

### **Mahbub Hussain, Ph.D.**

Associate Professor of Petroleum Geology, Earth Sciences Department  
King Fahd University of Petroleum and Minerals, Dhahran, Saudi Arabia  
Tel: (966) 3-860-2620 (work); (972) 509-2824 (home – USA); Email: mahbub@kfupm.edu.sa

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The professional career of Dr. Hussain spans over 18 years of which a total of 12 years in the academia. He joined the faculty of Sul Ross State University in 1985 as an Assistant Professor of Geology. During 1991-95, Dr. Hussain briefly moved to the consulting arena and worked as a hydrogeologist for PRC-EMI (a subsidiary of Black and Decker). He returned to the academia in 1996 as an Associate Professor of Geology at King Fahd University of Petroleum and Minerals (KFUPM), Dhahran, Saudi Arabia. At KFUPM, Dr. Hussain regularly offers several graduate and undergraduate courses including sedimentology (both clastic and carbonates), Petroleum geology, Regional Geology, Environmental Geology. In addition, he also regularly offers short courses to the professionals in the petroleum industry including Saudi Aramco (ARAMCO) and Bahrain National Oil Company (BANOCO). All these courses are taught in the WebCT setting. Dr. Hussain is the recipient of KFUPM year 2003 **“Distinguished Faculty & Advisor”** - a prestigious award recognizing the contribution of the faculty members of this 500 plus faculty university.

An accomplished researcher and a past national Vice President of the SEPM (Evaporite Research Group), Dr. Hussain has authored a total of fifty (50) technical papers and abstracts published in different journals including Sedimentary Geology, Carbonates and Evaporites, AAPG Bulletin, and SEPM Special Publication. Several of his researches were either funded or closely collaborated by different oil companies (e.g., Arco, Texaco, Sun Oil, and Exxon). Dr. Hussain has recently completed three externally (KACST, Aramco) funded projects on basin analysis and reservoir characterization. He is also the Principal Investigator of another KACST-funded project on Basin Analysis of a lower Paleozoic sequence in southwestern Saudi Arabia.

Dr. Hussain’s consulting experience includes various aspects of environmental restoration, compliance and investigations. More specifically, he has extensive experience in hydrogeologic investigations, hazardous waste management, remedial investigation and feasibility study (RI/FS), quality assurance and quality control (QA/QC), technical review, report preparation, cost estimating, UST services, environmental sampling, treatability study, remedial design, and regulatory (CERCLA, RCRA, SARA, CWA, NEPA, etc.) compliances.

#### **Education**

Ph.D. University of Texas at Dallas, 1986 – Carbonate Sedimentology/Petroleum Geology; Supervisor: Prof. John K. Warren  
M.S. Acadia University, Nova Scotia, Canada, 1980, Clastic Sedimentology; Supervisor: Prof. Reginald Moore

#### **Teaching Fields**

Primary – Sedimentology, Petroleum Geology, Geology of the Middle East  
Secondary – Environmental Geology, and Hydrogeology

#### **Research Interest**

Basin analysis (Trace element, REE and heavy mineral-based provenance study),  
Diagenesis (cement chemistry, stable isotopes)  
Biomarkers (geochemical correlations based on different hydrocarbon biomarkers including isoprenoids, stable carbon and oxygen isotopes, steranes, hopanes and other polyaromatic hydrocarbons)  
Quaternary carbonates along the Arabian Gulf coastlines  
Sequence stratigraphy of the Mesozoic carbonates in the Arabian Peninsula

#### **Employment**

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Tel: (972) 509-2824 (USA); (966) 3-8605259 (Saudi Arabia)  
Email: mahbub@kfupm.edu.sa

- ❑ **1996-Present** - Associate Professor, Earth Sciences Department, King Fahd University of Petroleum and Minerals. Dhahran, Saudi Arabia
- ❑ **1990 - 1996** - Senior Geologist, PRC-EMI (a subsidiary of Black and Decker), San Francisco
- ❑ **1985-1990** - Assistant Professor, Department of Geology, Sul Ross State University, Alpine, Texas

### **Teaching Effectiveness**

Scored an average of 9 (out of a maximum of 10) in student evaluation during the last seven years of teaching at KFUPM. Nominated for the KFUPM “Distinguished Faculty & Advisor” award in 2001 and 2002; Received Year 2003 KFUPM “*Distinguished Faculty & Advisor*” award.

