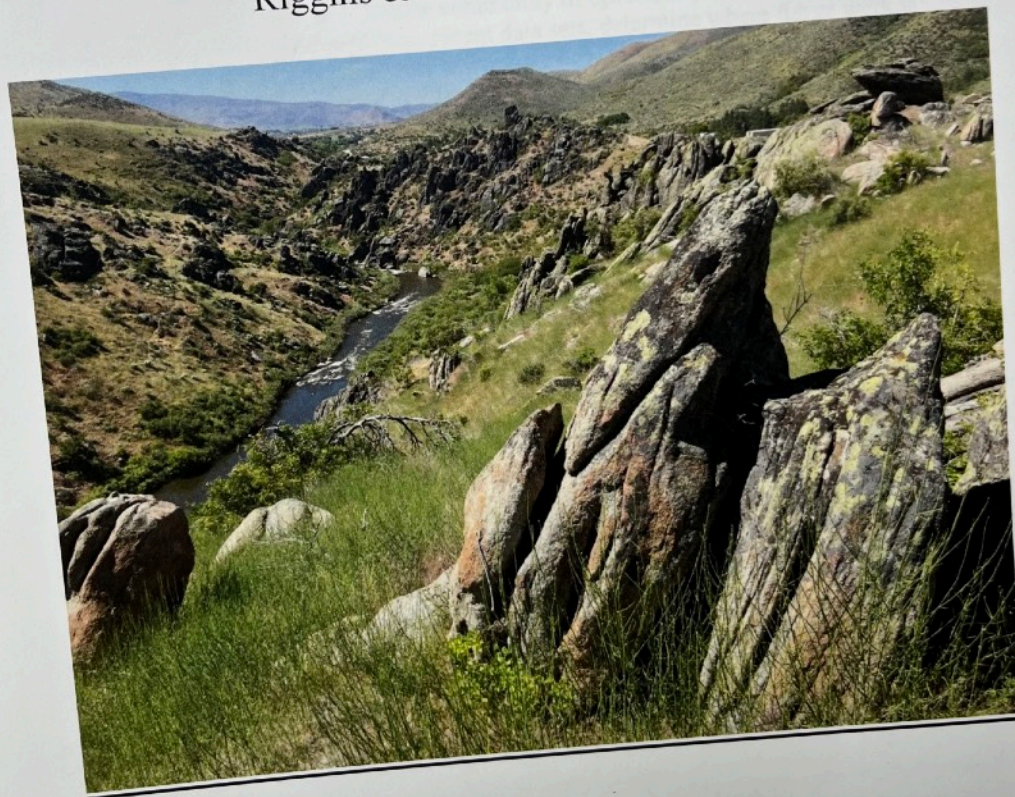


2023 GSA Penrose Conference

*Developing a New Paradigm for the mid-Cretaceous to
Eocene North America Cordillera: an Obliquely Convergent
Plate Margin*

August 18th–25th, 2023
Riggins & McCall, Idaho, USA



~ 1968

PLATE TECTONICS

- A unifying *kinematic* model for earth's lithosphere
- Lithosphere divided into a few, areally large but thin plates; a few areally small plates
- Plates are internally rigid. Deformation is restricted to plate boundaries—where plates interact—of which there are only three types
- Simple geometric rules govern movement of plates on a sphere
- Plates are composed of lithosphere. They move around *on* the asthenosphere.

HISTORY OF IDEAS & CONCEPTS

- ON-LAND RECORD OF SUBDUCTION in W NORTH AMERICA
- 1969 **ASILOMAR GSA PENROSE** —> 1985

WHY DOES THE DEBATE ABOUT
COASTWISE DISPLACEMENTS AND
TRANSLATIONS PERSIST?

