLEIN 1985 BACK ARC J. of Geol.
BLOOM

HIMALAYAN – BENGAL MODEL



PERIPHERAL BASIN – ON AN ~~overriding~~ OVERRIDDEN RIFTED CONTINENTAL MARGIN



p 5

DAVID BLOOM

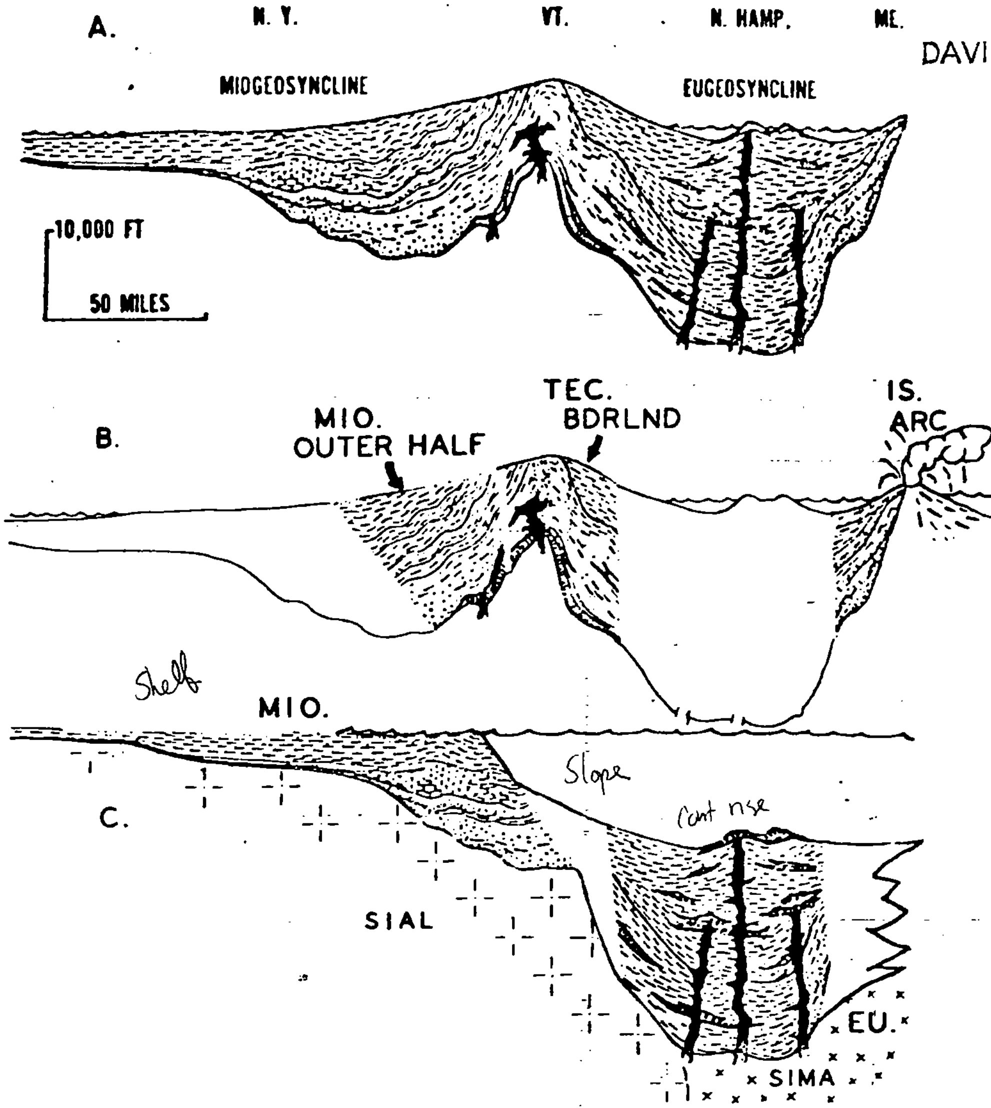


FIG. 1.—Kay's geosynclinal couplet. A drawing to show that, if three out of five elements are deleted from Kay's (1951) classical example of an ensialic mio-eugeosynclinal couplet, model is transformed into an ensialic-ensimatic actualistic geosynclinal couplet. Outer half of miogeosyncline, tectonic borderland, and island arc are eliminated; a continental slope is inserted, beyond which eugeocline is inserted. A, Mio-eugeosynclinal couplet along eastern North America palinspastically reconstructed as of mid-Ordovician when orogenesis began, according to Kay (1951); B, deleted elements, cut out of diagram A by scissors; C, new paste-up of mio-eugeoclinal couplet with new ensimatic eugeocline being downdropped along continental slope according to actualistic concept of geosynclines (Dietz, 1963a), by which pre-Middle Ordovician sedimentary prisms shown may be equated with sedimentary prisms along modern continental edge of eastern North America (adapted from Dietz and Sproll, 1968).

~~Dott (1974)~~

Dietz & Holden

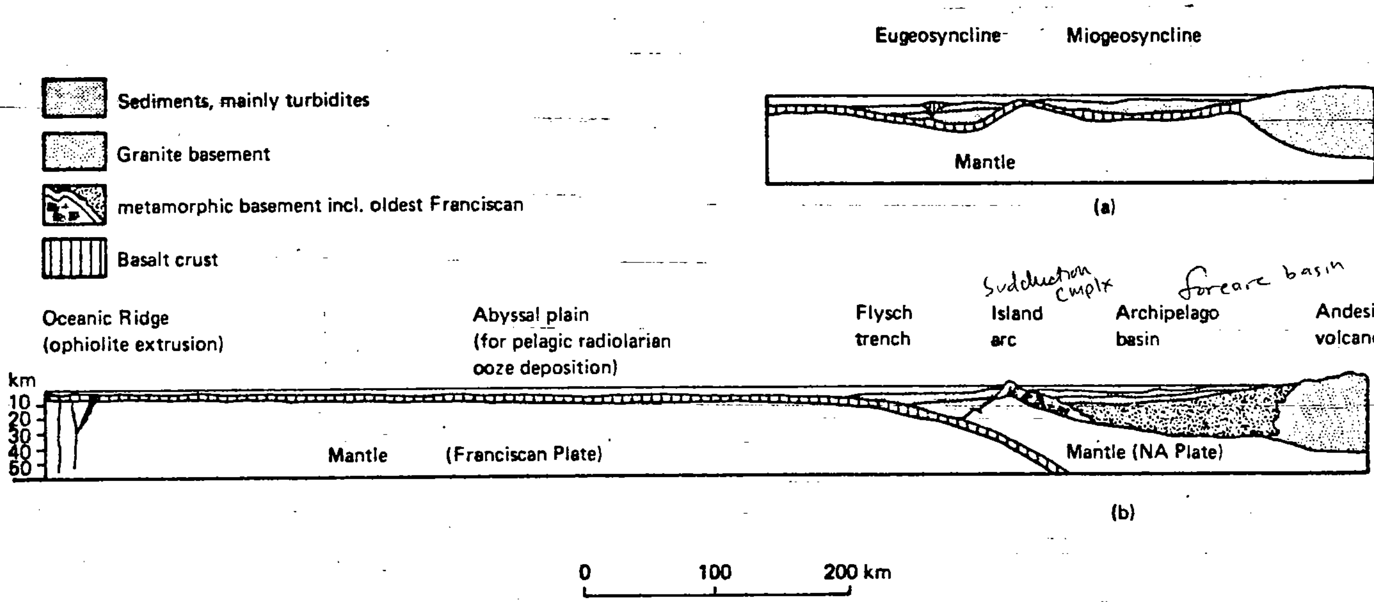


Fig. 3. Reconstruction of the Franciscan eugeosyncline: (a) as the outer member of a eu-miogeosynclinal couple, traditional model (Bailey & Blake 1969), (b) as a segment of the Pacific Ocean, plate-tectonic model (Hsü 1971).

Hsü (197?)

