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Weston Geophysical CORPORATION

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August 16, 1985
WGC - R531

Dr. Abou-Bakr Ibrahim
Geology - Geophysics Section
Division of Waste Management
US NUCLEAR REGULATORY COMMISSION
Washington, DC 20555

WM-RES
WM Record File
D1003
Weston

WM Project 10,11,16
Docket No.
PDR ✓
LPDR ✓ (B,N,S)

Distribution:
*Ibrahim *Trapp
(Return to WM, 623-SS)

SUBJECT: Task Order 0012
Contract NRC-02-84-001

Dr. Ibrahim:

Weston Geophysical has reviewed documents pertaining to the Palo Duro Basin, attended a data review meeting August 5-8, 1985 in Austin, Texas, and attended a meeting July 26, 1985 in Austin, Texas to review BWIP reflection processing as directed under Task Order 0012. Edward Levine and Glyn Jones attended the July 26th meeting and a trip report was sent to you on August 1, 1985. John Imse and Vincent Murphy reviewed Palo Duro documents and Mr. Imse attended the meetings August 5-8 in Austin, Texas. The enclosed trip report for Mr. Imse, memo from Mr. Imse to John Trapp of USNRC, and the attached document reviews close out activity authorized under Task Order 0012.

If you have any questions or comments regarding this submittal, please call me.

Sincerely,

WESTON GEOPHYSICAL CORPORATION

John P. Imse

JPI:wpt-0067J3
Enclosures

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D-1003 PDR

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TASK 012 - TRIP REPORT

Meetings at Texas Bureau of Economic Geology

Austin, Texas

August 5 - 8, 1985

The scope of these meetings, as defined primarily by DOE, was to examine core from the exploratory boreholes in Palo Duro Basin, to discuss stratigraphic interpretation with Texas Bureau of Economic Geology (TBEG) researchers, and to discuss the status of ongoing studies. In addition, personnel from Stone and Webster, Inc., RE-SPEC, ONWI and DOE presented status reports to NRC and contractors.

At the conclusion of meetings, NRC personnel and contractors gathered to develop notes and comments regarding the meetings and to submit individual memos regarding meeting content. The WGC memo from J. Imse to John Trapp, USNRC is also attached to this trip report.

SUMMARIES OF ACTIVITIES

August 5

Travel to Austin, Texas
Met with NRC personnel and began meetings at TBEG.

Presentation:

1. John Peck - SWEC
   Presented a very broad overview of SWEC program in Palo Duro. During question/answer period Roy Budnik (TBEG) stated that NW-trending highs south of Amarillo uplift and in site vicinity are an echelon fault blocks associated with the uplift.

2. Phil Murphy - SWEC
   Presented status of structural studies in region. He presented slides of structure confour maps showing faults in the Deaf Smith site area which were not shown in DEA for site. The slides are from a report Boyd and Murphy [1984] which has been undergoing ONWI/DOE review since fall of 1984. Stated that much of evidence was based on seismic reflection data. When questioned he stated that they feel seismic reflection data suitable to identify faults with greater than 100 feet of offset. Data is going to be reprocessed to enhance resolution.

3. Steve Ruppel - TBEG
   Presented overview of stratigraphic studies.

4. Dow Davidson - TBEG
   Described storage and analytical capabilities of TBEG core library.

5. Sue Hovorka - TBEG
   Presented introduction to her research concerning the San Andres units in the Palo Duro.

August 6

1. Sue Hovorka - TBEG
   Detailed discussion of the petrographic and stratigraphic studies she is conducting. Hovorka gave details of textural and sedimentary structural analyses which have led her to the theory of deposition in a shallow shelf environment versus a shelf environment.

2. Charles Kreitler - TBEG
   Presented overview of studies on dissolution of evaporites.
3. Sue Hovorka - TBEG
   Presented short discussion of the interior dissolution of evaporites above the Sea Andres Formation.

4. Tom Lamb - SWEC
   Lamb described the work SWEC is doing to correlate the stratigraphic research of TBEC, with geophysical logs and the development of geotechnical logs for the boreholes.

5. Paul Senseny - RE-SPEC
   Brief discussion of rock mechanics testing for SWEC.

6. Afternoon spent examining core from Grabbe and J. Friemel wells.

August 7

1. Morning spent examining core from Zeeck and Mansfield wells.

2. Jo Ann Sherwin - DOE
   Sherwin presented organization chart for project and tried to explain the interaction of the multiple workers.