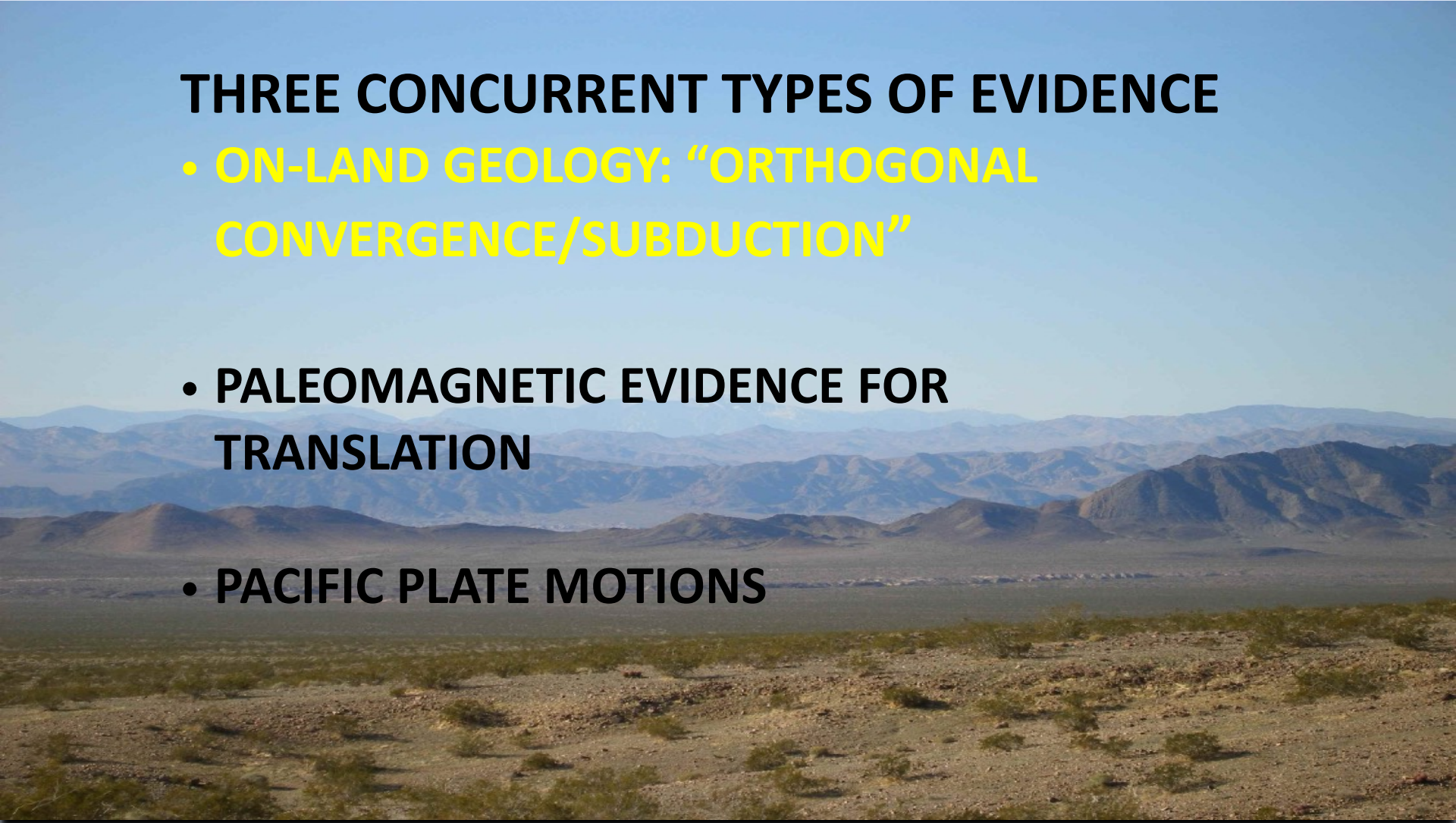
THREE CONCURRENT TYPES OF EVIDENCE

- **ON-LAND GEOLOGY: “ORTHOGONAL CONVERGENCE”**
- **PALEOMAGNETIC EVIDENCE FOR TRANSLATION**
- **PACIFIC PLATE MOTIONS**



THREE CONCURRENT TYPES OF EVIDENCE

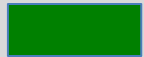
- ON-LAND GEOLOGY: “ORTHOGONAL CONVERGENCE/SUBDUCTION”
- PALEOMAGNETIC EVIDENCE FOR TRANSLATION
- PACIFIC PLATE MOTIONS