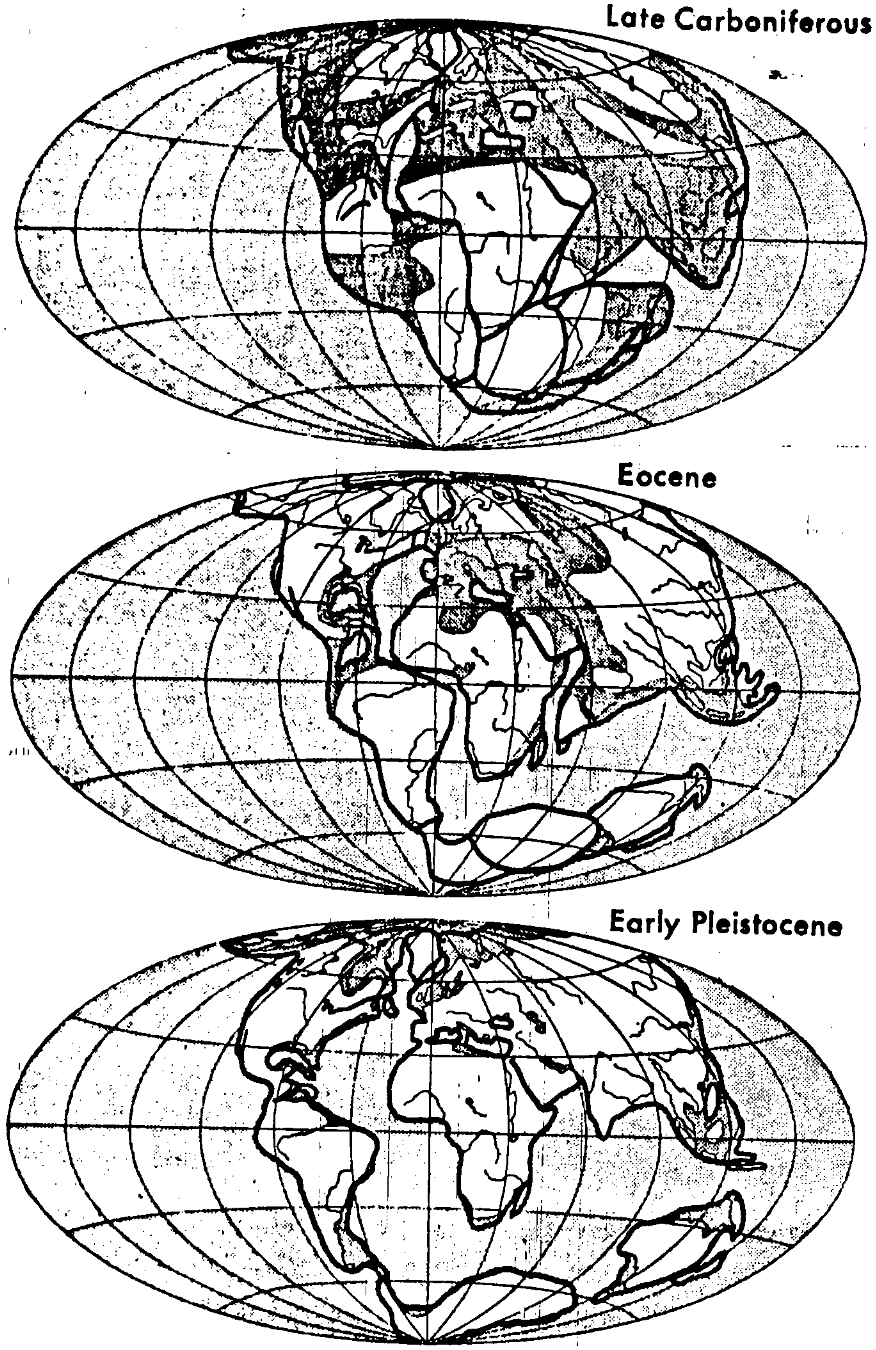


FIG. 861 Wegener's reconstruction of the distribution of the continents during the periods indicated. Africa is placed in its present-day position to serve as a standard of reference. The more heavily shaded areas (mainly on the continents) represent shallow seas (*From A. Wegener, Die Entstehung der Kontinente und Ozeane, 1915*)

Holmes 1964 p 1200

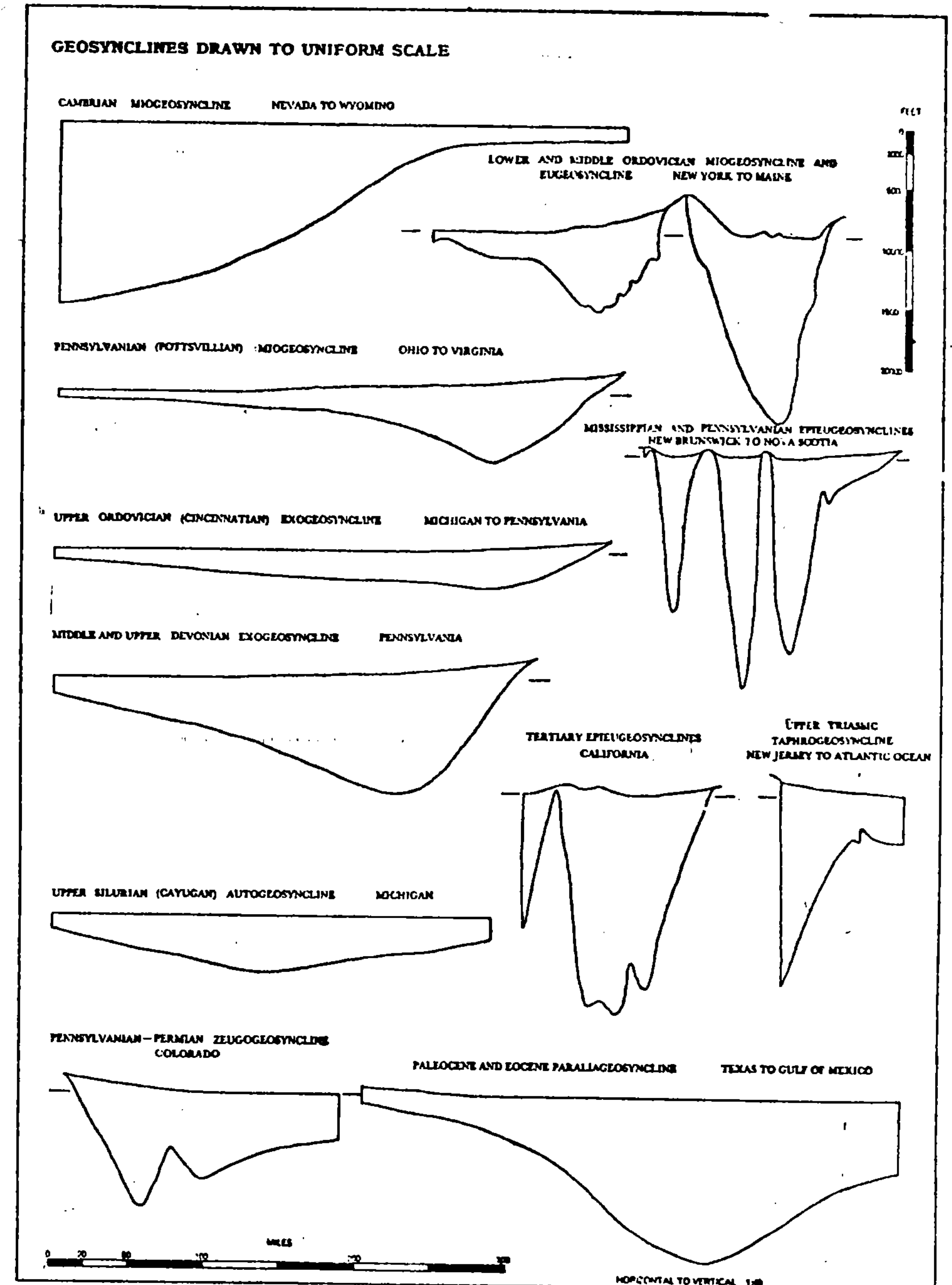
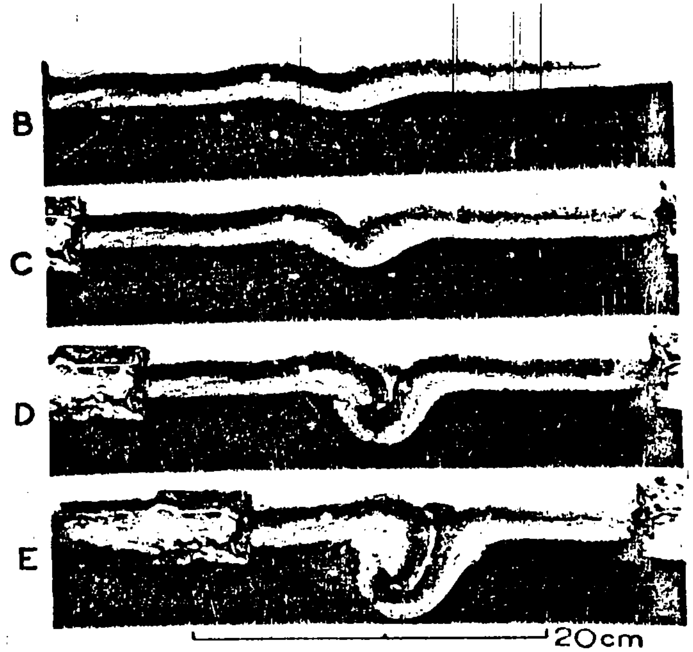