3. Ev Washter, Phil Murphy, Tom Lamb - SWEC
   Status reports.

4. Tom Gustausen and Charles Kreitler - TBEG
   Status report.

August 8

1. Morning spent working with NRC personnel and contractors developing general meeting notes and submitting individual memos on meetings.

2. Afternoon - travel to Boston.

9/8/85 ①

TO: [illegible] FROM: [illegible]

[illegible] GEOPHYSICAL

COMMENTS, CONCERNS, OBSERVATIONS

TBEG VISIT AUG 5-8, 1985

GENERAL

1. THE WORK CONDUCTED BY INDIVIDUAL TBEG RESEARCHERS IS HIGH QUALITY AND VERY DETAILED. THERE IS REASON FOR GREAT DEAL OF OPTIMISM REGARDING WORK CONDUCTED BY TBEG. THE ONLY CONCERN IS THAT THERE IS NOT AN OVERALL INTEGRATION OF THE TBEG STUDIES BEING CONDUCTED FOR DOE. STRATIGRAPHIC, STRUCTURAL & HYDROGEOLOGIC STUDIES HAVE NOT BEEN COMBINED ~~TO AT~~ AND SYNTHESIZED TO ADDRESS THE ISSUES SURROUNDING THE SITING OF A REPOSITORY.

2. IT IS VERY UNCLEAR HOW TBEG WORK IS BEING USED, WILL BE USED OR HAS BEEN USED BY ONWI/SWEC. SINCE THE ONWI/SWEC DOCUMENTS ARE EVENTUALLY GOING TO BE THE LICENSING DOCUMENTS, IT IS CRITICAL TO SEE THEIR WORK AND TO KNOW WHETHER THE ONWI/SWEC WORK IS ORIGINAL OR AN EDITED VERSION OF TBEG RESEARCH.

SPECIFIC

a) IN PRESENTATION MADE BY PHIL MURPHY OF SWEC, THE STATEMENT WAS MADE THAT A FAULT OF ≤100' OFFSET COULD BE MISSED BY PRESENT SEISMIC REFLECTION DATA. REPROCESSING OF DATA IS IN THE WORKS. HE ALSO STATED THAT FOR A PARTICULAR FAULT IN SITE AREA, A ~~NEW~~ RECENT WELL WAS

CRITICAL IN LOCATING THAT FAULT.

ALL OF THIS IS SLIGHTLY DISCONCERTING SINCE BUDNIK, WITH THE BENEFIT OF THE SAME DATA, MINUS THE NEW WELL, HAD MAPPED FAULTS IN THE DEAF SMITH AREA PREVIOUSLY. IT IS UNCERTAIN WHETHER SWEC/ONWI ARE USING TBEG WORK, AND IF NOT, WHY NOT. IT IS ALSO IMPORTANT TO NOTE THAT SEVERE LIMITATIONS OF SEISMIC REFLECTION DATA WERE NOT RECOGNIZED PRIOR TO RECENT WELL AND/OR BUDNIK WORK.

b) SUE HAUERKA IS USING EVERY DETAIL OF DATA AVAILABLE TO INTERPRET SED. HISTORY OF EVAPORITES – EXCEPT STRUCTURE. INTERNAL STRUCTURE OF BASIN AND POSSIBLE ENHANCEMENT OF DISSOLUTION ALONG FAULTS NOT INCORPORATED INTO HER WORK. DATA POINTS SHE IS USING FOR ASSESSING DEPOSITIONAL SYSTEM MAY BE DUE TO STRUCTURE, NOT A PERTURBATION IN SEDIMENTATION.

c) TOM BUDNIK MADE BRIEF STATEMENT THAT NW TRENDING HIGHS & LOWS PREVALENT IN STRUCTURE CONTOUR MAPS ARE RELATED TO NW TRENDING EN ECHELON BASEMENT BLOCKS – SOME OF WHICH ARE VERY NEAR DEAF SMITH SITE. THIS IS CRITICAL TO UNDERSTANDING THE SITE, YET NO ONWI/SWEC REPORT PRESENTS THESE DATA.

d) MICRO SEISMIC NETWORK PRESCRIBED BY SWEC IS CONCENTRATED WITHIN BASIN & SITE VICINITY. THIS WILL NOT PROVIDE ACCURATE AND DETAILED SENSING OF STRUCTURES MARGINAL TO BASIN.

