

21
300

R

Scientific Notebook for "Subregional
Hydrogeology" Research Project.
20-5104-173

The Boorum & Pease® Quality Guarantee

The materials and craftsmanship that went into this product are of the finest quality. The pages are thread sewn, meaning they're bound to stay bound. The inks are moisture resistant and will not smear. And the uniform quality of the paper assures consistent rulings, excellent writing surface and erasability. If, at any time during normal use, this product does not perform to your expectations, we will replace it free of charge. Simply write to us:

Boorum & Pease Company
71 Clinton Road, Garden City, NY 11530
Attn: Marketing Services

Any correspondence should include the code number printed at the bottom of this page as well as the book title stamped at the bottom of the spine.

CNWRA
CONTROLLED
COPY 145

One Good Book Deserves Many Others.

Look for the complete line of Boorum & Pease® Columnar, Journal, and Record books. Custom-designed books also available by special order. For more information about our Customized Book Program, contact your office products dealer. See back cover for other books in this series.

Made in U.S.A.
RMI171193

Contents

Page

Entries made by Ross Baptizyon
w/ inputs from B. Henderson

TASK 3: DEVELOPMENT OF 3D SITE-SCALE MODEL.


OBJECTIVE: 1) TO IDENTIFY & COMPILE DATA FROM THE
YM REGION (DOE-COLLECTED) IN ORDER
TO BUILD A 3D GEOLOGIC MODEL.

2) EVALUATE ASSOCIATED UNCERTAINTIES IN THE
CONTINUALLY EVOLVING MODEL.

DATA INVOLVED: PRIMARILY BOREHOLE & GEOLOGIC MAP INFORMA-
TION COLLECTED BY DOE UNDER THEIR QA
PROGRAM OR DATA COLLECTED PRIOR TO THE
ESTABLISHING OF AN APPROVED QA PROGRAM,
WHICH HAVE BEEN "GRANDFATHERED."

ALL THESE DATA ARE BEING (OR HAVE BEEN)
COLLECTED AT CNWRA BY THE
GEOLOGIC SETTING ELEMENT FOLKS UNDER
THE RESEARCH/TECTONIC & TA/GEOLOGIC
ISSUES PROJECT.

SUBREGIONAL, AND TASK 3 SPECIFICALLY, MAKES
USE OF THESE DATA, DEVELOPS APPROACHES TO
EVALUATE ERRORS/UNCERTAINTIES AND ULTIMATELY
MAKES USE OF THESE DATA IN OTHER TASK
EVALUATIONS.

 9/23/1999

10/4/94

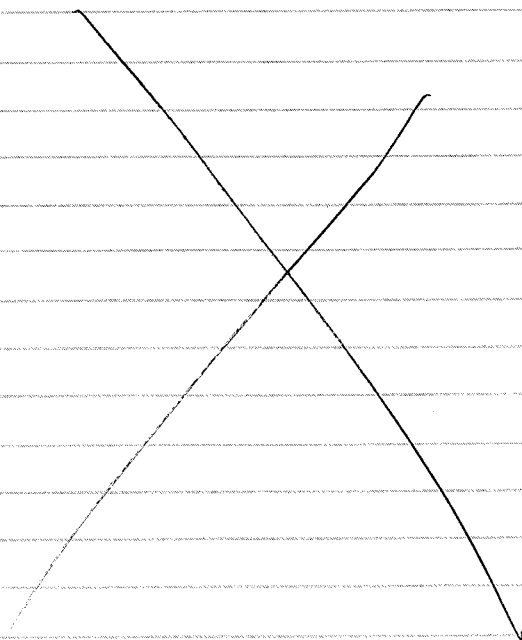
ALL DATA FILES RESIDE ON THE SILICON GRAPHICS STATION
 'PERFORMER' WHERE THE EARTH VISION SOFTWARE IS INVOKED
 FROM FOR ALL VISUALIZATION & ANALYSES.