FIGURE 19. SUMMARY OF GEOSYNCLINAL SECTIONS TO UNIFORM SCALE

Kay (1951) p.94

DAVID BLOOM

p1



Successive Stages in the Development of a Tectogene During one of Kuenen's Experiments.

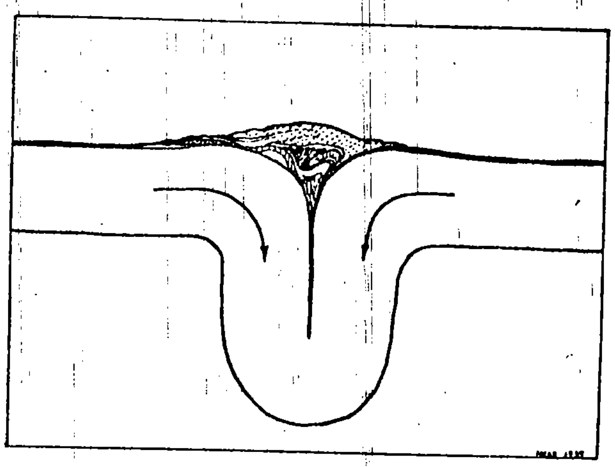


Fig. 6. General section of the Alps superimposed on the tectogene. Both features drawn to the same scale with no vertical exaggeration. From Hess.

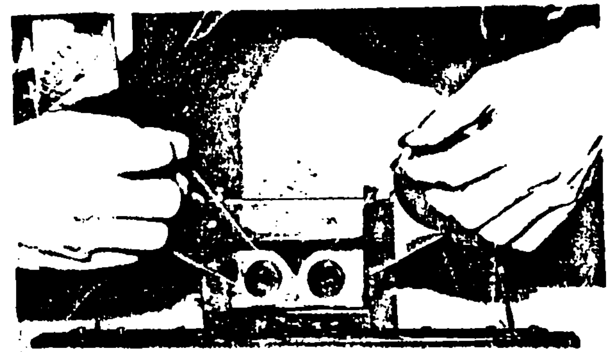


Fig. 1.

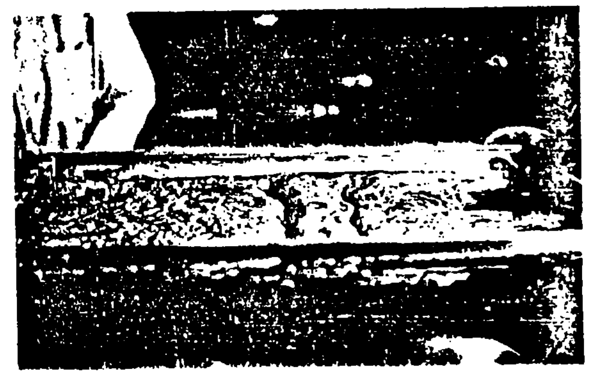


Fig. 2.

Fig. 1. Small Dynamic Model to Simulate the Action of Subcrustal Convection Currents and the Response of the Plastic Crust. Photograph Shows Revolving Drums Simulating Convection Currents and the Consequent Development of a Crustal Downfold.

Fig. 2. Large Dynamic Model after Development of Crustal Downfold and Two Underthrusts in the Crust.

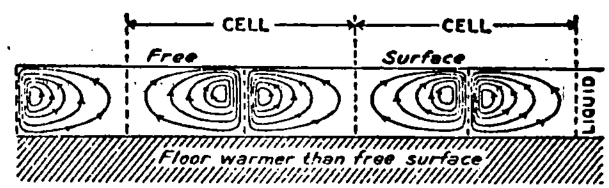


Fig. 7. Section through Experimentally Developed Convection Cells. After H. Bénard.

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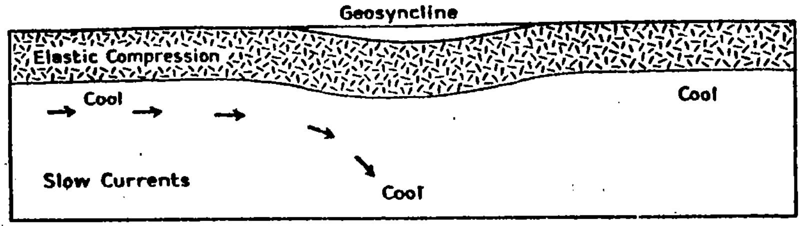
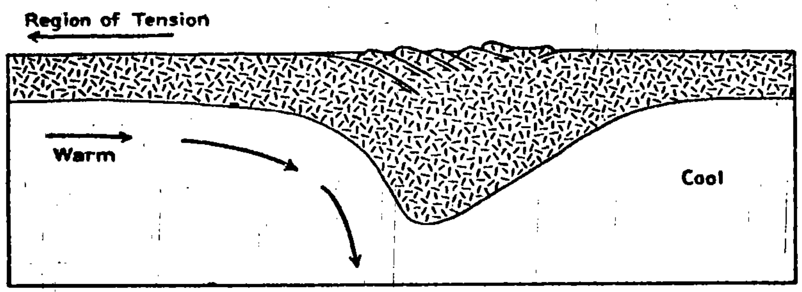
(All from Griggs 1939)

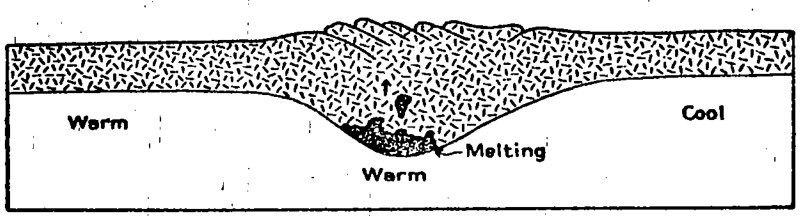
THE MOUNTAIN BUILDING CYCLE



1. First stage in convection cycle – Period of slowly accelerating currents.



2. Period of fastest currents – Folding of geosynclinal region and formation of the mountain root.



3. End of convection current cycle – Period of emergence. Buoyant rise of thickened crust aided by melting of mountain root.

Fig. 16. Hypothetical Correlation between Phases of the Convection-Current Cycle and Phases of the Mountain-Building Cycle. Structural Relations Drawn from the Model.