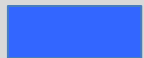
LATE MESOZOIC CALIFORNIA TRIAD



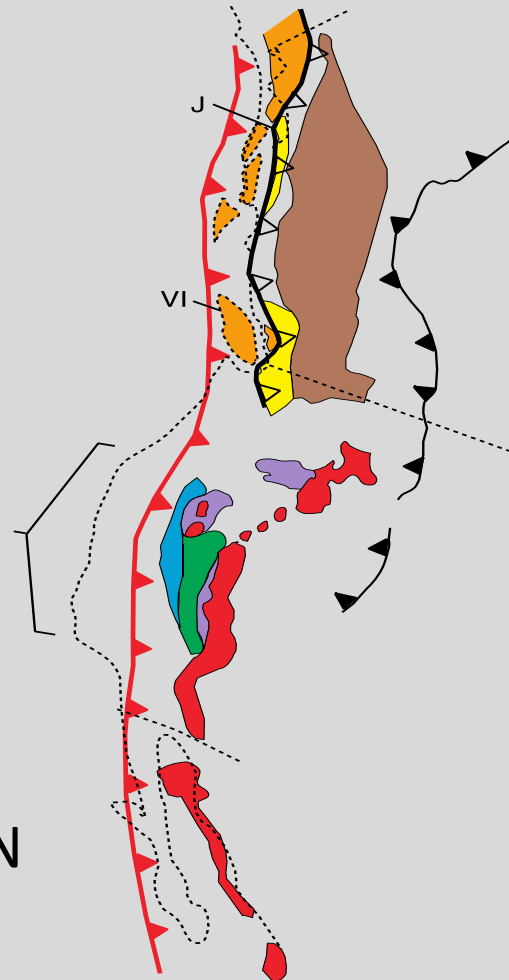
SIERRAN MAGMATIC ARC



GREAT VALLEY FORE-ARC



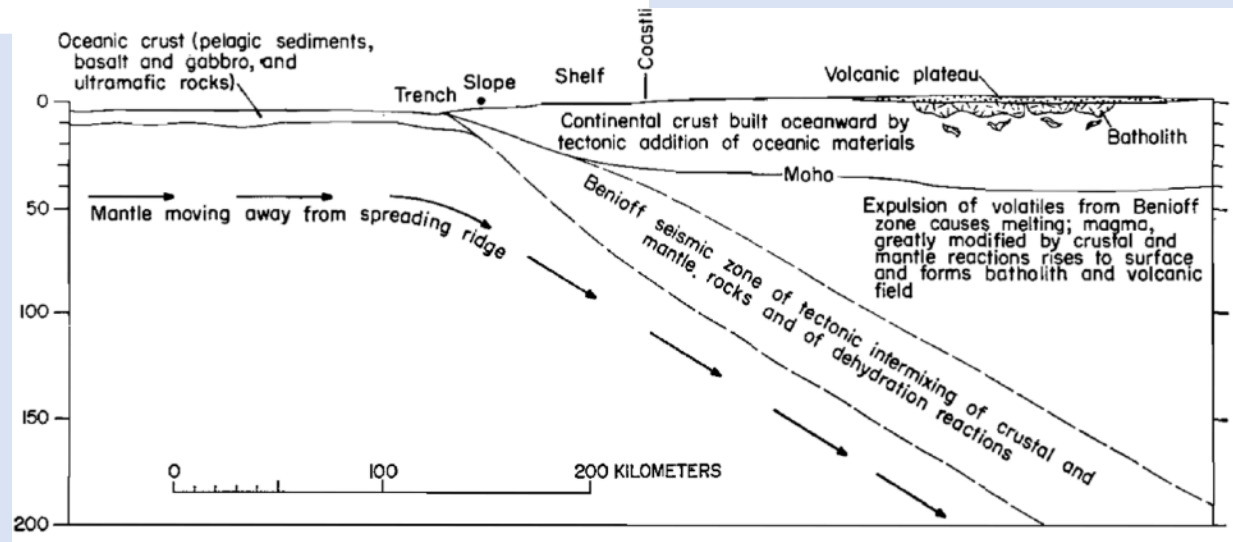
FRANCISCAN SUBDUCTION
COMPLEX



Cowan et al., 1997

WARREN HAMILTON *U.S. Geological Survey, Denver, Colorado 80225*

Mesozoic California and the Underflow of Pacific Mantle



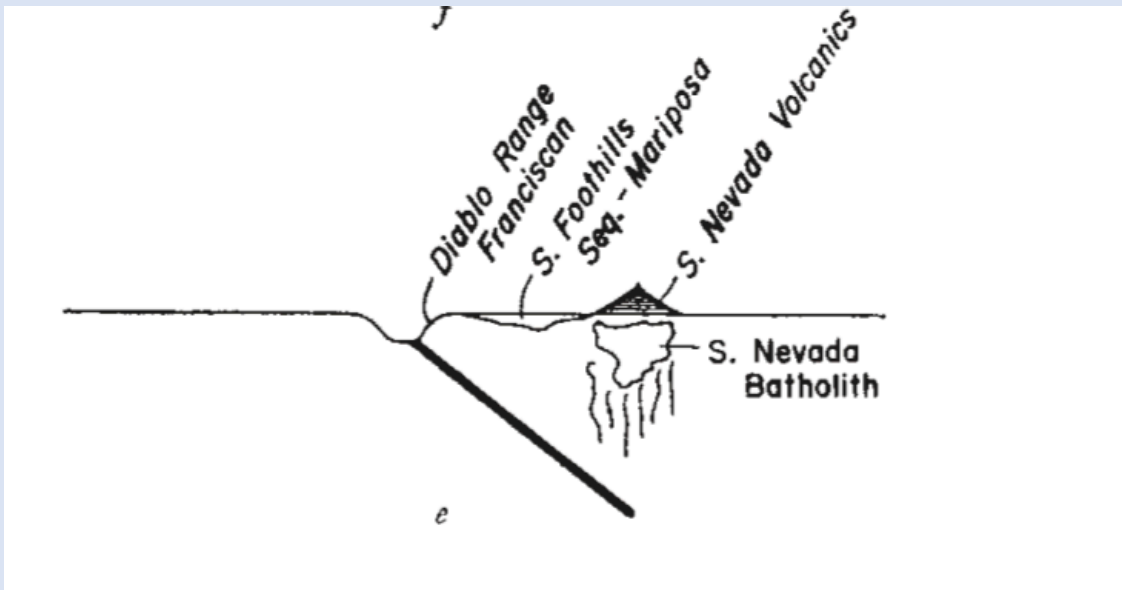
GSA BULLETIN December 1969

Ultramafics and Orogeny, with Models of the US Cordillera and the Tethys

by
ELDRIDGE MOORES

Department of Geology,
University of California, Davis

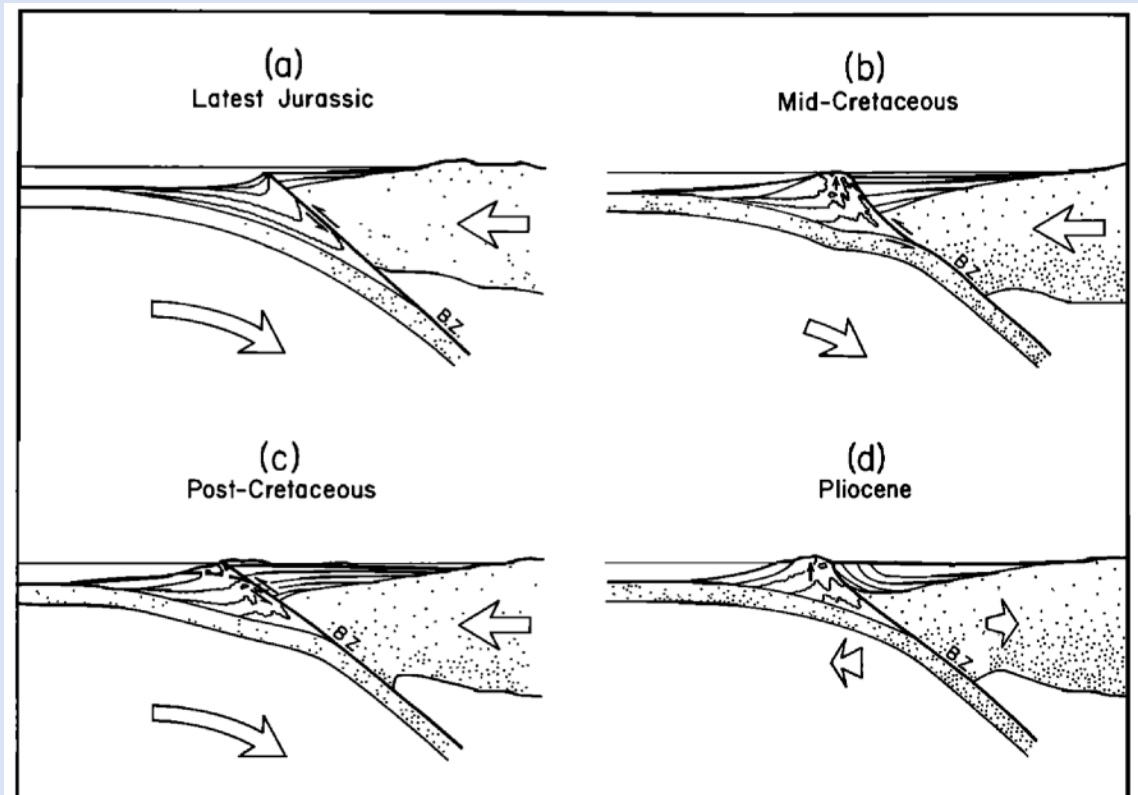
An attempt to synthesize regional and structural geology, particularly in the Alpine and Cordilleran systems, during the whole of Phanerozoic time.