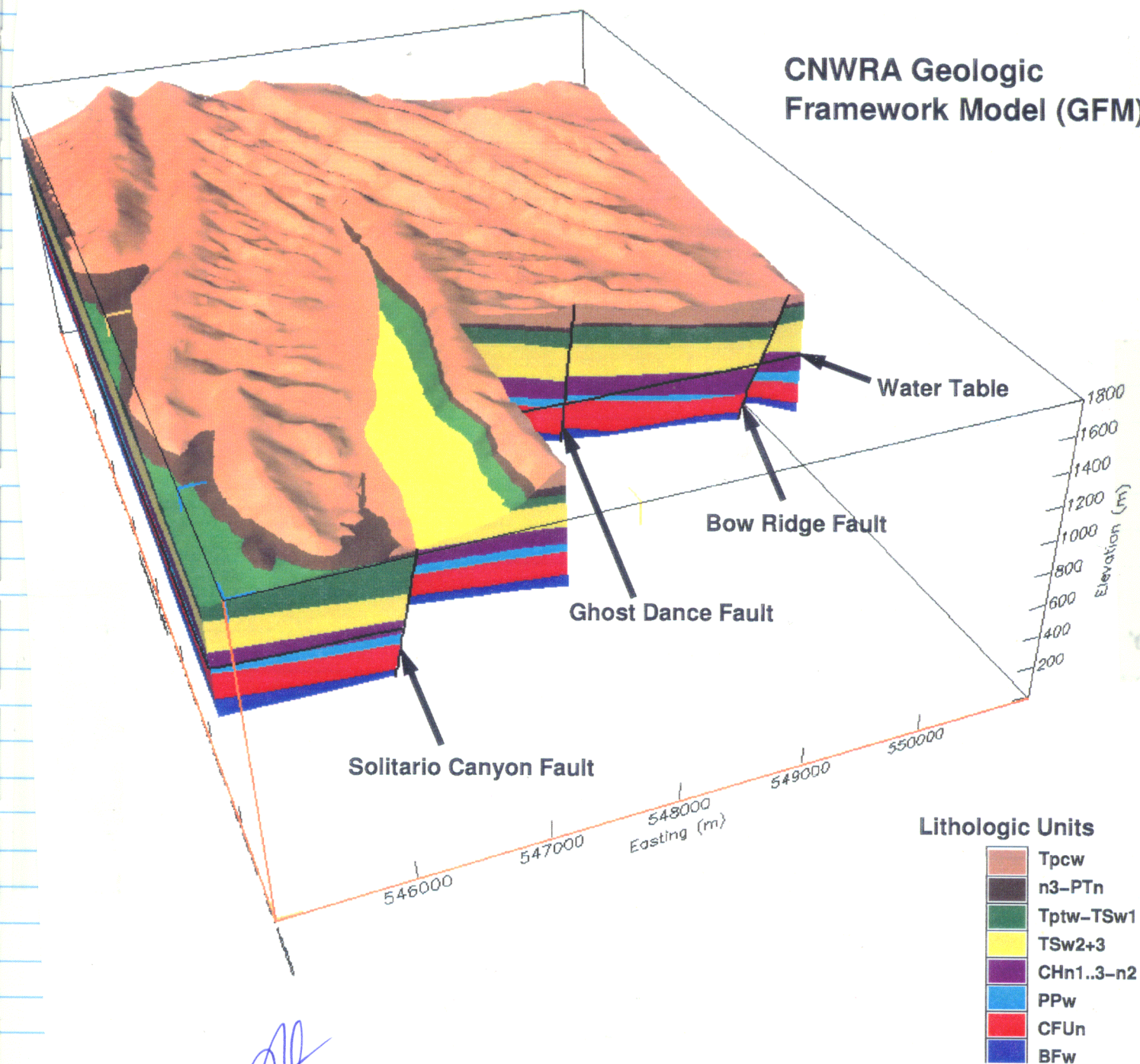
11/13/94

Preliminary version of CNRPA Geologic Framework Model (GFM) after
 the Bfw (Bullfinch) unit has been digitized & taken into account.

Note: vertical exaggeration is 1.5 of preliminary (guess-estimated) water
 table is presented. This may have to be updated in the future.