Griggs (1939)

Holmes (1964)

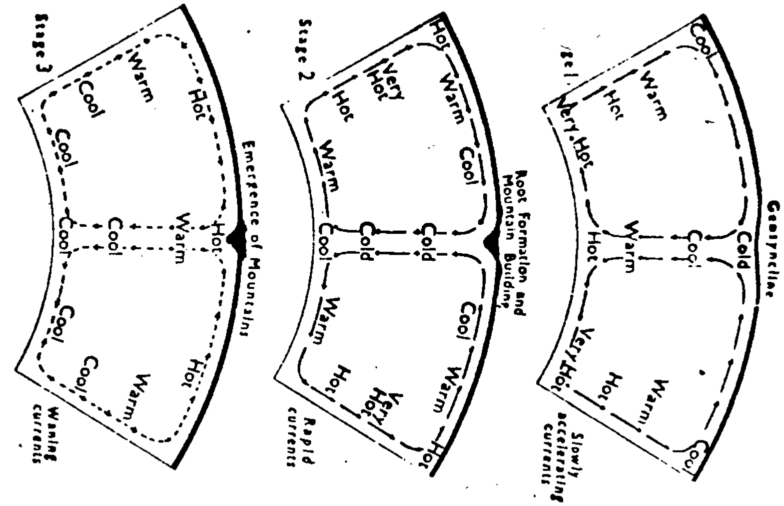


Fig. 842 Sections through the earth's crust and mantle to illustrate the supposed correlation between successive stages of an orogenic cycle and those of a hypothetical system of convection currents

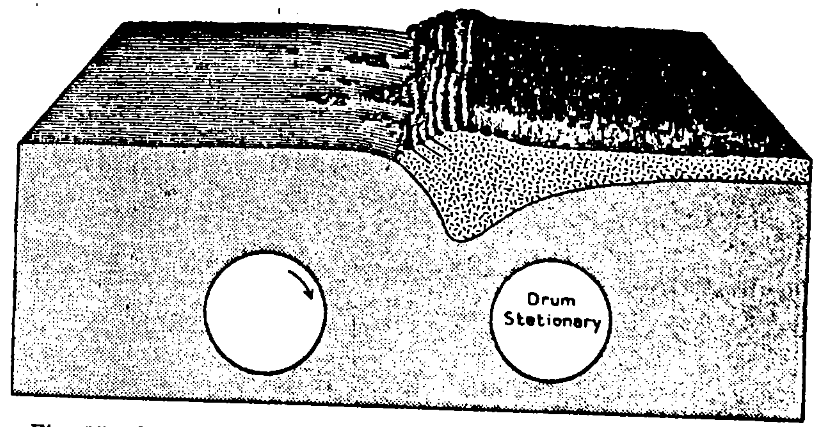


Fig. 15. Stereogram of Large Model with only One Drum Rotating, Showing Development of Peripheral Tectogene.

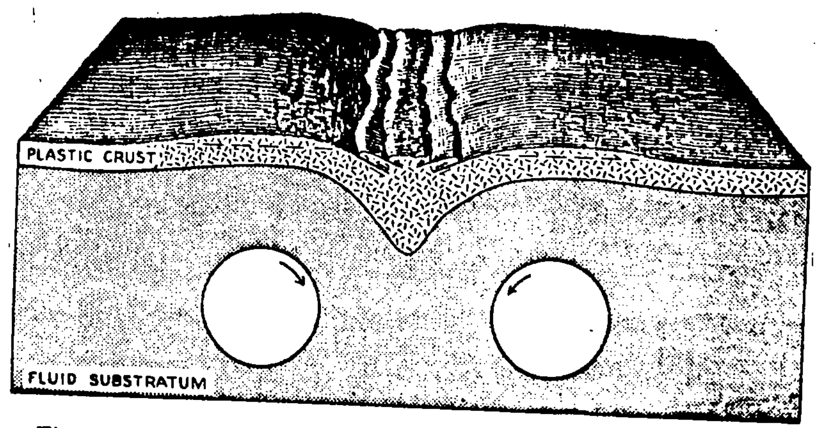


Fig. 14. Stereogram of Large Model with Both Drums Rotating, Showing Tectogene and Surface Thrust Masses with Relations Similar to Kober's Orogen.

DAVID BLOOM

p 4

NILSEN '77 — 13 APR 87

2 periods of deformation? Highly questionable
based on starved basin facies

Read Burchfiel & Davis '72; '76 (GENERAL REF)

SONOMAN	
SPEED '79	(CHEN)
SNYDER & B '83	(DUNKEL
STEWART et al '86	(CAVAZZ
Tr ~ J	
SPEED '78	(SMOKT)
BILODEAU-KEITH 86	(BLOOM)
STEWART et al 86	(Heins)

ANCESTRAL ROCKY MTNS

CASEY '80

COMPRESSIONAL OR RIDGE BASIN
(STRIKE-SLIP) MARINE to NONMARINE
PROGRADATIONAL

ROSS '86

VERY SITE SPECIFIC
MICROPALEO-STRAT. FUSILINIDS FROM CORRELATED WELL LOGS

KLUTH & CONEY '81

EVIDENCE FOR SOUTHERN CONTINENT
FOREARC BASINS & (as are subduction complexes)
REMNANT OCEAN BASINS ARE BARRIERS TO SEDIMENTATION
(NOT A PROBLEM)
N.A. (@ GULF COAST) WAS ON SUBDUCTED PLATE (STAYED NEAR SEA-LEVEL)
EVIDENCE FOR REASON FOR Anc. Rocky MTNS. EXISTANCE
WHAT IS ACTUALISTIC PLATE TECTONIC MODELS
NO VOLCANISM; PLUTONISM (NO ARC)

SONOMAN OROGENY — 20 APR 87

SPEED '79

OROGENY? No Meta during deformation; collision w/ ANTLER ALLOCHTHON; NOT CONDUSIVE TO FORMING FOREDEEP BASIN
NO SONOMA FORELAND BASIN. WHY?
HAVALLAH: REMNANT OCEAN BASIN.
- SED. EVIDENCE FOR SONOMA OROGENY IS SLANT TO NOTHING
- GOLCONDA THRUST; RELATED TO SONOMA? THRUSTING AT CULMINATION OF OROGENY
- UNDERTHRUST ROCK MY NOT BE ...
- most orogenys have underthrust blocks only little deformed

ANTLER OROGENY: Rifted margin into subduction zone; deep water & subsidence w/ turbidites

8

SONOMAN OROGENY — 20 APR 87

SPEED '78

why do lines of .706 & .704 lines come together in Idaho

Fig. 3: HYPOTHESIS: HAVE PLATE X. Why?

1. To have subduction. To have subduction

WEST-DIPPING SUBDUCTION

BULGING UP .706 LINES

" pp by.

SNYDER & BRUECKNER '83

BASIN FORMATION BY SPREADING

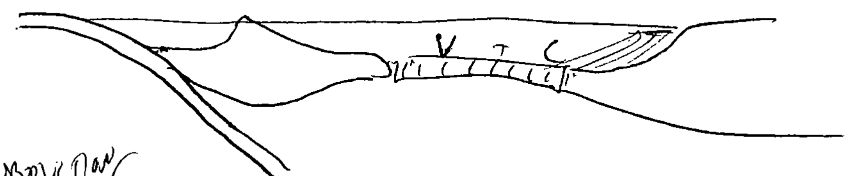
D_0 pre Structural structures (diagenesis)

D = DEFORMATION

S = SHEAR

F = FOLDS

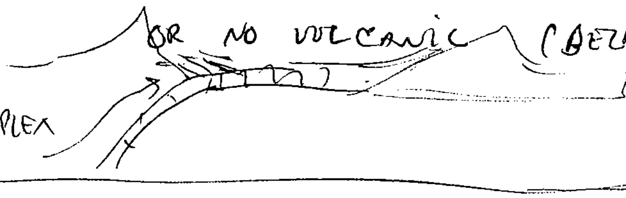
BACK ARC BASIN
REMNANT OCEAN BASIN } AND VARIOUS SUB-MODELS (Fig 9)