INTEGRATION OF GEOSCIENCE DATA BASE

IT IS UNCLEAR HOW TBEG WORK IS BEING USED, WILL BE USED, OR HAS BEEN USED BY ONWI/SWEC. AT PRESENT, THERE IS NOT AN INTEGRATING DOCUMENT FROM TBEG OR ONWI/SWEC WHICH SYNTHESIZES THE STRATIGRAPHIC, STRUCTURAL AND HYDROGEOLOGICAL RESEARCH CONDUCTED BY TBEG. RESULTS OF RESEARCH CONDUCTED BY TBEG AND PRESENTED AT THIS MEETING WERE SIGNIFICANTLY DIFFERENT FROM DATA PRESENTED IN THE DEA DOCUMENTS FOR THIS AREA. SINCE ONWI/SWEC DOCUMENTS ARE EVENTUALLY GOING TO BE LICENSING DOCUMENTS, IT IS CRITICAL TO SEE THIS SYNTHESIS AND TO KNOW HOW MUCH TBEG DATA HAVE BEEN USED, HOW MUCH TBEG INTERPRETATION HAS BEEN USED, AND IF TBEG INTERPRETATIONS ARE NOT USED, WHY NOT.

AREAS OF CONCERN BASED ON THIS COMMENT INCLUDE:

1. STRUCTURE IN SITE AREA BASED ON DRILLING, ~~AND~~ SEISMIC REFLECTION DATA, AND FRACTURE/JOINT STUDIES.
2. STRATIGRAPHY AND SEDIMENTATION STUDIES RELATED TO PREDICTABILITY OF CORRELATIONS.
3. INTERIOR DISSOLUTION EVIDENCED BY VARIATIONS IN THICKNESS AND STRATIGRAPHY OF DOCKUM & OGALLA AND HOW THIS MAY OR MAY NOT BE STRUCTURALLY CONTROLLED.
4. DISSOLUTION WITHIN THE PERMIAN SECTION WHICH MAY OR MAY NOT BE ~~REA~~ SYNCHRONOUS WITH DEPOSITION, EG. CLEAR HALITE AT TOP OF UNIT 4 SALT IN ZEECK WELL.
5. THE BLACKWATER DRAW FORMATION WHICH WAS NOT MENTIONED IN EA DOCUMENTS YET ~~COMPRISES A~~ IS OF A SIGNIFICANT THICKNESS IN SITE

AREA TO AFFECT FROM ENGINEERING STUDIES AND TO PROVIDE A UNIT FOR DATING AGE OF FAULTING, DISSOLUTION, ETC.

REVIEW COMMENTS

REFERENCE: Budnik, R.T., 1984, Structural geology and tectonic history of the Palo Duro Basin, Texas Panhandle: Texas Bur. Econ. Geol., Austin, TX for U.S.D.O.E, Office of Nuclear Waste Isolation, OF-WTWI-1984-55.

REVIEWER: J. Imse, Weston Geophysical Corporation

MAJOR COMMENTS:

The author develops a tectonic history for this region characterized by intermittent, yet persistent, structural deformation along the same structural trends from the late Precammbrian through the late Cenozoic. Most, if not all, structural relief mapped in the basin is shown to be fault controlled, where sufficient data are available to the author. Faults at the margin of the basin are shown to extend to the surface and affect surface units. Seismicity is interpreted to be associated with bounding structures along the northern margin of the basin. Due to the prevalence of a long history of rejuvenation, the apparently ubiquitous presence of faults in areas of basement relief, and the recent seismicity in the vicinity of the basin make it imperative to analyze the apparent "highs" in the vicinity of the Deaf Smith site to evaluate the possibility of faults extending up through the repository formation.

Particular attention should be given to the number of faults described in this report which extend through the San Andres, and the many which appear to offset surficial units. This has particular significance in the site area regarding seismicity, continuity of repository horizon and potential for dissolution resulting from water flow along fault zones.

DETAILED COMMENTS

1. p.7, Para. 1

The northern margin of the basin is now termed the Oldham-Harmon trend. Is this trend closer to the site such that if seismicity associated with the Amarillo Uplift could be linked to this trend, the seismic ddesign for this site would be significantly different from that expressed in the DEA? The en echelon nature of the Oldham-Harmon trend is compatible with dextral strike-slip motion. How might that affect seismic design criteria and interpretation of compatible NW-SE trends through the Deaf Smith site area.