CNWRA Geologic Framework Model (GFM)



Vertical Exaggeration 1.5

11/29/99

PREMISE : CAN WE CHECK ACCURACY / REALISM OF DEEP
GFM, based on surficial information?



- | | |
|---|------------|
| 9 | tcw |
| 8 | n3ptn |
| 7 | tptwtsw1 |
| 6 | tsw23 |
| 5 | chn1n2 |
| 4 | ppw |
| 3 | cfun |
| 2 | tcbw |
| 1 | below tcbw |

Z exaggeration: 1.0

Obviously, one can compare particular unit outcrops from the model of other type of information (i.e., geologic map) & attempt to infer constraints on the model. The particular geologic map we used is Frazier & Stollers (1990) because it follows the unit classification of Langford that the CWRPA GFM uses.



11/30/99.

Implemented a spread-sheet calculation of a comparison measure called "normalized cross correlation". The way this approach works is that you provide x,y coordinates of the output outline for the model to be tested & what you consider the "ground truth".

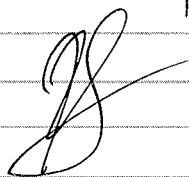
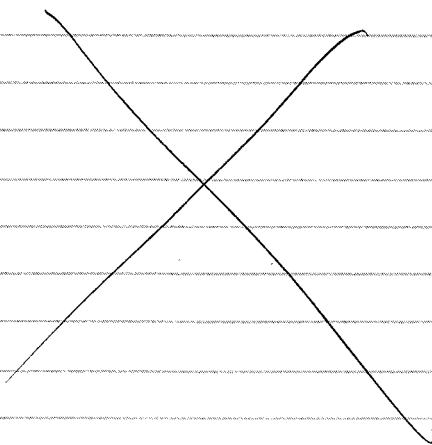
Then the 2 images are moved around while the sum of differences squared (normalized) is recorded. At the point where this difference is minimal you have identified the best position of the two images w/ respect to each other.

By-products are: 1) translational component

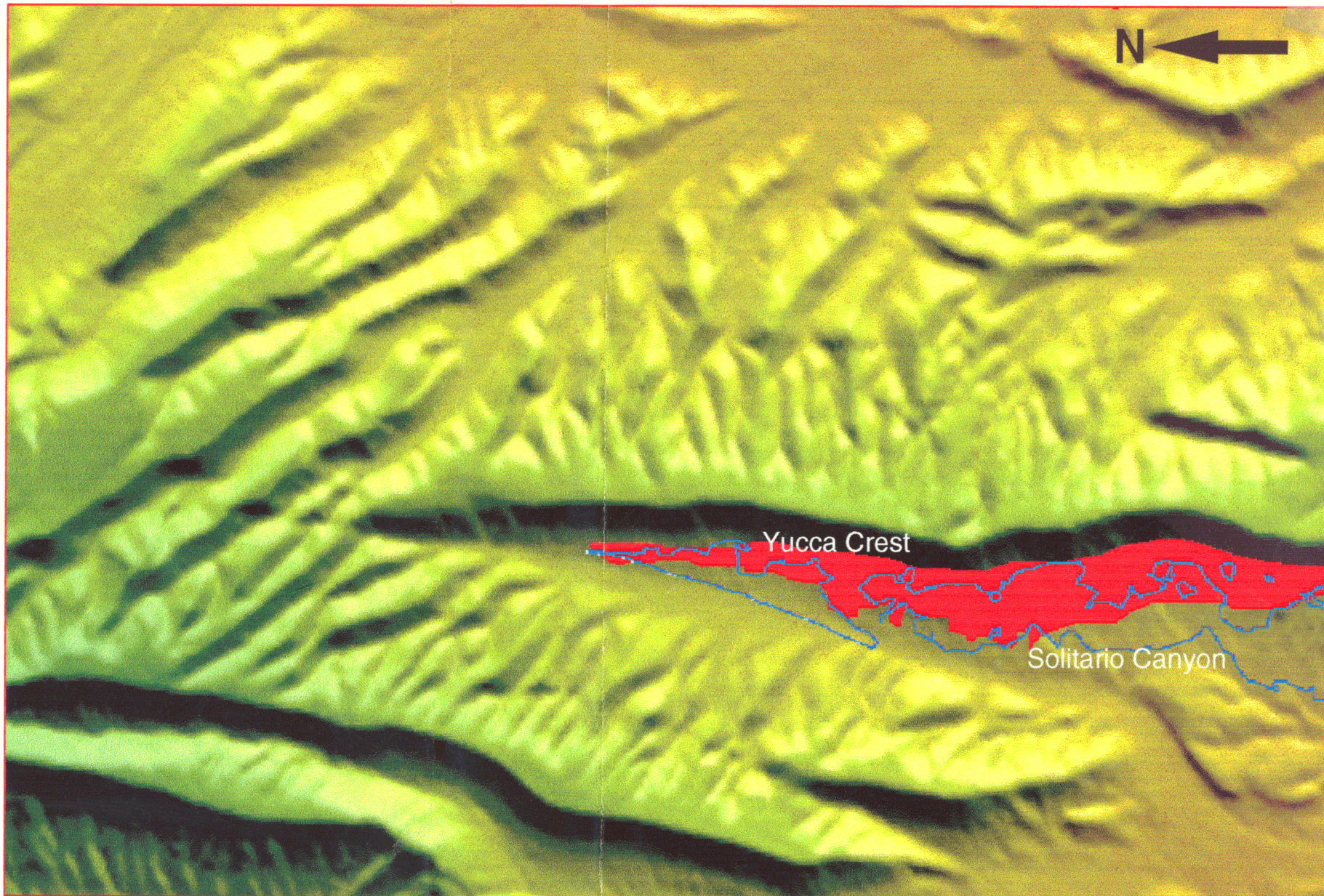
2) ρ (corr.-coefficient), which is =1 only