### **Publication**

Published a total of fifty (50) papers and abstracts in different national and international journals. The list does not include numerous technical reports prepared during the tenure (1990-95) in the industry.

### **Courses Offered**

**Graduate** – Carbonates & Evaporites, Advanced Clastic Sedimentology, Advanced Petroleum Geology, Waste Management & Environmental, Geology of the Middle East, Coal Geology.

**Undergraduate** - Physical Geology, Historical Geology, Field Geology, Environmental Geology, Hydrogeology, Regional Geology, Environmental Geology, Oceanography, Petroleum Geology, Carbonate Sedimentology, Clastic Sedimentology.

### **Thesis/Dissertation Supervision**

Supervised a total of 21 M.S. thesis and 2 Ph.D. dissertations.

### **Honor & Office**

- ❑ Vice President, Evaporite Research Group, Society of Sedimentary Geologists (formerly, SEPM), 1990
- ❑ Coordinator, Central Analytical Laboratory, Sul Ross State University, 1988-90
- ❑ Recipient, AAPG Teaching Excellence (academic development) award, 1988
- ❑ Recipient, AAPG Grants -in -Aid for Research Excellence, 1985
- ❑ Chairman, Ph.D. program establishment Committee, ESD, KFUPM, 1999-2000
- ❑ Chairman, M.S. and B.Sc. Curriculum Revision Committee, ESD, KFUPM, 1998-2000
- ❑ Chairman, Research Committee, ESD, KFUPM, 2001-2003
- ❑ Member, Graduate Environmental Science Program Designing and Establishment Committee, KFUPM
- ❑ Member, Undergraduate Environmental Science and Engineering Program Designing and Establishment Committee, KFUPM
- ❑ Member, University Research Committee, KFUPM, 2003-2004

- Academic Chairman, Dhahran Geosciences Society, 2004

### **List of Thesis/Dissertation Supervised (Last 5 years)**

#### Completed

Al-Mousa, A. M., 2003, The impact of 3-D seismic data on constraining the reservoir geologic uncertainty: Department of Geology, KFUPM, 113p. (Member, Supervisory Committee)

Siddiqie, A., 2002, Reservoir Quality of the Unayzah Formation in Waqr, Tinat, and Haradh fields, northeastern Saudi Arabia, 176p. (Principal Supervisor)

El-Hassan, W.M., 2002, Khafji reservoir mechanical properties calibration and in-situ stress modeling, Zuluf Field, Northeastern Saudi Arabia: Department of Geology, KFUPM, 168p. (Principal Supervisor)

Al-Ramadan, K.A., 2001, Diagenesis of the Jauf Sandstone in Hawiyah area, Ghawar Field: Department of Geology, KFUPM, 106p. (Co-Supervisor)

Mohammad, M.A., 2002, Acoustic and resistivity studies of the Khobar Member, Dammam Formation, Eastern Province, Saudi Arabia: Department of Geology, KFUPM 159p. (Member, Supervisory Committee)

Al-Eid, G.A., 2000, Diagenetic facies of the late Permian Khuff-B reservoir, southern Ghawar: Implications for reservoir quality distribution: M.S. Thesis, Department of Geology, KFUPM, 206p. (Principal Supervisor)

Ahmed, S.M., 1999, Quality assessment of irrigated water at SHADCO irrigation project, Al-Fadhli, Eastern Province, Saudi Arabia: Department of Geology, KFUPM, 131p. (Principal Supervisor)

Babalola, L.O., 1999, Depositional environments and provenance of the Wajid Sandstone, Abha-Khamis Mushayt area, southwestern Saudi Arabia: Department of Geology, KFUPM, 239p. (Principal Supervisor)

#### On-Going

Tayyib, M.A., 2003-4, Sequence stratigraphic subregional framework for middle Triassic Jilh Formation, Saudi Arabia using core, cutting and wireline logs: Department of Geology, KFUPM. (Principal Supervisor).

Al-Dhubeeb, A. G., 2004, Biofacies as a Tool for Calibrating the Jubaila-Arab Formational Contact from Outcrop in Riyadh area to Subsurface in Eastern Province, Saudi Arabia. (Principal Supervisor).

