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~~JHC~~ WHC - comments ? Porph Copper ~~General~~ (MISC)

J. H. C.

APR 15 1971

AMERICAN SMELTING & REFINING COMPANY
Tucson Arizona

March 12, 1971

W.E.S.
APR 13 1971

MEMORANDUM

TO: W. E. Saegart

FROM: John C. Balla

Possible Research on
Gravity Sliding of
Porphyry Copper Deposits

Exploration by Asarco over the years, which has developed the Mission-San Xavier and Santa Cruz-Sacaton deposits, has pointed up the significance of low angle, post-mineral displacements of segments of porphyry copper deposits. Recent discoveries at Cactus-Carlota, San Manuel-Kalamazoo, in addition to the Asarco deposits, have shown that low angle, post-mineral displacements are a rather common feature of many porphyry copper deposits, as was mentioned on the recent Asarco porphyry copper tour.

In light of the obvious exploration significance of such faulting, I suggest that Asarco, if they have not done so already, consider doing a exploration-oriented research program on low angle, post-mineral faulting of porphyry copper deposits.

The research might be carried out in the following manner: A detailed study of the low angle faults underlying Mission-San Xavier, Sacaton, and Cactus-Carlota. Then considerations of "how" and "why" the deposits slid, and why they stopped where they did. Finally, exploration attempts in other districts that are known to be underlain by flat faults - - - such as Courtland-Gleason, Kelvin (Riverside), and Price (Red Hills), to determine if the displaced segment can be found.

Because of the large amount of company data that would be involved, it might be better to have a company geologist work on this problem rather than a graduate student doing a dissertation on it.

Asarco is in the unique position of probably having more information on this problem than any other company. Because of this, exploration oriented research on this topic might be quite productive.

John

John C. Balla

JCB:van

Toxic → file
Gravity Faults

ASARCO

Southwestern Exploration Division

March 10, 1977

MAR 10 1977
F. T. G.

TO: F. T. Graybeal

FROM: J. D. Sell

Thrust Faults, Gravity Slides, and Crustal Flexure
Geologic Division Center for Continuing Education
USGS Denver Federal Center
Denver, Colorado

On March 4 I attended the above seminar of Lucian Platt which was his fourth seminar on structural geology. Mr. Chuck Beverly of the Denver office also attended.

Dr. Platt is a very accomplished speaker, with terrific view photographs, but apparently did not convince other thrust fault people, such as H. Drewes, nor clarify the issue with the attendees.

His basic premise was that a piled group of rocks will load and depress the crust and mantle by elastic deformation and such deformation produces a moat in front of the load with a forebulge ridge between the moat and the undeformed far away.

Thrust faults are a definite part of the scheme once it has been established, but he is unsure of how the first one got on top of the initial unit to get this thing going.

His distributed outline and references are attached.

James D. Sell

James D. Sell

JDS:lb
Atts.

Thrust faults, gravity sliding, and crustal flexure

This talk related to next one on "Opportunities for failure in mountain building"

Mountain ranges have wave trains and thrust faults. Wave trains known since the Rogers brothers in Tennessee in 1842. Thrust faults known in the Rockies at least since McConnell, 1887. But large movement has not been accepted always.

Historical comments on recognition of huge thrust fault movements, from E. B. Bailey.
Note especially Arnold Escher von der Linth, 1841, and Schardt, 1893.
Gravity slides, such as those in Appennines, not the main scene, although they are real and have long movement.
Coherent thrust plates. Phil King's "Anatomy and habitat"
Anisotropic sediments and faults parallel to bedding for long distances.
Decollement or ungluing on salt, shale, etc.
Basement thrust plates, e.g. Grandfather Mountain window. Armstrong.

How do huge plates miles thick move tens or even hundreds of km?
A solution by Hubbert and Rubey. $(1 - \lambda)$
To raise lambda: Rubey calls on sedimentation. See Bredehoeft & Hanshaw, 1968.
Secor suggested compaction; Cady offered up-dip migration.
Metamorphic or igneous activity. Raleigh & Paterson studied dehydration of serpentine. Heard & Rubey considered breakdown of gypsum.
Too many thrust plates don't have suitable base of impermeable material.

Reset the question. How do thrust plates move? Three main proposals.
A piston pushes. Squeeze box of James Hall 1812, and of King Hubbert.
Slide by gravity off a highland. Argand, deSitter, Rubey, Mudge, Scholten, Dennison in Appalachians, and many others.
Gravity push rather than gravity pull. Price, Elliott.

Isostasy on an elastic plate. Inadequacy of textbook model of blocks floating.
Case from ICE - density vs density of displaced medium (mantle)
speed of recovery = speed of deflection.
Moat and forebulge. 20 m and seismicly active.
Ocean plate - Oceanic volcanic islands, gravity and topography. Haskell
Moat and outer high.
Trench and forebulge. Watts, Hanks, Brotchie & Sylvester.
Continental plate - Walcott, 1970 in Alberta and elsewhere.
Here return to thrust belt.