when the 2 images are identical.

We applied this technique to the outcrop of Topogah Spring which is a deep stream exposed at the Solihua Canyon area.

116d 25' 40"



116d 29' 43"



Topopah Spring unit outcrop from geologic map by Frizzell and Shulters (1990)

Topopah Spring unit outcrop from CNWRA 3D model using EarthVision software

1st - 2nd wk of 12/94.

Obviously the GFM has problems, as evidenced by highly broken patterns. Discussed it w/ Brent, Shu & Gerry directly. Investigating the possibility that some "mess up" has been done by the geologists at the fault unit interfaces.

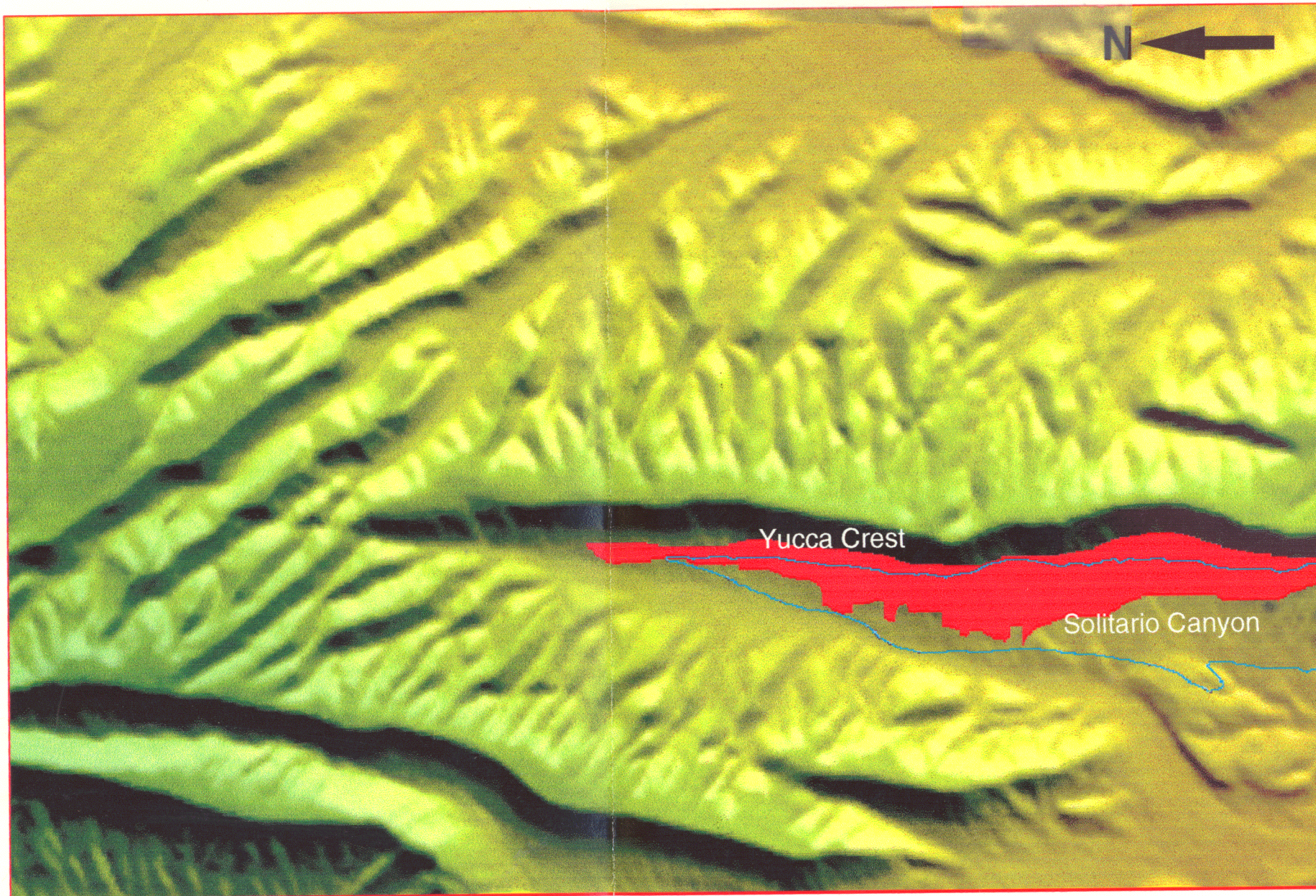
Jo

12/16/94.

EUREKA! Major problem w/ fault identified. Brent is working on updating the GFM w/b. FORCING the unit patterns not to bend around faultlines to be working.

Jo

116d 25' 40"



116d 29' 43"



Topopah Spring unit outcrop from geologic map by Frizzell and Shulters (1990)

Topopah Spring unit outcrop from CNWRA 3D model using EarthVision software

Major
improvement!
compare w/
Pg. 7.
See small
differences
still persist.