2. p. 7, Para. 3

Figure 12 is not included. This is supposed to be a structural contour map of the region, without which, a complete and thorough review is not possible.

3. p. 11, Para. top

The Wittenburg Trough is described as consisting of "two smaller, trapezoid-shaped subbasins". This geometry is compatible with strike-slip movement. What is the significance of large-scale strike-slip deformation in the vicinity of the site?

4. p. 16, Para. 2

Juxtaposition of the Ogallala and lower Cretaceous strata, as described in text, is not shown on referenced figure.

5. p. 17, Para. 2

Based on the maps available to the viewer, Deaf Smith county does not appear to have a comparable distribution of wells as the other counties noted. Therefore, structural analysis in Deaf Smith county should not be considered as complete. Individual structures, of the scale mapped nearby, may be present and undocumented.

6. p. 19, Para. 3

Where sufficient data are available, the structural margin is fault-controlled. Therefore, it is not unreasonable to interpret the opposite margin of this structure, with "limited control", to be fault-controlled.

7. p. 22, Para. 3

Are these "monocline" in the San Andres fault controlled, similar to a majority of structures in the area?

8. p. 23, Para. 4

"... structural highs... are generally small, isolated, fault bounded..." Based on this interpretation, is the basement relief in the vicinity of the site fault-controlled?

9. p. 23, Para. 4

The author states that post-Pennsylvanian strata exhibit a subtle influence of structures, yet the following sentence states that there has been "significant post-Permian deformation". Are these conflicting statements or is a differentiation being made where there is subtle influence of paleo-structures and significant deformation by "new" post-Permian structures?

10. Figure 11

A thickening of the arkosic clastics in the area of the Deaf Smith site is similar in magnitude to nearby fault-bounded basins. Might this also be fault-bounded?

11. Figure 14

The figure does not reflect the statement in the text [p. 9] that the Potter County fault intersects the surface.

REVIEW COMMENTS

REFERENCE: Hovorka, S.D., Luneau, B.A., Thomas, S., 1985, Stratigraphy of bedded halite in the Permian San Andres Formation, Units 4 and 5, Palo Duro Basin, Texas: Texas Bur. Econ. Geology, OF-WTWI-1985-9.

REVIEWER: John Imse, Weston Geophysical Corporation

GENERAL COMMENTS

The authors have presented a very thorough and detailed analysis of the textural properties of these salt units and have derived a genetic model for the units. Their interpretation is that the bedded salts were deposited in a areally extensive, shallow, shelf environment as opposed to supratidal sabkha environments. Using this model and subsequent detailed log correlations, they have mapped continuous units over thousands of square miles. If this interpretation is substantiated, and stands the test of further drilling, this model greatly enhances the ability to predict the presence and general character of the halite beds over long distances.

DETAILED COMMENTS

1. p. 13, Para. 0

The authors compare pits in the San Andres core to channel-form features mapped at the WIPP site. If there are channel-form in the San Andres, two questions arise. First, might these channel-form features result from short-lived streams traversing the exposed halite? Second, might these be evidence for sabkha-like environments which are a subset of the shelf environment?

2. p. 13, Para. 1

The age of development for the vertical fractures with mudstone and carbonate beds is important. If the fractures are syndipositional, they are important to evaluating any Permina dissolution of the salt. If the fractures are much younger, they become important in evaluating structural history of the site and mechanical properties of the salt.

3. p. 29, Para. 2

Is it possible that the disturbed intraclastic fabrics are due to tidal effects associated with sabkha environment as well as haloturbation?

4. p. 31, Para. 2

See comment 2.

5. p. 33, Para. 0

See comment 2.

REVIEW COMMENTS

REFERENCE: Fracasso, M.A. and Hovoka, S.D., 1985, Cyclicity in the Middle Permian San Andres Formation, Palo Duro Basin, Texas Panhandle: Texas Bur. Econ. Geology, OF-WTWI-1984-21, Rev. 1.