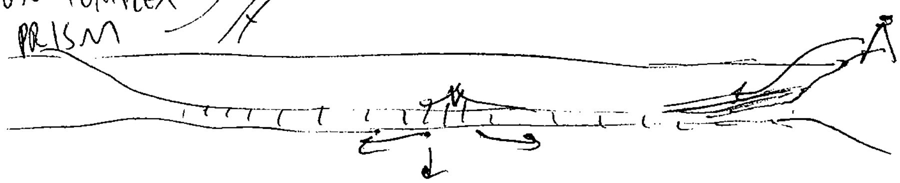
SUBDUCTION MUST HAVE FLIPPED

USUALLY VOLCANIC + CONTINENTAL

OR NO VOLCANIC (BECAUSE BACK-ARC IS SUBDUCTED)



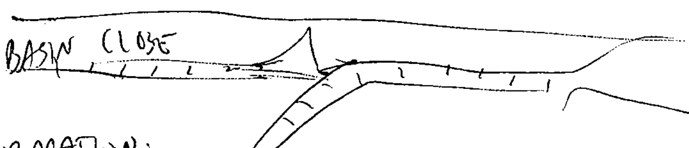
ACCRETED SUBDUCTION COMPLEX & ACCRETIONARY PRISM



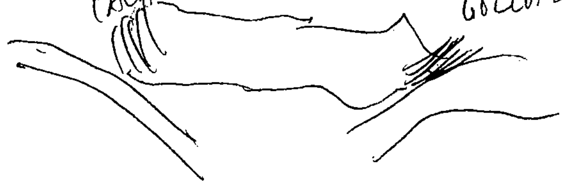
ANDEAN VOLCANIC DERIVED THINGS DUMPED INTO RIFTED MARGIN

OR

DID A BIG OCEAN BASIN CLOSE



STYLE OF DEFORMATION:
LONG HISTORY OF DEFORMATION



MODELS FOR BASIN CLOSURE
B.A THRUSTING

STEWART ET AL '86 — 20 APR 87

LONG HISTORY OF ACCRETION
SHORT BACK-ARC CLOSING
- LIMITED IN CONCLUSION: COMPLEX DEPOSITIONAL SETTING
ACCUMULATED IN LARGER, COMPLEX BASIN
DIFFERENT APPROACHES:
DETAILED STUDIES: (STEWART et al) (MARSAGLIA & DICKINSON)
STRUCTURAL & PALEONTOLOGICAL & SEDIMENTOLOGICAL
SPEED & SLEEP IS
ARM WAVING BUT SOMEWHAT MATHEMATICALLY CONSTRAINED
WE HAVE SEDS IN OCEAN BASIN
OLDER OR SAME AGE AS ANTLER OROGENY
SO LONG HISTORY OF ACCRETION IN REMNANT OCEAN BASIN IS MORE LIKELY

22 APR 87

FOR MONDAY: SEVIER OROGENY	
ALLMENDINGER & JORDAN '81	(DUNKEL
LAWTON '83	(CHEN)
~~DICKINSON et al 86~~	
CROSS '86	(LINN)

SPEED '78 — LOOK AT TIME BETWEEN
SONOMA VS NEVADAN OROGENY; COMPLEX
BASINAL, SHELF, MAGMATIC ARC

AGE OF THRUSTING COINCIDENT W/ NEVADAN OROGENY — SPEED (BUT NO DATA)
CONTRACTION OCCURRED IN SEVIER OROGENY — R.V.I.
OROGENIC TERRANES — QZ ARENITES INTO TECTONIC DEPRESSIONS (p 282)
MARINE ENVIRONMENTS DRYED UP AFTER ℞
SCATTERED JUR BASINS, LOCALLY
BUT DOES THRUSTING ACCOMPANY FM OF THESE BASINS ← DOESN'T NEED TO FORM AT THE SAME TIME AS THRUSTING
- COULD BY THAT THERMAL SUBSIDENCE ENDED?, or
- SEA LEVEL DROPPED or,
- (OTHER NON-TECTONIC/THRUSTING MECHANISM)

STEWART et al. '86; ℞ASSIC
SONORA-MOHAVE MEGASHEAR ??
FORELAND BASIN; CHIHUAHUA BASIN:- A FAILED RIFT BASIN
CHINLE - VOLCANICS COULD BE BURIED U-Pb 225 my.

29 APR 87

HELLER et al '86

INITIAL THRUSTS OF SEVIER BELT NO OLDER THAN APTIAN (100-105 my. ago)
TECTONIC EVENTS TO WEST ARE UNRELATED TO DEFORMATION IN ID-WY & UT THRUST BELTS

AGE OF EARLIEST CGL BED OF EPHRAIM CGL (LOWER MEMBERS ARE PRE-OROGENIC)
ABRUPT CHANGE IN COMP FROM LOWER – UPPER MEMBER

TEST HYPOTHESIS USING SUBSIDENCE HISTORIES
SINCE EMPLACEMENT OF THRUST PLATES MUST DOWN-FLEX ADJ. FORELAND AREA
IF WE CAN FIND OUT WHEN BASINS BEGAN TO DEEPEN, WE CAN TIME THE BEGINNING OF THRUSTING (SINCE FORELAND BASIN FM IS INSTANTANEOUS 10^5-10^6 my)

NEVADAN OROGENY 160-150

NO BACK ARC THRUSTING UNTIL COLLISION OCCURED

WHY DID METAMORPHISM MIGRATE EASTWARD?
DID NEVADAN OROGENY EFFECT METAMORPHISM?

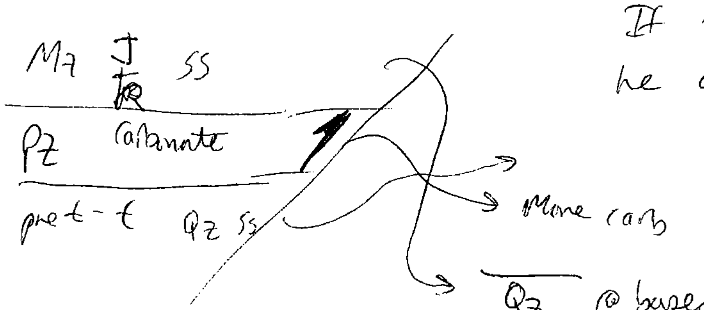
LAWTON '86
ENRICHMENT OF Qz UPSEC
GENERAL TREND IS THERE, BUT SEVERAL INTERPRETAT. POSSIBLE
– COULD HAVE FITTED DATA TO POLYNOMIAL CURVE (LINEAR TOO SIMPLIFIED)
~~MAY~~ CARBONATE AT BOTTOM; QZ AT TOP
TRYS TO DO TOO MUCH W/ DATA
UPWARD QZ
~~pre-€~~ €
Much Qz @ base
(maybe from Mz)

READINGS FOR NEXT WEEK: M

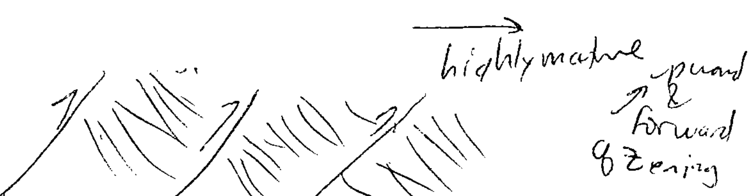
MONDAY 4 MAY
- WERNICKE et al '82 (SHORT)
- WERNICKE et al '85 (CHEN)
- BOHANNON '83 (LINN) MEMOIR 157 125-148 (or USGS Prof. paper 1259)

WEDNESDAY 6 MAY
- FLECK '70 Fig 2 (attach to [illegible])
- ARMSTRONG '68 p430-7; 441-2 + Figs & maps
- BURCHFIEL et al '74 p 1013-1022 + Strat
- BLAKEY/MIDDLETON '83
  Lower Mz strat & depo. systems
  GSA Cordill/RMt fieldtrip guide pt. 2 p33-
- (+MARZOLF '83)
- +STOKES '83 Tr + J Fm, SW UT in Guidebook to Geol of SW Utah (IAPGP) p 66-64
- PETERSON/PIPIRINGOS '79 NAVAJO etc. USGS Prof. Pap # 1035B B1-B20