JF
early Jan '95
1/5/95

3/1/95.

Applied normalized cross correlation to TSW unit.

Results look encouraging.

Compared 1st iteration of the Gm w/ 2nd.

Results from Normalized Cross Correlation analyses (a value of 1.00 indicates perfect match) are summarized below.

Comparison Between	2	10	20	30	40
Geologic Map/(1 st Model)	0.274	0.310	0.316	0.316	0.316
Geologic Map/(2 nd Model)	0.299	0.427	0.554	0.584	0.585

Clearly the approach is capable of capturing/quantifying the qualitative differences observed through the use of visualization tools. 2nd iteration model is substantially closer to the geologic map. The increase of 0.299 to 0.585 indicates the existence of a translational component; unit must be positioned erroneously by an almost constant distance (13,-17).

JF 3/1/95

3/20/95.

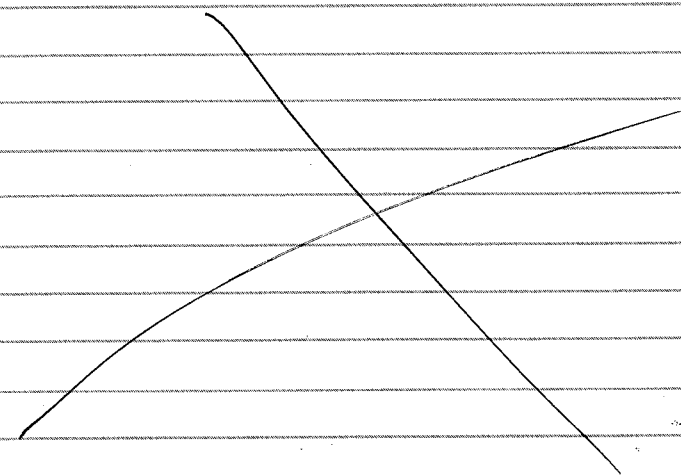
MAJOR ERROR DISCOVERED!! An excellent proof that this approach actually works. The fact that we identified a significant translational component made us suspicious (pg. 1-). How can it be possible to have an error of 17 pixels.