REVIEWER: John Imse, Weston Geophysical Corporation

GENERAL COMMENTS:

The cyclicity demonstrated by the authors has important implications to repository siting in the Palo Duro. Determining the presence of a correlatable and predictable sequence enables greater confidence in predicting what units and how much of those units may be found at repository depths in the site area. Although due to the heterogenous nature of the lost units, a determination is necessary regarding how much non-salt material is acceptable for repository siting. As stated in the review of Havorka, et al., [1985], the resolution of shallow shelf environment versus sabkhe type depositional environment is necessary to fully assess this heterogeneity.

REVIEW COMMENTS

REFERENCE: Collins, E.W., 1984, Jointing history of the Palo Duro Basin: Texas Bureau Econ. Geology, OF-WTWI-1984-20.

REVIEWER: John Imse, Weston Geophysical Corporation

GENERAL COMMENTS:

Data in this study are important to several aspects of repository siting including seismiciity, hydrogeology and site structure. Joints have been mapped systematically over the interior and margins of the basin. Three major sites of joints trendig NW, E-W, and NNE are compatible with known structural features in the area including faults and folds. Joint trends are similar to basement faulting as well as possible post-ogallall faulting near Alamosa Creek Fault. The joint studies are going to be very important in assessing the ages of movement on structures near the site, which will also influence conclusions regarding seismicity of the area. Finally, the author has documented areas where dissolution appears to be localized along joints. This is significant to an assessmet of interior dissolution as it may affect the site, as well as radio-nuclide migration along joint trends in the event of a release.

REVIEW COMMENTS

REFERENCE: Budnik, R.T., Active stress field in the Texas Panhandle: Texas Bureau of Geol., Austin, TX, OF-WTWI-1984-4.

REVIEWER: John Imse, Weston Geophysical Corporation

General Comments:

This is a brief summary report stating that the Palo Duro is transitional to two areas defined by previous workers. Results of hydrofracture testing in a DOE well indicated a NE-SW principal stress direction, similar to the Midcontinent Province of Zobuck and Zolack (1980). It should be noted that this orientation is compatible with failure of NW trending reverse and west and northwest trending strikeslip movement, which are typical in the Amarillo uplift marginal to the Palo Duro and near the Deaf Smith site.

REVIEW COMMENTS

REFERENCE: Pennington, W.D. and Davis, S.D., 1984, Historic seismicity in and around the Texas Panhandle: Texas Bureau Econ. Geology, Austin, Texas, DF-WTWI-1984-14.

REVIEWER: John Imse, Weston Geophysical Corporation

General Comments:

The importance of this study is in guiding future work in the area simply because the present historical record is sparse, with a probable high threshold of detection greater than M=3.0. The historical seismicity does show a correspondence to the Amarillo Uplift. Activity seems to have areas of concentration although these may be artifical due to patterns of settlement in the Panhandle. In general, these historical data emphasize that studies of seismicity for the Palo Duro should be sufficiently extensive to monitor margins of the basin and should be maintained with a low detection threshold. Structures at the site will require engineering to accommodate predicted goundmotions, but microearthquake data could be very useful for mapping structure in the site area.

REVIEW COMMENTS

REFERENCE: McGookey, D.A., 1984, Uplift, tilting, and subsidence of the Palo Duro Basin area: Texas Bureau Econ. Geology, Austin, TX, OF-WT-WI-1984-2.

REVIEWER: John Imse, Weston Geophysical Corporation

GENERAL COMMENTS:

This analysis contains significant data which substantiate theories of structural rejuvenation, changing structual styles and scales of influence, as well as indications of relatively young movement along old faults. Isopach analyses provide evidence for recurrent movement along individual structual trends. Therefore, it is reasonable to assume that where there is evidence for basement structures, one should also expect similar structures within overlying sedimentary sequence. Data presented regarding thickness trends in the Ogallala formation indicate possible post-Ogallala deformation along some of these ancient basement trends.

D1003
PDR

Weston Geophysical
CORPORATION

August 16, 1985
WGC - R531

Dr. Abou-Bakr Ibrahim
Geology - Geophysics Section
Division of Waste Management
US NUCLEAR REGULATORY COMMISSION
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REVIEWER: J. Imse, Weston Geophysical Corporation

MAJOR COMMENTS:

The author develops a tectonic history for this region characterized by intermittent, yet persistent, structural deformation along the same structural trends from the late Precammbrian through the late Cenozoic. Most, if not all, structural relief mapped in the basin is shown to be fault controlled, where sufficient data are available to the author. Faults at the margin of the basin are shown to extend to the surface and affect surface units. Seismicity is interpreted to be associated with bounding structures along the northern margin of the basin. Due to the prevalence of a long history of rejuvenation, the apparently ubiquitous presence of faults in areas of basement relief, and the recent seismicity in the vicinity of the basin make it imperative to analyze the apparent "highs" in the vicinity of the Deaf Smith site to evaluate the possibility of faults extending up through the repository formation.