NATURE 1970

Tectonic Contact between the Franciscan Mélange and the Great Valley Sequence—Crustal Expression of a Late Mesozoic Benioff Zone

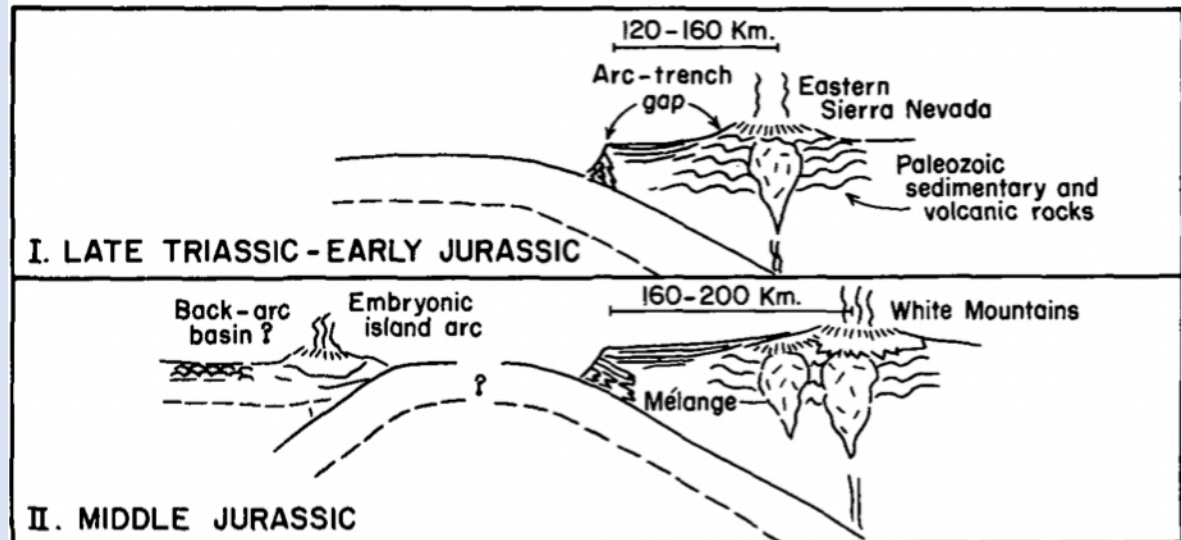
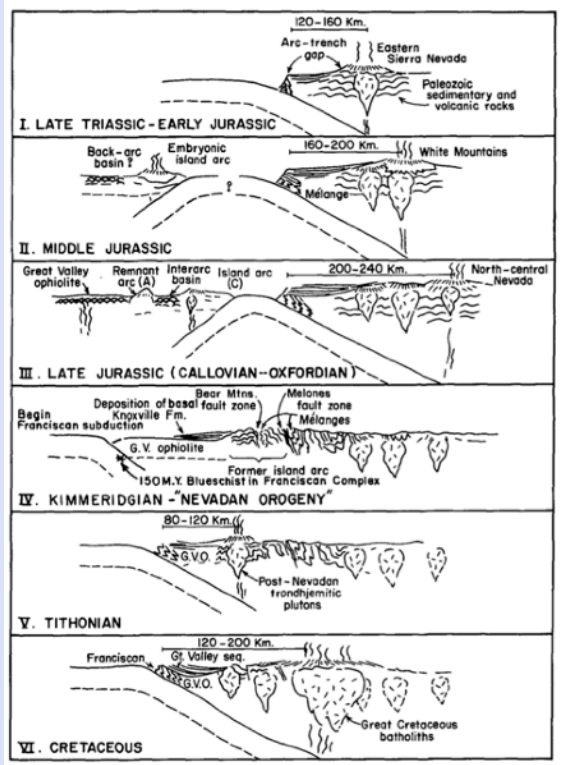
W. G. ERNST



JGR 1970

Early Mesozoic tectonic evolution of the western Sierra Nevada, California

RICHARD A. SCHWEICKERT *Department of Geological Sciences and Lamont-Doherty Geological Observatory of Columbia University, New York, New York 10027*
 DARREL S. COWAN *Department of Geological Sciences, University of Washington, Seattle, Washington 98195*