Found out that we were testing TSW 23 (the majority of CAMPAGN's TSW unit) against Fritzel & Shulken (1990) which has all the TSW

unit put together. No wonder we saw that much improvement in

the \int doing our analyses. Will repeat analyses with "full" unit.

JF



3/21/95.

Results from Normalized Cross Correlation analyses (a value of 1.00 indicates perfect match) are summarized below.

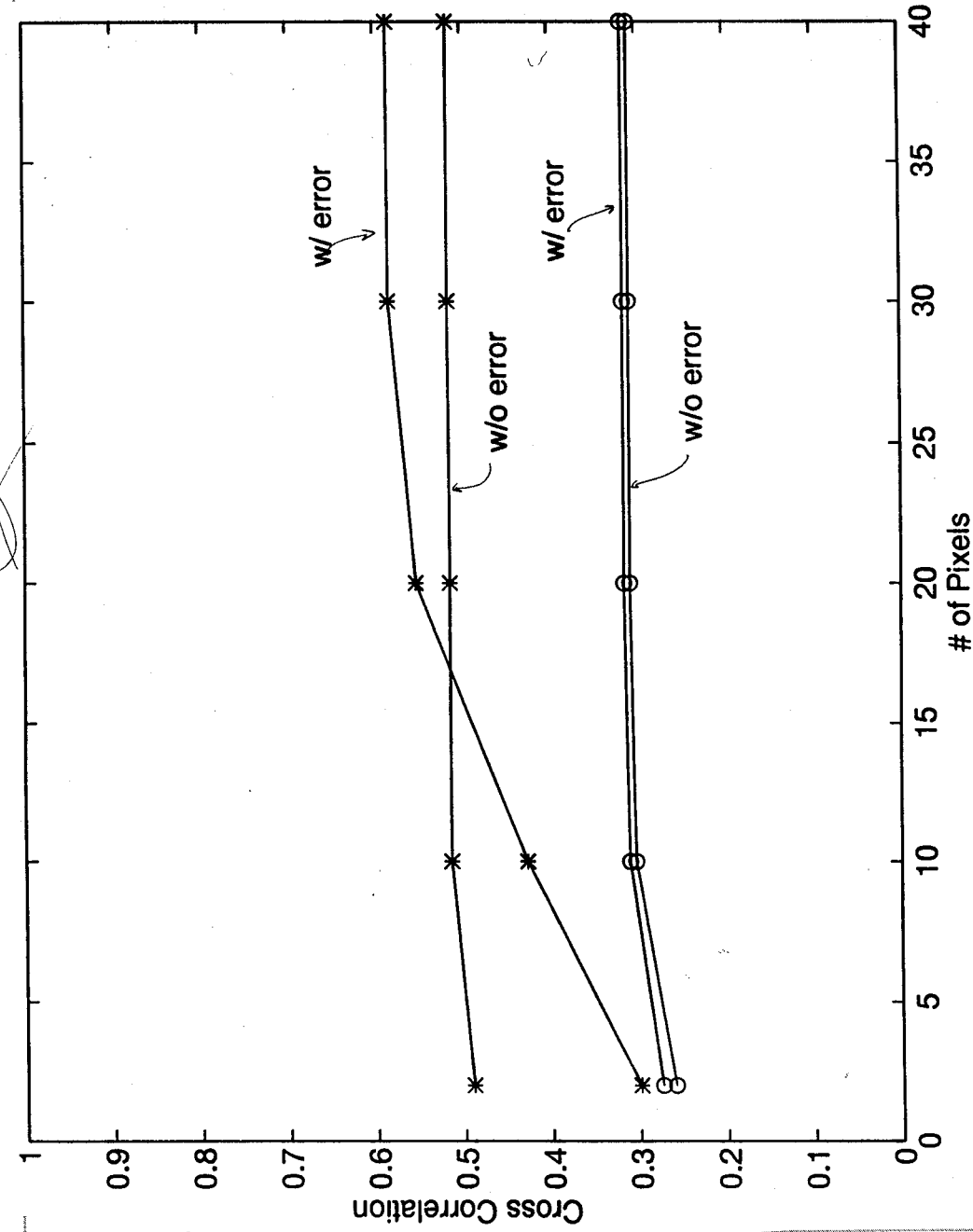
Comparison Between	2	10	20	30	40
Geologic Map/(1 st Model)	0.259	0.303	0.309	0.309	0.309
Geologic Map/(2 nd Model)	0.490	0.514	0.515	0.516	0.516