Al-Enezy, S.S., 2003-4, Foraminiferal biofacies of Recent and Miocene foraminifera from eastern Saudi Arabia: Department of Geology, KFUPM. (Co-Supervisor)

Al-Dakhil, R.K., 2003, High-resolution sequence stratigraphy of the Khuff carbonates in the subsurface of Haradh area, southern Ghawar field, and the outcrops of Al-Qasim province, Saudi Arabia: Department of Geology, KFUPM. (Principal Supervisor)

Al-Khalifa, F., 2003, Sedimentology and geostatistical modeling of the Quwarah Member, Quassim Formation: Paleozoic Sandstone reservoir outcrop analog, Saudi Arabia: Department of Geology, KFUPM. (Member, Supervisory Committee)

### **Field Experience**

- ❑ Regularly served as the Director of the Summer Field Camp, Department of Geology, Sul Ross State University
- ❑ Instructor, Summer Field Camp, KFUPM, 1996-present
- ❑ Has extensive field experience in different parts of the world including foothills of the Himalayas, Marathon-Ouachita Fold Belt, Arbuckle Mountains, Permian Basin, Annapolis Valley (including the Bay of Fundy), Arabian Shield, Paleozoic sequences in southwestern Saudi Arabia, Mesozoic and Cenozoic sequences in central and northeastern Saudi Arabia; also, led several field trips for the Dhahran Geosciences Society (an affiliate of the AAPG).

### **Laboratory Experience**

- ❑ Hands-on experience on several state-of-the art analytical equipment including SEM, XRD, XRF, and MS-GC.
- ❑ Coordinator, Central Analytical Laboratory, Sul Ross State University, Alpine, Texas, 1987-90.
- ❑ Originator of the recently acquired JEOL 5900 LV Scanning Electron Microscope at the Earth Sciences Department at KFUPM.

### **Computer Literacy**

Operating systems – Windows, NT and Unix; Database – Access, and Oracle; Language – Visual Basic and C++; Spreadsheet – Excel; Application software – GeoFrame, Rockware Utilities, Modflow; Statistica, and Surfer; Graphics – Adobe Illustrator and Flash.

### **List of funded Research Projects (last 5 years)**

#### Aramco/RI CPM 2231 – 2002-2003)

On-site Core Flooding, Uthmaniya, Hawiah and Haradh wells, Ghawar Field, Saudi Arabia.

(P.I. Dr. Sadqi Bu – Khamsein, Department of Petroleum Engineering, KFUPM; C.I. Mahbub Hussain, Dr. Osman Abdullatif)

#### Aramco/RI CPM 2231 -Part II – 2003)

Scanning electron microscopy and energy dispersive spectra (EDS) analysis of the solids captured on the filter papers from on-site flooding tests in Uthmaniya, Hawiah, and Haradh wells, Ghawar Field, Saudi Arabia.

(P.I. Dr. Sadqi Bu – Khamsein, Department of Petroleum Engineering, KFUPM; C.I. Mahbub Hussain, Dr. Osman Abdullatif)

Aramco/RI CPM 2227 – 2002-2003

Wellbore instability in Khafji reservoir, Zuluf Field – Phase II.

(P.I. Dr. Abdurrahim Abdulaziz, Center for Petroleum & Minerals, R.I; C.I. Dr. Mahbub Hussain)

KACST LGP 7-15 – 2000-2002

Origin and economic significance of kaolin (china clay) deposits in Abha-Khamis Mushyt area in Asir Province.

(P.I. : Dr. Mahbub Hussain; C.I: Dr. Abdulaltif Osman)

KACST LGP 6-14 (2000-2003)

Trace Element Geochemistry and Heavy Mineral Assemblage of the Cambro-Ordovician Saq Sandstone of the Tabuq Basin and its possible Correlation with the Wajid Sandstone.

(P.I. : Dr. Mahbub Hussain; C.I: Dr. Mustafa M. Hariri and and Dr. Abdullatif Osman, ESD)

KACST LGP 4-12 – (2000-2002)

Origin and Economic Significance of Ironstone in the Paleozoic Wajid Sandstone, Asir Region

(P.I. : Dr. Mahbub Hussain; C.I: Dr. Mustafa M. Hariri)

KACST LGP 283 – 1999-2001

Framework mineralogy, diagenesis and provenance of the Wajid Sandstone in Asir region, southwestern Saudi Arabia.