INGERSOLL



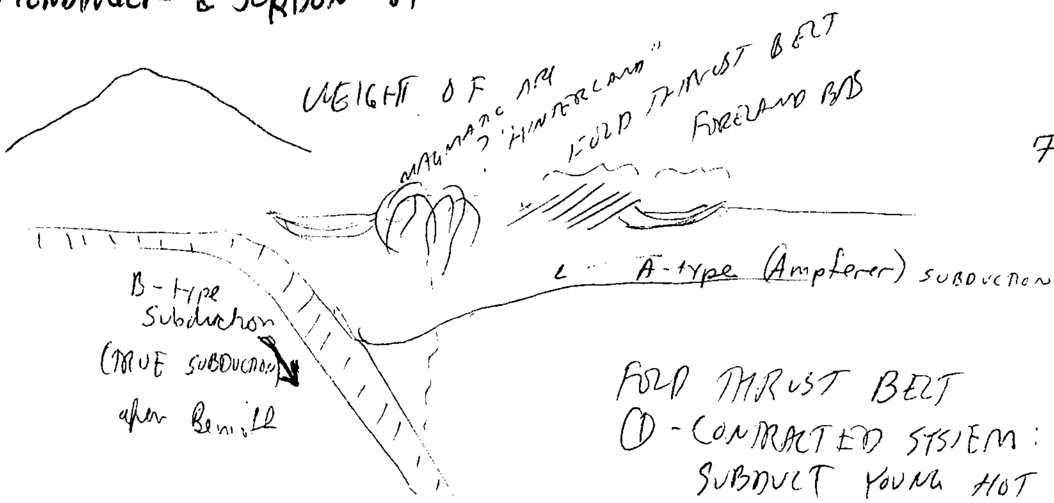
If thrust plate is deeply dissected, he defeats his argument



ALLMENDINGER & JORDAN '81

27 APR 87

PAPER TOPICS DUE
7 MAY: CASEY MOORE



FOLD THRUST BELT
① - CONTRACTED SYSTEM: DIFFICULT TO SUBDUCT YOUNG HOT OCEANIC CRUST
CRATON UNDERTHRUSTS ARC

② NEUTRAL W/RESPECT TO STRESSES
MAGMATISM CAUSES THICKENING AND RESULTING IN SPREADING OUT

LAWTON '83

WHY ARE PALEOCURRENTS ALWAYS GOING NE?
WHY NOT NW PALEOCURRENTS ON WEST SIDE OF SAN RAFAEL SWELL; CENTRIPETAL CURRENTS AROUND A SWELL EXPECTED
DEALS MOSTLY WITH SWELLING AT BEGINNING OF LARAMIDE OROGENY

CROSS ('86)

REVIEWS FORELAND PROCESSES; CONFUSED DETAILS
FIG. 4: LOCUS OF SUBSIDENCE IS SO DEEP IN FOLD-THRUST BELT BECAUSE OF COMPRESSION

COLORADO PLATEAU: EVERYTHING FOLLOWS PRE-EXISTING WEAKNESSES - (NOT MENTIONED IN PAPER)

FIELD TRIP

FIELD TRIP READINGS:
PRESENTATIONS:
CONTRAVERSIAL PAPERS:

DICKENSON et al '86	HEWS
HELLER et al '86	BLOOM
LAWTON '86	CAVAZZA

20 cm / ~~1000 00000~~ 6 cm ~~1000 000 000~~ cm
yr$ ~~#10~~ ~~15~~ 6 million yrs avg.

29 APR 87

DICKINSON et al
SEVIER to LARAMIDE TRANSITION
SHIFTING PROVENANCE

4 MAY 87

WERNICKE et al '82
65% min extension in SOUTHERN GREAT BASIN

BOHANNON '83
Mz & Cz tectonic development

WERNICKE et al '85
Low ∠ ext faulting w/o reactivation of pre-existing; MOST OF WHAT THEY ...
THRUST: THIN-BRECCIA
NORMAL/DETACHMENTS: THICK-BRECCIA
BALANCED X-SEX:
ASSUMES VOLUME HAS NOT CHANGED
UPPER PLATE: COMPLEX [illegible]
DO THRUSTS PENETRATE BASEMENT? THRUSTS CAN'T; DETACHMENTS DO - WERNICKE

6 APR 87

LOGISTICS
Be here @ 7:00 am
leave @ 7:30 Loading Dock

	B	L	D
Sat	X	Personal Sand	RESTAURANT
Sun	I	Linn	Spanish casserole ~~RESTAURANT~~
Mon (Possible grocery stop; Buy food)	↓	Hemis	Kabobs
Tue		Blum	Stir-fried chicken
Wed		Meek	spaghetti Zion
Thurs (Morning buy food)			
Fri	↓	↓	

CHICKEN CR. E of Levan ; CAMPGROUND
TRAVERSE ; Gunnison Plateau; CAMP, primitive
E. Gunnison Plateau K section structure; N. Horn Beds;
MAPLE GROVE CAMPGROUND
CAMP @ BRYCE
Valley of Fire
restaurant

B ||||
C ||||
G ||||
D ||
H |||
L |||
M |||
S |||

PAPERS

6 MAY 87

Sevier Overthrust
Old west
Young east

Thicken to west

Navajo → sand sea
Kayenta → alluvial + eolian facies
Moenave →
Chinle
Moenkopi

M	W			
18	20 NEVADAN	SCHWEICKERT & COWAN	'75	LINN
		HARPER & WRIGHT	'84	HEINS
		INGERSOLL & SCHWEICKERT	'86	SHORT
25 ~~NACIEMENTO & LARAMIDE~~ MEMORIAL DAY	27 NACIEMENTO & LARAMIDE	DICKINSON '83		~~HEINS~~ BLOOM
		CHAPIN & CATHER '81		CAVAZZA
		SALES '83		DUNKLE
1 NEOGENE	3 NEOGENE			

20 MAY 87

Schweickert & Cowan

WHY IS WESTERN ARC E. FACING?

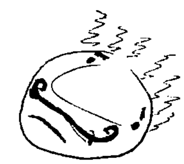
SIERRA NEV. COMPOSED OF 2 MAGMATIC ARC COMPLXS:

FOOTHILLS/WESTERN & EASTERN/NORTHERN
E-facing W-facing
island arc marginal arc
remnant arc + back-arc basin

CONSUMED OCEANIC LITHOSPHERE
COLLIDED IN L. J (NEV. OROGENY)

SUBDUCTION RESUMED IN WEST IN LATEST J

HARPER & WRIGHT
KLAMATHS TERRANE FORMED BY SINGLE W-FACING MAGMATIC ARC
+ ACCRETED TERRANES



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1 JUNE

NEOGENE INTERIOR

HEINS	BALDRIDGE et al '84	RGR
	~~GLAZNER & LOOMIS '84~~	MENDOCINO SUBD.
DUNKLE	ALMENDINGER et al '87	COCORP

7 \ 17J, 7J4

3 JUNE

PIZZA + BEER '87

NEOGENE ~~COASTAL~~

~~GRAHAM et al '83~~ — CONVERGENT TO TRANSFORM

CROUCH et al '84 — COASTAL TERTIARY BASINS

Hornafius et al '86 — SHORT, MEEK

SALEEBY '83 U/Pb; COMPLEX

NUR '83 PURE GEOPHY; PALEOMAG

JONES et al '83

LATE CENOZOIC

GOOD SUMMARY

EARLY PLATE TECTONIC PAPERS

BURCHFIEL & DAVIS '72 & 75

DICKENSON '81

3 JUNE

SCHWEICKERT & COWAN

SHORT	CONEY et al '80	CLASSIC TERRANE ARTICLE
	Howell et al '85	
	HAMILTON '85	
CHEN	SCHERMER et al '84	

PAPER TOPIC

DAVID BLOOM

WHAT THE NEOGENE BASINS OF THE MOJAVE BLOCK REVEAL OF THE TECTONIC HISTORY OF THE REGION, ESPECIALLY WITH RESPECT TO MIGRATION OF THE MENDOCINO TRIPLE JUNCTION.