Particular attention should be given to the number of faults described in this report which extend through the San Andres, and the many which appear to offset surficial units. This has particular significance in the site area regarding seismicity, continuity of repository horizon and potential for dissolution resulting from water flow along fault zones.

DETAILED COMMENTS

1. p.7, Para. 1

The northern margin of the basin is now termed the Oldham-Harmon trend. Is this trend closer to the site such that if seismicity associated with the Amarillo Uplift could be linked to this trend, the seismic ddesign for this site would be significantly different from that expressed in the DEA? The en echelon nature of the Oldham-Harmon trend is compatible with dextral strike-slip motion. How might that affect seismic design criteria and interpretation of compatible NW-SE trends through the Deaf Smith site area.

2. p. 7, Para. 3

Figure 12 is not included. This is supposed to be a structural contour map of the region, without which, a complete and thorough review is not possible.

3. p. 11, Para. top

The Wittenburg Trough is described as consisting of "two smaller, trapezoid-shaped subbasins". This geometry is compatible with strike-slip movement. What is the significance of large-scale strike-slip deformation in the vicinity of the site?

4. p. 16, Para. 2

Juxtaposition of the Ogallala and lower Cretaceous strata, as described in text, is not shown on referenced figure.

5. p. 17, Para. 2

Based on the maps available to the viewer, Deaf Smith county does not appear to have a comparable distribution of wells as the other counties noted. Therefore, structural analysis in Deaf Smith county should not be considered as complete. Individual structures, of the scale mapped nearby, may be present and undocumented.

6. p. 19, Para. 3

Where sufficient data are available, the structural margin is fault-controlled. Therefore, it is not unreasonable to interpret the opposite margin of this structure, with "limited control", to be fault-controlled.

7. p. 22, Para. 3

Are these "monocline" in the San Andres fault controlled, similar to a majority of structures in the area?

8. p. 23, Para. 4

"... structural highs... are generally small, isolated, fault bounded..." Based on this interpretation, is the basement relief in the vicinity of the site fault-controlled?

9. p. 23, Para. 4

The author states that post-Pennsylvanian strata exhibit a subtle influence of structures, yet the following sentence states that there has been "significant post-Permian deformation". Are these conflicting statements or is a differentiation being made where there is subtle influence of paleo-structures and significant deformation by "new" post-Permian structures?

10. Figure 11

A thickening of the arkosic clastics in the area of the Deaf Smith site is similar in magnitude to nearby fault-bounded basins. Might this also be fault-bounded?

11. Figure 14

The figure does not reflect the statement in the text [p. 9] that the Potter County fault intersects the surface.

REVIEW COMMENTS

REFERENCE: Hovorka, S.D., Luneau, B.A., Thomas, S., 1985, Stratigraphy of bedded halite in the Permian San Andres Formation, Units 4 and 5, Palo Duro Basin, Texas: Texas Bur. Econ. Geology, OF-WTWI-1985-9.

REVIEWER: John Imse, Weston Geophysical Corporation

GENERAL COMMENTS

The authors have presented a very thorough and detailed analysis of the textural properties of these salt units and have derived a genetic model for the units. Their interpretation is that the bedded salts were deposited in a areally extensive, shallow, shelf environment as opposed to supratidal sabkha environments. Using this model and subsequent detailed log correlations, they have mapped continuous units over thousands of square miles. If this interpretation is substantiated, and stands the test of further drilling, this model greatly enhances the ability to predict the presence and general character of the halite beds over long distances.

DETAILED COMMENTS

1. p. 13, Para. 0

The authors compare pits in the San Andres core to channel-form features mapped at the WIPP site. If there are channel-form in the San Andres, two questions arise. First, might these channel-form features result from short-lived streams traversing the exposed halite? Second, might these be evidence for sabkha-like environments which are a subset of the shelf environment?