GSA BULLETIN
 1975

THREE *CONCURRENT* TYPES OF EVIDENCE

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- PALEOMAGNETIC EVIDENCE FOR TRANSLATION
- PACIFIC PLATE MOTIONS



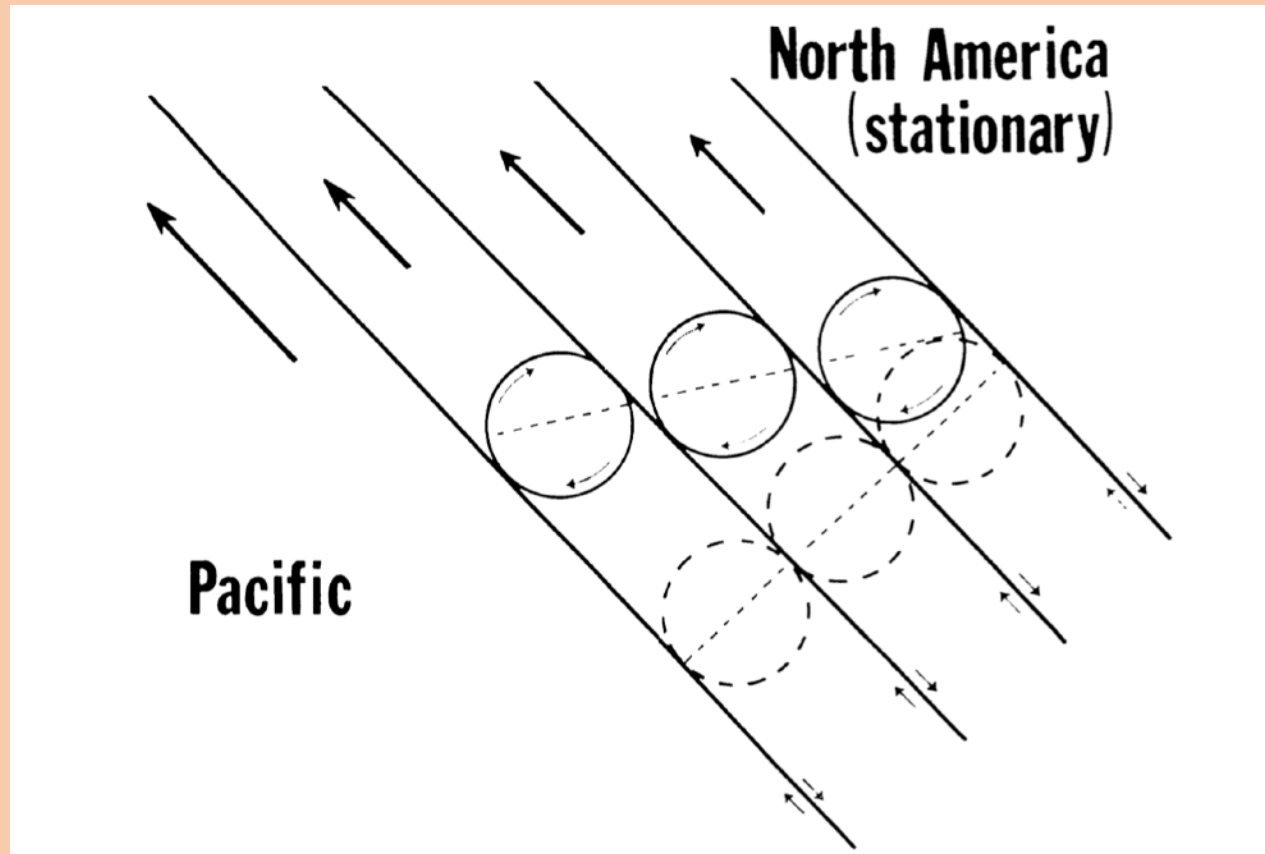
Anomalous Palaeolatitudes in Cretaceous Granitic Rocks

BECK & NOSON, *Nature*, 1972

- **93 Ma Mt. Stuart batholith, North Cascades**
- **“magnetically stable” sites**
- **Originated ca. 25° further south**
- **Recognized possibility of undocumented northward tilt**

**DISCORDANT PALEOMAGNETIC POLE POSITIONS
AS EVIDENCE OF REGIONAL SHEAR IN THE
WESTERN CORDILLERA OF NORTH AMERICA**

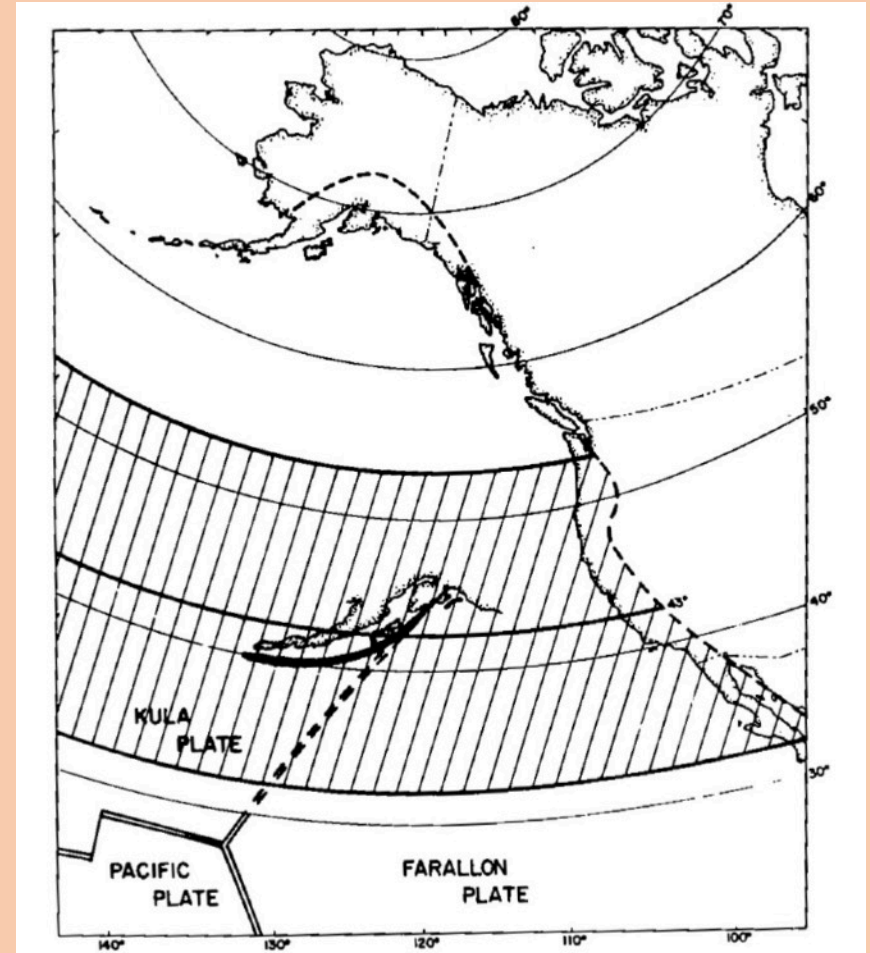
MYRL E. BECK, JR.