OK/RNI

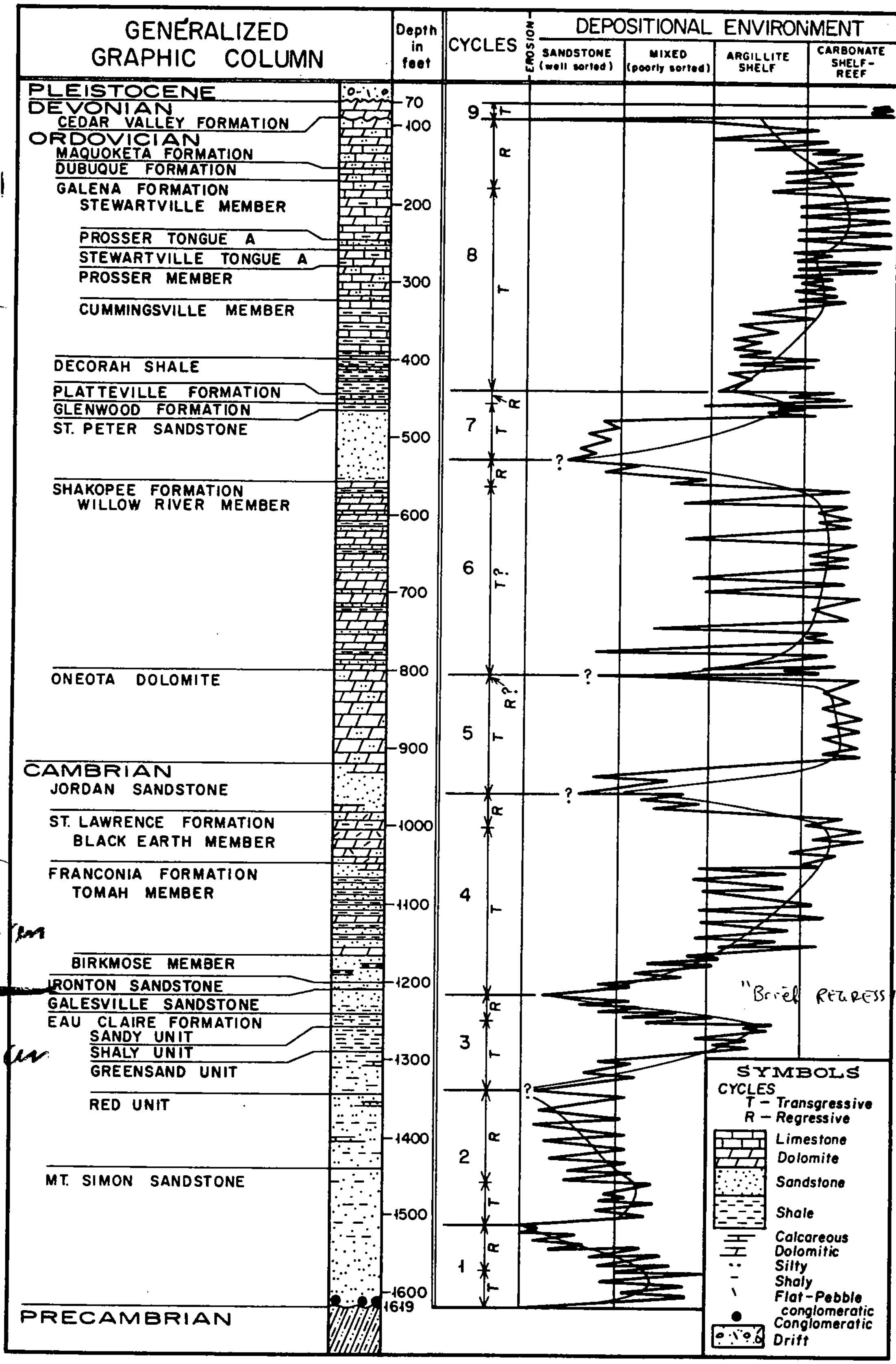

Figure VI-21. Generalized graphic log and cyclic depositional environments of rock units in a deep stratigraphic test well near Hollandale, Minnesota. Major cycles are outlined by the thin line superimposed on the irregular thick line which indicates minor fluctuations in the depositional environment (after Austin, 1970b).

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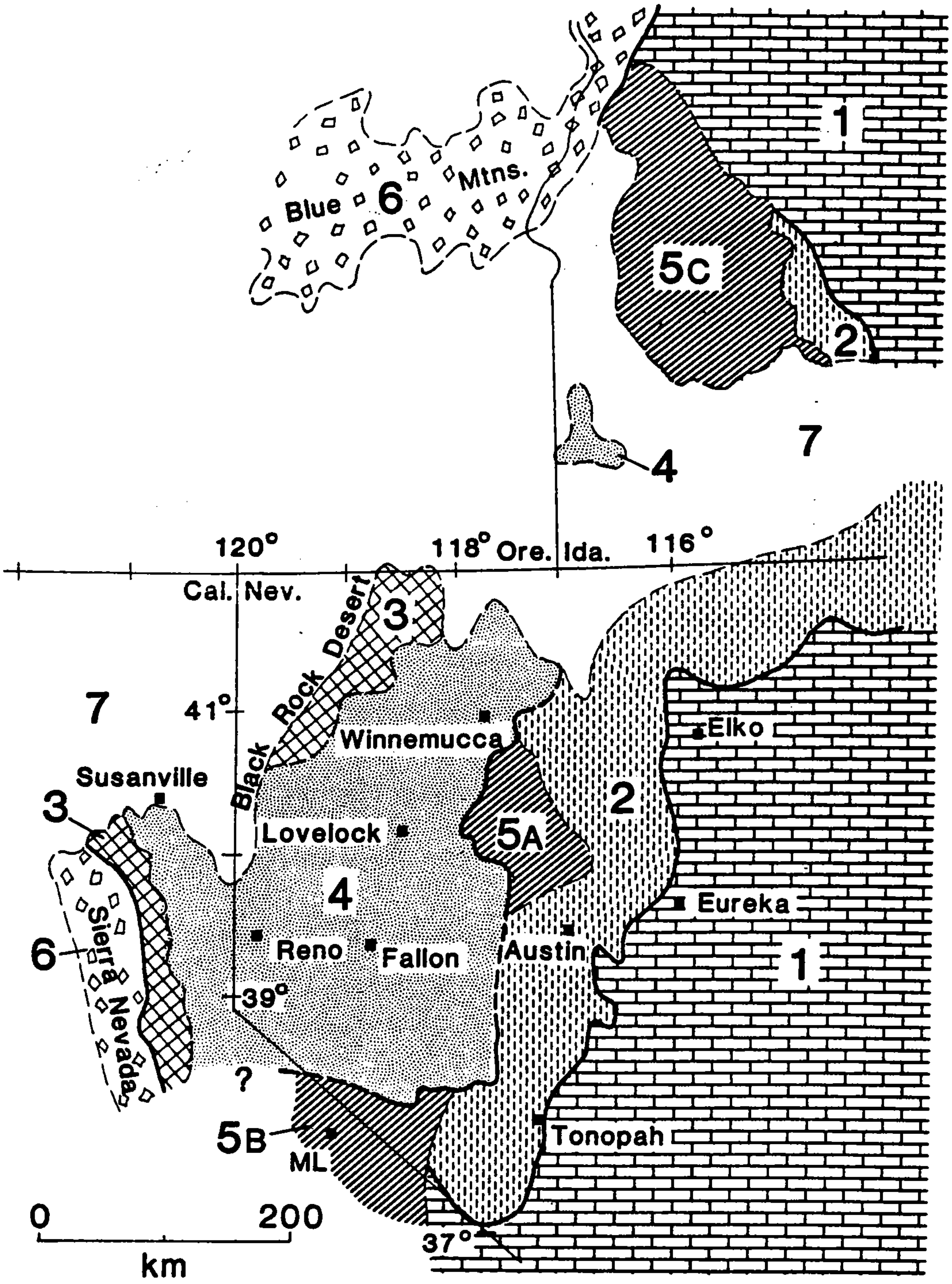