2. p. 13, Para. 1

The age of development for the vertical fractures with mudstone and carbonate beds is important. If the fractures are syndipositional, they are important to evaluating any Permina dissolution of the salt. If the fractures are much younger, they become important in evaluating structural history of the site and mechanical properties of the salt.

3. p. 29, Para. 2

Is it possible that the disturbed intraclastic fabrics are due to tidal effects associated with sabkha environment as well as haloturbation?

4. p. 31, Para. 2

See comment 2.

5. p. 33, Para. 0

See comment 2.

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REVIEW COMMENTS

REFERENCE: Fracasso, M.A. and Hovoka, S.D., 1985, Cyclicity in the Middle Permian San Andres Formation, Palo Duro Basin, Texas Panhandle: Texas Bur. Econ. Geology, OF-WTWI-1984-21, Rev. 1.

REVIEWER: John Imse, Weston Geophysical Corporation

GENERAL COMMENTS:

The cyclicity demonstrated by the authors has important implications to repository siting in the Palo Duro. Determining the presence of a correlatable and predictable sequence enables greater confidence in predicting what units and how much of those units may be found at repository depths in the site area. Although due to the heterogenous nature of the lost units, a determination is necessary regarding how much non-salt material is acceptable for repository siting. As stated in the review of Havorka, et al., [1985], the resolution of shallow shelf environment versus sabkhe type depositional environment is necessary to fully assess this heterogeneity.

REVIEW COMMENTS

REFERENCE: Collins, E.W., 1984, Jointing history of the Palo Duro Basin: Texas Bureau Econ. Geology, OF-WTWI-1984-20.

REVIEWER: John Imse, Weston Geophysical Corporation

GENERAL COMMENTS:

Data in this study are important to several aspects of repository siting including seismiciity, hydrogeology and site structure. Joints have been mapped systematically over the interior and margins of the basin. Three major sites of joints trendig NW, E-W, and NNE are compatible with known structural features in the area including faults and folds. Joint trends are similar to basement faulting as well as possible post-ogallall faulting near Alamosa Creek Fault. The joint studies are going to be very important in assessing the ages of movement on structures near the site, which will also influence conclusions regarding seismicity of the area. Finally, the author has documented areas where dissolution appears to be localized along joints. This is significant to an assessmet of interior dissolution as it may affect the site, as well as radio-nuclide migration along joint trends in the event of a release.

REVIEW COMMENTS

REFERENCE: Budnik, R.T., Active stress field in the Texas Panhandle: Texas Bureau of Geol., Austin, TX, OF-WTWI-1984-4.

REVIEWER: John Imse, Weston Geophysical Corporation

General Comments:

This is a brief summary report stating that the Palo Duro is transitional to two areas defined by previous workers. Results of hydrofracture testing in a DOE well indicated a NE-SW principal stress direction, similar to the Midcontinent Province of Zobuck and Zolack (1980). It should be noted that this orientation is compatible with failure of NW trending reverse and west and northwest trending strikeslip movement, which are typical in the Amarillo uplift marginal to the Palo Duro and near the Deaf Smith site.

REVIEW COMMENTS

REFERENCE: Pennington, W.D. and Davis, S.D., 1984, Historic seismicity in and around the Texas Panhandle: Texas Bureau Econ. Geology, Austin, Texas, DF-WTWI-1984-14.

REVIEWER: John Imse, Weston Geophysical Corporation

General Comments:

The importance of this study is in guiding future work in the area simply because the present historical record is sparse, with a probable high threshold of detection greater than M=3.0. The historical seismicity does show a correspondence to the Amarillo Uplift. Activity seems to have areas of concentration although these may be artifical due to patterns of settlement in the Panhandle. In general, these historical data emphasize that studies of seismicity for the Palo Duro should be sufficiently extensive to monitor margins of the basin and should be maintained with a low detection threshold. Structures at the site will require engineering to accommodate predicted goundmotions, but microearthquake data could be very useful for mapping structure in the site area.

REVIEW COMMENTS

REFERENCE: McGookey, D.A., 1984, Uplift, tilting, and subsidence of the Palo Duro Basin area: Texas Bureau Econ. Geology, Austin, TX, OF-WT-WI-1984-2.