The moderate increase in cross correlation from 0.490 to 0.516 indicates the existence of a minor translational component. There exists an offset difference between the model and the geologic map equal to 5 and 1 pixels in the east-west and north-south directions, respectively.

Substantial difference in the results. The best that now the model output is bigger, provides less "room for improvement".

Here the $\rho = 0.49 \rightarrow 0.516$. Also, note the decrease in the required translational component, from 1) to 5 pixels.

Summary of results, below is graphical form.



Digitized geological map from Frizzell and Shulters with
topopah spring unit as black: geology_dig_ts.rgb

Nov94 3D model from EarthVision with topopah spring unit
as red: 3dtop_red.rgb

Feb95 3D model from EarthVision with topopah spring unit
as black: rtsw23a.rgb

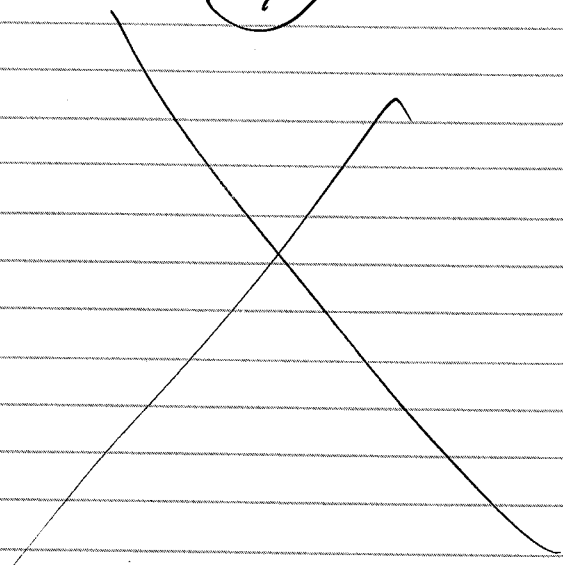
-rw-rw-r-- 1 brent datsys 1067526 Mar 20 15:08 3dtop_red.rgb
-rw-rw-r-- 1 brent datsys 1118762 Mar 20 15:07 geology_dig_ts.rgb
-rw-rw-r-- 1 brent datsys 48410 Mar 20 15:07 rtsw23a.rgb

xsize ysize zsize min max bpp type storage name
497 750 3 0 254 1 NORMAL rle 3dtop_red.rgb
497 750 3 0 255 1 NORMAL verb geology_dig_ts.rgb
497 750 3 0 254 1 NORMAL rle rtsw23a.rgb

-rw-rw-r-- 1 brent datsys 1119032 Mar 21 09:32 3dtop_red.ras
-rw-rw-r-- 1 brent datsys 1119032 Mar 21 09:32 geology_dig_ts.ras
-rw-rw-r-- 1 brent datsys 1119032 Mar 21 09:32 rtsw23a.ras

Location of files used is previously discussed
and explained by Brent.

[Handwritten signature]



Project terminates at end of January 1996,
due to re-organization of CNWRPA

No entries beyond

this point

[Handwritten signature] 3/21/96