AMERICAN JOURNAL OF SCIENCE June 1976

Palaeomagnetism of volcanic rocks of the Kodiak Islands indicates northward latitudinal displacement

Peter W. Plumley*, Robert S. Coe*, Tim Byrne†, Mary R. Reid‡ & J. Casey Moore*



NATURE NOVEMBER 1982

Franciscan Complex limestone deposited at 17° South paleolatitude

WALTER ALVAREZ *Department of Geology and Geophysics, University of California, Berkeley, California 94720*

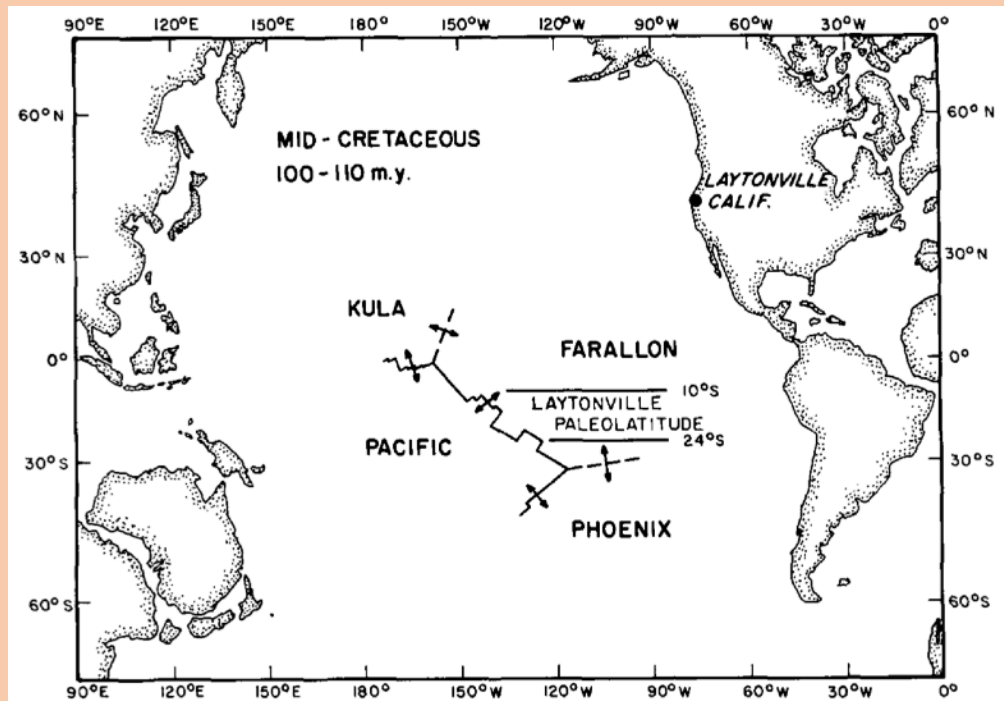
DENNIS V. KENT *Lamont-Doherty Geological Observatory, Palisades, New York 10964*

ISABELLA PREMOLI SILVA *Istituto di Paleontologia, Piazza Gorini, 15, Milano, Italy*

RICHARD A. SCHWEICKERT

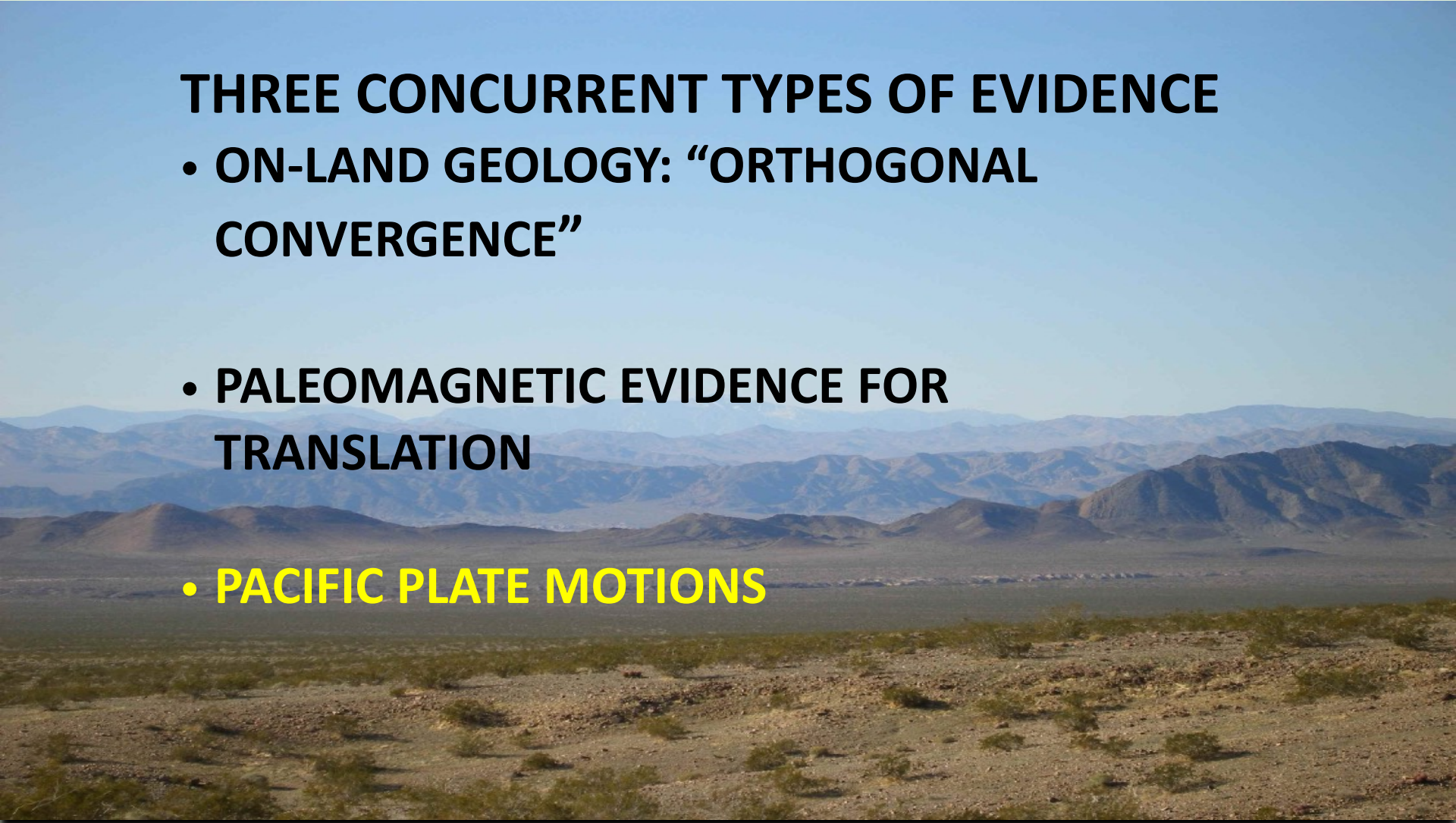
ROGER A. LARSON

} *Lamont-Doherty Geological Observatory, Palisades, New York 10964*



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TANYA ATWATER *University of California, San Diego, Marine Physical Laboratory of the Scripps
Institution of Oceanography, La Jolla, California 92037*