1) North America: Precambrian crust plus parautochthonous cover

2) displaced Paleozoic oceanic terranes overlying N. America; Early Triassic and older attachment

3) displaced Paleozoic terranes; probable Early Triassic attachment to North America

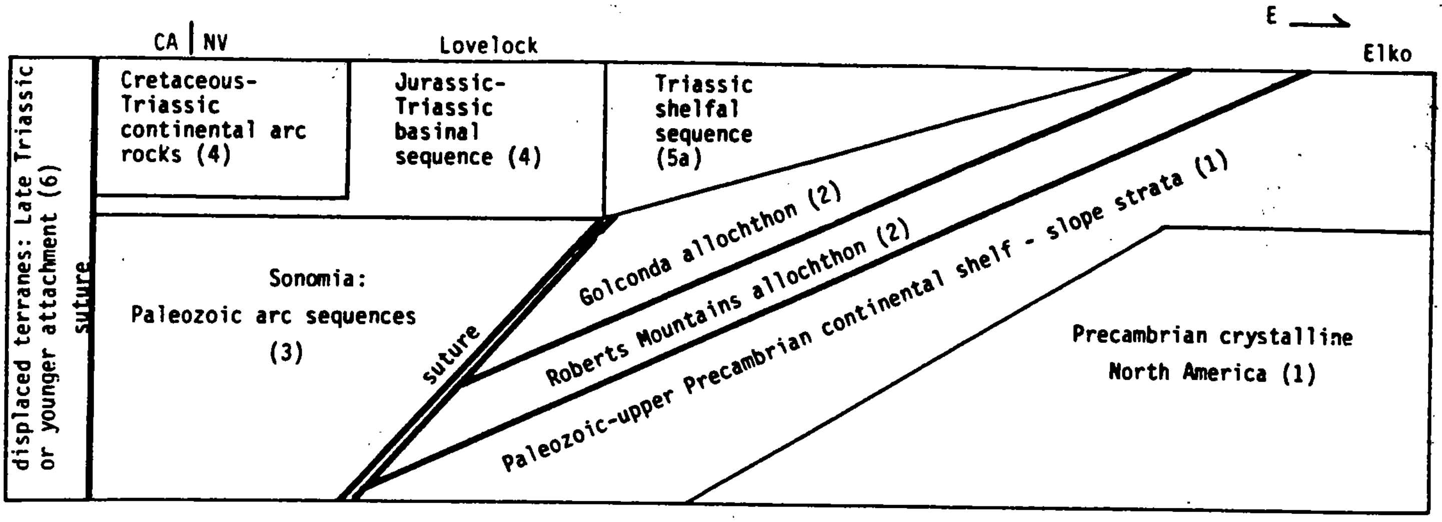
4) parautochthonous Mesozoic cover to and intrusions in terrane 3

5) mainly autochthonous Mesozoic cover to and intrusions in terranes 1 and 2

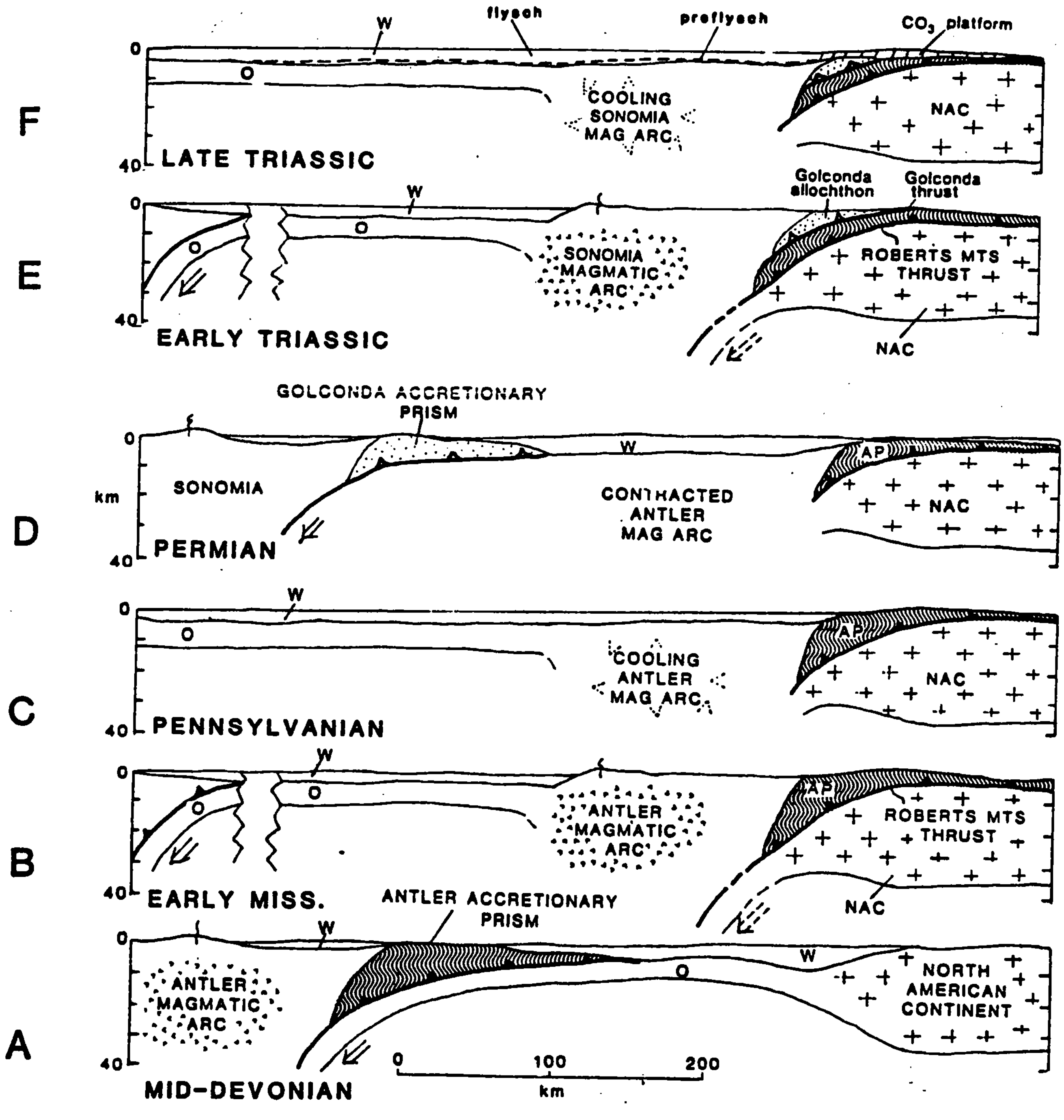
6) displaced terranes; Late Triassic or younger attachment

7) Quaternary to Upper Cretaceous cover to all other units

[Fig. 1.]


E
CA | NV
Lovelock
Elko
displaced terranes: Late Triassic or younger attachment (6)
suture
Cretaceous-Triassic continental arc rocks (4)
Jurassic-Triassic basinal sequence (4)
Triassic shelfal sequence (5a)
Sonomia: Paleozoic arc sequences (3)
suture
Golconda allochthon (2)
Roberts Mountains allochthon (2)
Paleozoic-upper Precambrian continental shelf - slope strata (1)
Precambrian crystalline North America (1)

[Fig. 2]



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[Fig. 5.]

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Figure 1