In FRONT - The weight of the advancing plate and molasse wedge flexes the crust.
A moat forms and catches most sediment shed from thrust plates.
Rate of formation of moat exceeds rate of advance of thrust plates, so the moat keeps ahead of plates.
Pile of thrust plates depresses entire area of pile. Area still down.
But top of pile builds up higher than crust is depressed.
Elliott shows effective push of the surface gradient on pile.
Bucher showed this in his GSA Presidential address.
At present there is reason to believe the pile builds up from the back to the front, so the gradient would exist.
How the first one gets up onto the next one is speculative.

A selection of references to thrust faults and thrusting, including some on crustal flexure because I think they are related.

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SVFay - I'd like Chuck Beverly, and you if you wish to attend this, and disseminate any important data!

JDSell - please note

OPPORTUNITIES

GEOLOGIC DIVISION CENTER FOR CONTINUING EDUCATION
MS 953, U.S. GEOLOGICAL SURVEY, BOX 25046
FEDERAL CENTER, DENVER, COLORADO 80225, (303) 234-4790

RECEIVED
FEB 9 1977
EXPLORATION DEPARTMENT
2/14/76

FEBRUARY 1977

The following educational activities are open to any interested earth scientists on a space-available basis.

February 17: Asian Tectonics--Peter Molnar (MIT); 2:00 p.m., Petroleum Hall, Green Center, Colorado School of Mines. Seminar sponsored jointly by Office of Earthquake Studies and Center for Continuing Education.

March 4: Thrust Faults, Gravity Sliding, and Crustal Flexure--Lucian Platt leads the fourth of his much appreciated seminars on structural geology from 10:00 to 11:30 a.m., Lecture Halls A & B, Bldg. 25.

March 11: Opportunities for Failure in Mountain Building-- The last of Lucian Platt's seminars on structural geology from 10:00 to 11:30 a.m., Lecture Halls A & B, Bldg. 25.

March 15: Quaternary Faulting in Colorado--Robert M. Kirkham, consulting geologist; 2:00 p.m., Petroleum Hall, Green Center, Colorado School of Mines. Another seminar sponsored jointly by Office of Earthquake Studies and Center for Continuing Education.

Reservation to Denver on 4th then to SLC.

Return open to Tucson.

Call New Office & inform Sect. for CEB

Ticket pickup on Thurs 3rd

AMERICAN SMELTING AND REFINING COMPANY
EXPLORATION DEPARTMENT
120 BROADWAY, NEW YORK, N.Y. 10005

RECEIVED
NOV 4 1974
S. W. U. S. EXPL. DIV.

JOHN J. COLLINS
DIRECTOR OF EXPLORATION

AIR MAIL

October 30, 1974

Mr. A. Giesecke
Asarco
Madrid Office

Dear Al:

I acknowledge receipt of your letter of October 22. I can agree to postponing the confrontation of nappes with magnetics in Arizona until the subject heats up again.

As for "Aquifer Mineralization," I think you should not take time from the search for ore in Spain to prepare a talk in Salt Lake City. However, if your current work should generate an abstract as a by-product by mid-January, I would be glad to consider it for the Salt Lake City meeting.

I am sorry to say accommodations at Buchans are limited and that group is complete, barring a dropout.

Have you recovered your vehicle from Lisbon?

Regards and best wishes.

Sincerely,

John J. Collins

cc: JHCourtright
WLKurtz
CKMoss
RBSprague
JJMerz

file? (cont AG Nappe Rpt?

ASARCO

AMERICAN SMELTING AND REFINING COMPANY Y CIA., S. R. C.
EUROPEAN EXPLORATION DIVISION

AVENIDA DEL GENERALISIMO, 52, ENTREPLANTA
MADRID - 16 (ESPAÑA)

JOY J. MERZ CABLES: ASARCOCIA - MADRID TELEFONO 457 24 91

RECEIVED
NOV 7 1974
S. W. U. S. EXPL. DIV.

October 22, 1974

Mr. J.J.Collins
ASARCO
Director of Exploration
120 Broadway
New York, N.Y. 10005

Dear John,

I acknowledge receipt of a copy of your letter to Mr. C.K. Moss, dated October 15, 1974.

The question whether I will persist with my "gross Nappe picture" implies that I am still active with this problem. However, I am removed from this topic both in time and space. No progress or change has taken place. Hence, my old views necessarily have remained the same.

With respect to the possible refutation of the Nappe model by Cal Moss, the decision to go-ahead with a magnetic exercise may depend on how final the expected results will be. In case of only vaguely definable conclusions, time and effort might not be justifiable.