Implications of Plate Tectonics for the Cenozoic Tectonic Evolution of Western North America

GSA BULLETIN December 1970

Relative Motions Between Oceanic and Continental Plates in the Pacific Basin

David C. Engebretson
Allan Cox
Richard G. Gordon




SPECIAL PAPER
206

1985

tectonics

Volume 3 Number 2 April 1984
TCTNDM 3 (2) 103-316
ISSN 0278-7407

Correlation Between Plate Motions and Cordilleran Tectonics

Introduction to the Special Issue on Correlations
Between Plate Motions and Cordilleran
Tectonics (Paper 3T1482)

Myrl E. Beck, Jr. 103

The Subduction of the Farallon Plate Beneath
North America as Derived From Relative
Plate Motions (Paper 3T1859)

Donna M. Jurdy 107

Correlation of Plate Motions With Continental
Tectonics: Laramide to Basin-Range (Paper 3T1886)
D. C. Engebretson, A. Cox, and G. A. Thompson 115

Mesozoic Aseismic Ridges on the Farallon Plate
and Southward Migration of Shallow Subduction
During the Laramide Orogeny (Paper 4T0049)

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Correlation Between the Geologic Record and
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Benjamin M. Page and David C. Engebretson 133

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Nevada: Constraints on Reconstructions
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Leah S. Frei, James R. Magill, and Allan Cox 157

APRIL 1984

Tectonics

Whence British Columbia?

from E. Irving

NATURE APRIL 1985

GEOLOGICAL SURVEY OF CANADA

- **Randy Enkin**
- **Jane Wynne**
- **Ted Irving**

HISTORY OF IDEAS & CONCEPTS

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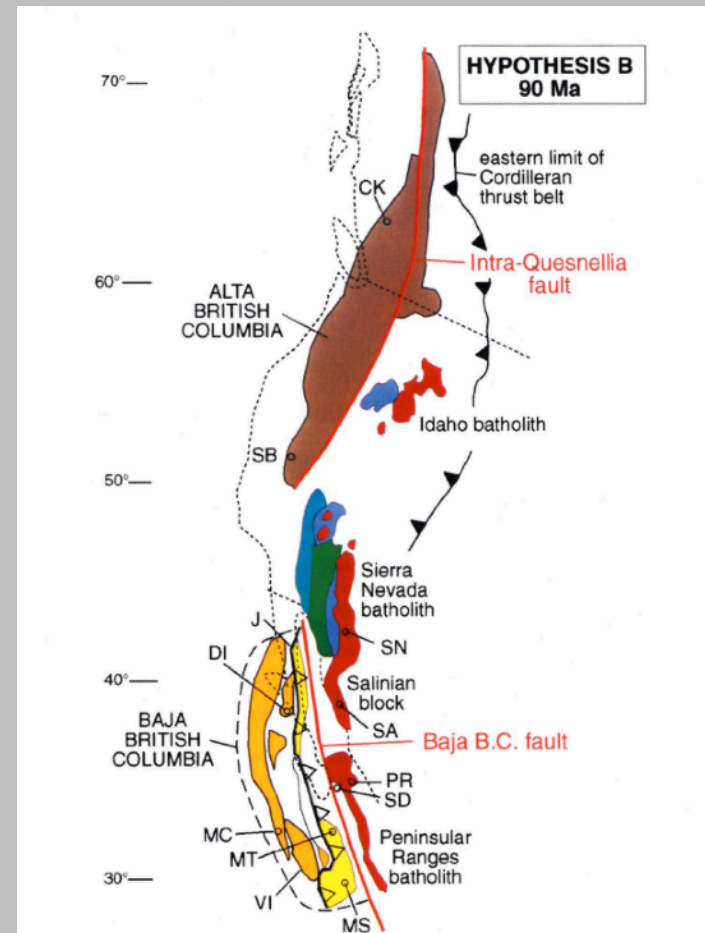
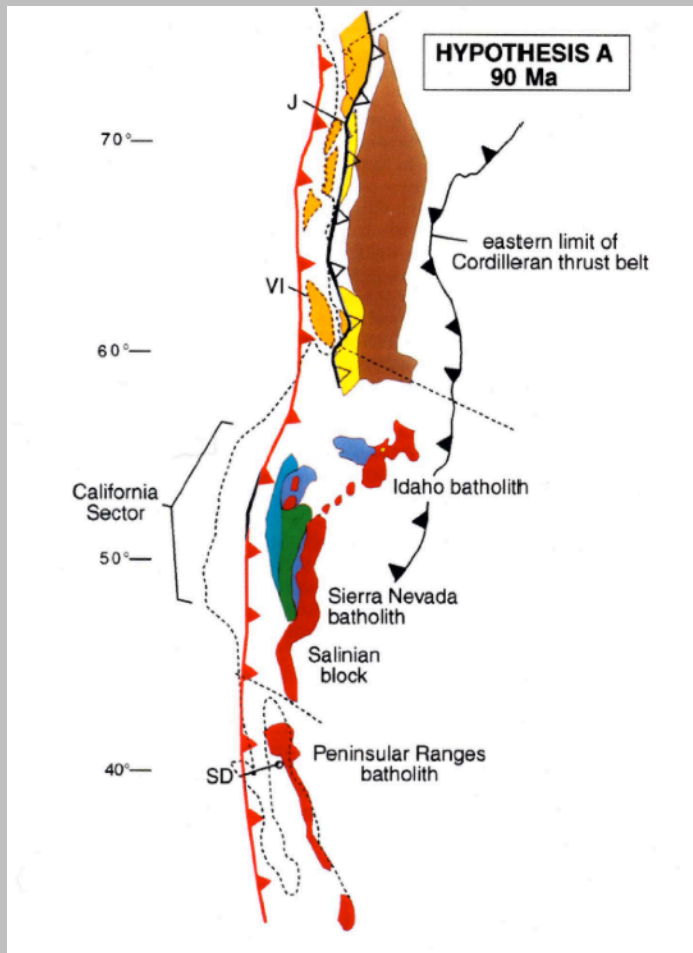
**WHY DOES THE DEBATE ABOUT
DISPLACEMENTS AND TRANSLATIONS
PERSIST?**