(P.I. : Dr. Mahbub Hussain; C.I: Dr. N.I. Khandaker, City University of New York)

**Professional License/Training**

- Professional Geologist
- Registered Environmental Assessor
- Registered TNRCC LPST Program Manager
- OSHA 40-Hour Health, Safety and Emergency Response Training (29CFR 1919.120)
- Underground Storage Tank: Installation, Monitoring and Removal
- Contaminant Hydrogeology: Practical Monitoring, Protection, and Cleanup
- Site Characterization of High-Level Nuclear Waste Disposal
- Geotechnical Applications in Environmental Industries
- RCRA Regulation and Compliance

**Personal**

US citizen; married; two sons, Shafayet (19) and Shanzyan (11); permanent address: 4225 Lavaca Drive, Plano, Texas 75074.

## LIST OF PUBLICATIONS

Hussain, M., 2004, The Jabal Al Qarah caves – a unique cave system in the karstic Shedgum Plateau, north eastern Saudi Arabia: *GeoArabia (in review)*.

Ahmed, S.M., Hussain, M., Abderrahman, W., 2004, Using multivariate factor analysis to assess surface/logged water quality and source of contamination at a large irrigation project at Al Fahdli, Esatern Province, Saudi Arabia: *Bulletin of Engineering Geology and the Environment. (accepted)*

Al-Ramadhan, K.A., Hussain, M., Imam, B., Saner, S., 2004, Lithologic characteristics and diagenesis of the Devonian Jauf Sandstone at Ghawar Field, Eastern Saudi Arabia: *Marine and Petroleum Geology*, v. 21, pp. 1221-1234.

Hussain, M., Babalola, L.O., and Hariri, M.M., 2004, Heavy Minerals in the Wajid Sandstone, Abha-Khamis Mushayt Area, Southwestern Saudi Arabia: Implications on Provenance and Regional Tectonic Setting: *GeoArabia*: v. 9, pp. 72-102.

Hussain, M., Khandaker, N.I., and Al-Khalifa, F., 2004, Neogene Hofuf Formation hosted Jabal Al Qarah caves: Structural and depositional constraints, eastern Saudi Arabia: *Annual Conference, Geological Society of America; Abstracts with Programs*, v. 36, p.235.

Hussain, M., Abdullatif, O., 2004, Trace element geochemistry and geochemical correlation of the Saq and Wajid Sandstone, Saudi Arabia: *Abstracts with Programs, The Second Saudi Science Conference, Jeddah, Saudi Arabia, March 15-17, 2004*, pp. 55.

El Hasan, W., Hussain, M., and Abdullatif, O., 2004, Control of Lithology and depositional environment on Geomechanical properties of reservoir rocks: An example – Khafji reservoir, Zuluf filed, offshore Saudi Arabia: *Abstracts with Programs, The Second Saudi Science Conference, Jeddah, Saudi Arabia, March 15-17, 2004*, pp. 70.

Ahmed, S.M., Abderrahman, W., and Hussain, M., 2004, Using multivariate factor analysis to assess surface/shallow groundwater quality and source of contamination at a large irrigation project at Al-Fadhli, Easter Province, Saudi Arabia: *Abstracts with Programs, The Second Saudi Science Conference, Jeddah, Saudi Arabia, March 15-17, 2004*, pp. 54.

Ahmed, S.M., Abderrahman, W., and Hussain, M., 2004, Major, minor ions and trace element concentrations in logged water at a large irrigation project at Al-Fadhli, Eastern Province, Saudi Arabia: *Challenges on New Horizon Towards Managing the Global Environment and Water Resources Manama, Kingdom of Bahrain, January 18 - 20, 2004*.

Hussain, M., Hariri, M.M., Warren, J.K., and Bize, E., 2004, “Eggshell” Eolinite in calcitic Pleistocene Dunes from the Arabian Gulf Coastal Region, Northeastern Saudi Arabia: *Carbonates and Evaporites. (in review)*

Hussain, M., Hariri, M.M., Bize, E., Warren, J.K., 2003, Models of oomoldic porosity development in Quaternary Eolianite in arid setting: An example from the Arabian coastlines, Saudi Arabia: *KFUPM-Schlumberger Technical Exchange Meeting on Carbonate reservoirs from exploration to IOR: Special CD-ROM publication*, 17p.