REVIEWER: John Imse, Weston Geophysical Corporation

GENERAL COMMENTS:

This analysis contains significant data which substantiate theories of structural rejuvenation, changing structual styles and scales of influence, as well as indications of relatively young movement along old faults. Isopach analyses provide evidence for recurrent movement along individual structual trends. Therefore, it is reasonable to assume that where there is evidence for basement structures, one should also expect similar structures within overlying sedimentary sequence. Data presented regarding thickness trends in the Ogallala formation indicate possible post-Ogallala deformation along some of these ancient basement trends.

8/13/85

WM Record File DN1003 HL

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LPDR ✓

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23

MEMORANDUM FOR: File

FROM: Contract Administrator

SUBJECT: ISSUANCE OF A PARTIAL STOP WORK ORDER, CONTRACT NO. NRC-02-84-001, TASK ORDER NO. 0011, WITH WESTON GEOPHYSICAL CORPORATION

Subject action is recommended as a result of (1) a review of the July 29, 1985 memorandum form Dr. Ibrahim to me, and (2) my telephone discussions on August 1-2, 1985 with R. Avery of ELD, Dr. Ibrahim and P. Justis of NMSS, and V. Murphy of Weston.

Dr. Ibrahim's memorandum with attachments provides information from Weston concerning potential conflicts of interest. There are two separate issues as follows:

1. Weston, under contract to Washington Public Power Supply System (WPPSS), previously had a subcontractor perform aeromagnetic surveying of the Hanford area. Weston then made magnetic tapes of the data under the WPPSS contract and retained a copy of the tapes. Rockwell, who is working for DOE, recently requested tape copies from WPPSS. WPPSS then authorized Weston to reproduce and provide to Rockwell a copy of the tapes. Rockwell issued a purchase order to Weston for $900 to provide for the cost of the tapes. There exists a potential for conflict of interest if Weston were requested to review the data they provided to WPPSS and Rockwell. However, to date, Weston has not been required to review this data. To avoid potential conflict of interest, the NRC shall not issue task orders which involve review of this data.

2. Concerning the second potential conflict of interest, in 1982, Rockwell provided Weston with refraction data and seismic recordings of the Hanford area. Weston, under contract to Rockwell, then performed a mathematical compilation resulting in numerical listing tables which were incorporated into a report entitled "Interpretation of Seismic Refraction Data, Hanford Site, Prepared for Rockwell International, Rockwell Hanford Operations, September 1982." Rockwell, who is working for DOE, has recently submitted seismic reflection data from Hanford. NRC, as a part of Task Order 11, required Weston to evaluate and interpret seismic reflection data concerning Hanford. Weston sent a copy of the 1982 report to the Project Officer after issuance of Task Order 11. The Project Officer advised me that he did not believe that Weston had a conflict of interest in performing Task Order 11, however, he sent me his memorandum just to be sure. I discussed the situation with the contractor's V. Murphy who advised me as follows:

   (a) Seventy-five percent of the area under consideration for review in Task Order No. 11 was not involved in the work performed by Weston. Therefore, all the line drawings, except for approximately 20-25%, could definitely be completed without any consideration of Weston's previous work.

(b) Concerning the area where Weston performed the work, they are not sure if their data was used at all in the Rockwell reflection information provided. Only a further review of the Rockwell information will enable them to determine this. Therefore, they believe it is possible that all or a sizeable portion of the area they previously worked on could be evaluated by them without a potential conflict of interest.

(c) Weston desires to provide detailed information showing why a potential conflict of interest does not exist and/or how, through elimination of only an extremely small portion of the work (approximately 1%), Weston could complete the task.

(d) Weston would have no difficulty in stopping work on the part of the task order effort involving their previous work while continuing with the rest of the task order.

I discussed the contractor's interpretation with Dr. Ibrahim's Section Leader, P. Justis (Dr. Ibrahim was not available), who advised that he agreed with the contractor's statements and had no objection to the Division of Contracts issuing a prompt partial stop work order to Weston, for only analysis of the data they had previously worked on.

I discussed the situation with R. Avery who advised that issuance of a partial stop work order for Task Order 11 appeared to be reasonable. He verbally concurred with the proposed stop work order which I read to him verbatim.

Prompt issuance of the stop work order is required as completion of Task Order No. 11 is scheduled for August 17, 1985.

8/12/85
(Date)

Barry J. Bromberg
Barry J. Bromberg
Contract Administrator

Reviewed and Concur:

8/12/85
(Date)

Elois Wiggins
Elois Wiggins
Contracting Officer

cc: R. Avery
Dr. Ibrahim
E. Halman