From your memo of Oct. 1, 1974, I have realized that I am expected to speak on "Nappes" at the Salt Lake City Meeting in March 1975. I certainly appreciate this gesture but must tell you that I have no new comments on the old problem. Hence, my talk would be no more than a repeat performance. Therefore, let me offer an alternative topic: "Aquifer mineralization", covering copper occurrences in Molasse-type environment.

Truly yours,

Al

A. Giesecke

AG/mg

c.c.: J.H. Courtright
W.L.Kurtz
C.K.Moss
R.B.Sprague
J.J.Merz

AMERICAN SMELTING AND REFINING COMPANY
Tucson Arizona

April 4, 1973

FILE MEMORANDUM

Gravity Sliding (Nappism)
Southern Arizona

Messrs. Sell, Giesecke and myself met with Harald Drewes of the U.S.G.S. to discuss his work in southeastern Arizona concerning the large scale movements of rock units along low angle faults.

Drewes confirmed that he believes the major movements to have occurred about 70 million years ago and, therefore, are pre-Laramide porphyry copper formation. He acknowledges that the age of major movement is slightly younger as one goes eastward. He believes the major direction of movement was in a N60E direction. He believes he can firmly document 10 miles of movement in the Rincon Mtn. area and has fair evidence for 20 miles. He is of the opinion that overall movement may be on the order of 60 to 100 miles, though positive documentation of this is not yet possible.

The obvious conclusion to be drawn from Drewes' work (if he is correct), and one which he acknowledged, is that the Laramide porphyry coppers have not been displaced by major low angle faults. This would then make Laramide porphyry copper geology essentially in-situ geology. Drewes recognizes, as do we, low angle fault movement of other ages in which the movement is on the order of a few miles (i.e., Mission, Sacaton, Miami, Superior East).

W. L. Kurtz

WLK:lb

cc: JHCourtright
TCOsborne
JDSell
AEGiesecke

Gravity, Faults, Etc.

AMERICAN SMELTING AND REFINING COMPANY
SOUTHWESTERN EXPLORATION DIVISION
P. O. BOX 5747, TUCSON, ARIZONA 85703

1150 NORTH 7TH AVENUE
TELEPHONE 602-792-3010

March 2, 1973

Mr. Harold Drewes
U.S. Geological Survey
Federal Building
Denver, Colorado 80225

Dear Mr. Drewes:

I am aware of your work on large scale thrust faulting in Southeastern Arizona. Our Mr. Giesecke has been doing some regional mapping and structural interpretation in southern Arizona and tends to confirm at least some of the features printed in the GSA Abstracts (Vol. 5, Number 1, February 1973).

Since none of our geologists from Tucson will be attending the Cordilleran Section meeting in Portland this month, I would appreciate receiving any manuscript or maps you might be able to send us. One feature that we are particularly interested in is the age and evidence for the age you have assigned to the large scale thrusting.

Mr. Giesecke and I would be happy to discuss these matters with you and accompany you in the field to observe pertinent outcrops if the opportunity avails itself.

Thank you for any information you may be able to supply us.

Very truly yours,

W. L. Kurtz
Manager of Exploration

WLK:lb

cc: AGiesecke
bc: JDSell

Gauth Faults - Flat Faults - Nappes

AMERICAN SMELTING AND REFINING COMPANY
Tucson Arizona

December 7, 1971

TO: W. L. Kurtz

FROM: J. D. Sell

Nappes

As previously pointed out in verbal discussion, the utilization of nappe tectonics in studies of the southwest has been seriously deficient for a variety of reasons.

It has been well expressed in the Pima-Duval region through the publication of J. R. Cooper's paper "Some Geologic Features of the Pima Mining District, Pima County, Arizona" (USGS Bulletin 1112-C), and ASARCO personnel work, that a flat fault structure underlies some ore bodies and presumably the portions are the beheaded parts of other mineral deposits.

Through Mr. Giesecke's paper and diagrams, and subsequent discussion, it was pointed out that several methods of approach and study are available for deciphering the tectonic history of a nappe environment.

Also, in the extension of the work in the Miami district, and in features we have found in drilling under the Dacite Plateau, it is believed that flat faulting is a probable mechanism in the movement of several of the ore bodies in the district and their related non-mineralized rock. Further, it is recognized that Santa Cruz-Sacaton is in the same class of fault tectonics.

The Southwest Exploration Department is active in the area of interpretation of these blocks and their origin, but with the abundance of cover rocks, the lack of good surface outcrops of the flat faulting itself, it is a difficult task.

The point I wish to suggest is that Mr. Giesecke be requested to review in specific the problems and features in the Pima-Duval district where our geologic information is best and propose an exploration program for confirmation of the suspected displacement of ore bodies. He should also specifically suggest information gathering programs and points of study which should lead to the better understanding of the processes and results of nappe tectonics applicable to the study of any area suspected of such features as a guideline for the SWED.

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