GEOLOGIC TESTS OF HYPOTHESES FOR LARGE COASTWISE DISPLACEMENTS—A CRITIQUE ILLUSTRATED BY THE BAJA BRITISH COLUMBIA CONTROVERSY

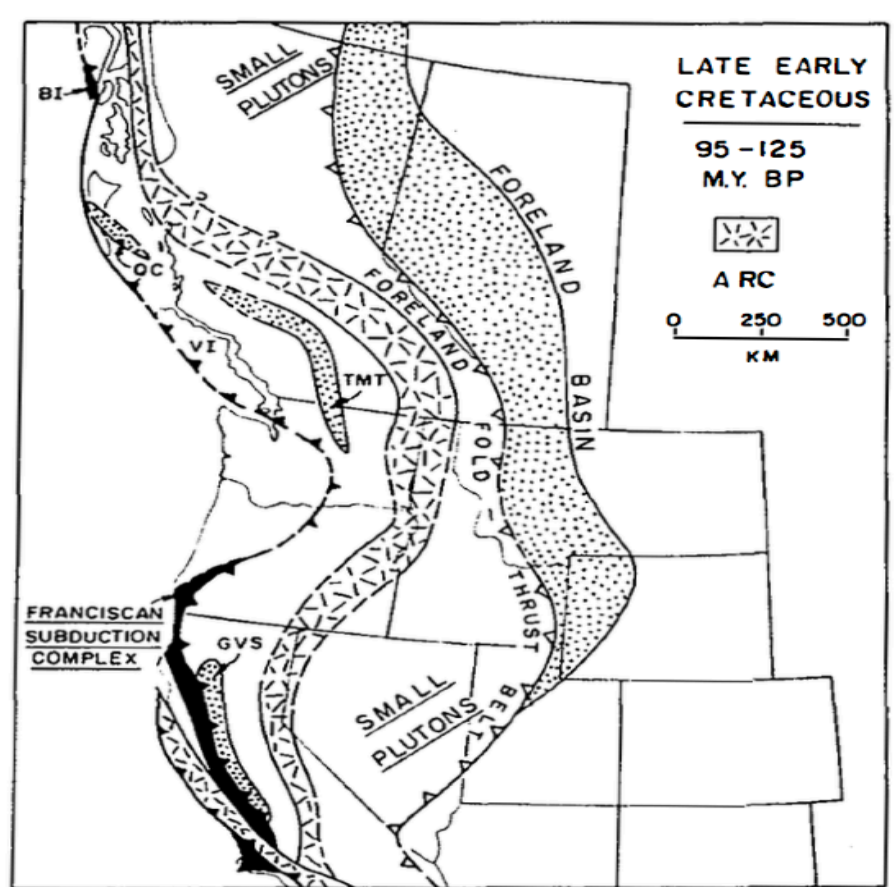
DARREL S. COWAN,* MARK T. BRANDON,**
and JOHN I. GARVER***

1997



Sedimentary basins developed during evolution of Mesozoic–Cenozoic arc–trench system in western North America¹

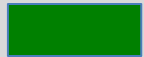
WILLIAM R. DICKINSON



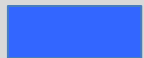
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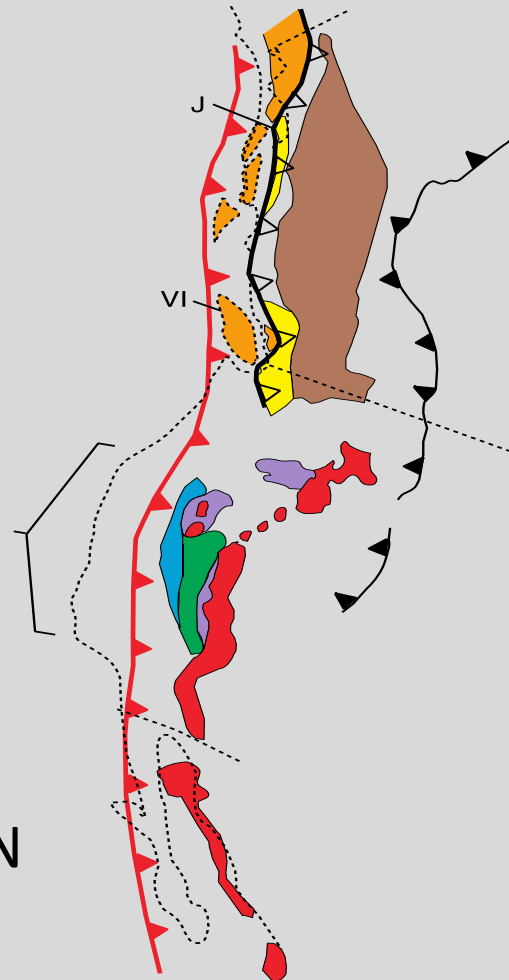
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Cowan et al., 1997

**GEOLOGIC TESTS OF HYPOTHESES FOR LARGE
COASTWISE DISPLACEMENTS—A CRITIQUE
ILLUSTRATED BY THE BAJA BRITISH
COLUMBIA CONTROVERSY**

DARREL S. COWAN,* MARK T. BRANDON,**
and JOHN I. GARVER***

- Reconstruction of Baja BC based on *paleomagnetic data*
- Paleohorizontal, and ages of rocks and magnetization confirmed
- Mount Stuart (Beck et al., 1981; Ague & Brandon, 1996)
 - 3100 +/- 600 kms south
- Mount Tatlow (Wynne et al., 1985)
 - Mid-Cretaceous sedimentary and volcanic rocks
 - 2960 +/- 450 kms south