Osman, A., Hussain, M., Qasim, M., 2003, Thin-section and SEM characterization of the effects of water flooding on the porosity in carbonate rocks, Ghawar Field, Saudi Arabia: *KFUPM-Schlumberger Technical Exchange Meeting on Carbonate reservoirs from exploration to IOR: Special CD-ROM publication*, 14p.

Babalola, L. O.; Hussain M.; and Hariri, M. M., 2002 The Possible Origin of Iron-Rich Beds (Ironstone) in the Basal Section of the Paleozoic Wajid Sandstone, Abha-Khamis Mushayt Area, Southwest Saudi Arabia: Arabian Journal of Science and Engineering, v.28, pp.2-22.

Hussain, M., Hariri, M., and Warren, J.K., 2002, A Quaternary Eolinite Sequence in the Arabian Gulf Coastal Region, Northeastern Saudi Arabia: A Modern Analogue for Oomoldic Porosity Development in an Arid Setting: Abstracts with Programs, AAPG International Conference, Cairo, Egypt, October 27-30, 2002.

Hussain, M., Siddique, S.A., Gabor, K., Abdulaziz, A., 2002, Porosity Prediction of Unayzah Reservoir from Well Log Data Using Backpropagation Neural Network: Abstracts with Programs, AAPG International Conference, Cairo, Egypt, October 27-30, 2002.

Al-Ramadhan, K., Hussain, M., Imam, B., and Senner, S., 2002, Diagenesis of Jauf Sandstone in Hawiyah Area, Saudi Arabia: Abstracts with Programs, AAPG International Conference, Cairo, Egypt, October 27-30, 2002.

Al Eid, Ghazi, A.; Kamal, R. A.; Cole, J. C; Hussain, M.; Imam, B.; and Hughes, G. W., 2002, Identifying and Mapping Key Diagenetic Lithotypes; A New Approach in Modeling Carbonate Reservoirs II: Abstracts with Programs, GEO 2002, Bahrain, April 15-18, 2002.

Hussain, M., 2002, Petroleum Geology Education at KFUPM: (Invited Talk) – AAPG Summit on "Teaching Petroleum Geology", Abstracts with Programs, Annual Conference, American Association of Petroleum Geologists, Houston, USA, March 8-9. 2002.

Hussain, M.; and Raza, M. J. 2002, Source Beds for the Mesozoic and Younger Oils in Saudi Arabia: Constraints of Biomarker Applications. Abstracts with Programs, Annual Conference, American Association of Petroleum Geologists, Houston, USA, March 9-14. 2002.

Hussain, M., 2001, The concept of carbonate/evaporate source beds, and source beds of the hydrocarbons in the Arabian Peninsula: Oil Drop, v. 13, pp.6-9.

Imam, M.B., Hussain, M., 2001, A review of the habitats of Hydrocarbons in Bangladesh: Journal of Petroleum Geology, v. 25, pp. 31-52.

Al Eid, Ghazi, A.; Kamal, R. A.; Cole, J. C; Hussain, M.; Imam, B.; and Hughes, G. W., 2001, Identifying and Mapping Key Diagenetic Lithotypes; A New Approach in Modeling Carbonate Reservoirs: Abstracts with Programs, Annual Conference, American Association of Petroleum Geologists, Denver, USA, May 6-9.

Hussain, M., Babalola, L.O., and Hariri, M.M., 2001, Ironstone in the Wajid Sandstone: An Example of Hydrothermally-Induced Iron Accumulation in a Sedimentary Sequence: Gondwana Research, v.4, pp. 217 (addendum).

Hussain, M., Al-Khalefah, F., Raza, M.J., 2001, Geology of Jabal Al-Qarah Caves, Al-Hasa, Northeast Saudi Arabia: Proceedings, The First Saudi Science Conference, April 9-11, 2001, Dhahran, pp. 259-274.

Hussain, M., Babalola, L.O., and Hariri, M., 2000, Provenance of the Lower Paleozoic Wajid Sandstone, Southeastern Margin of the Arabian Shield: A Geochemical and Petrographic Approach: Special Proceeding, AAPG Annual Convention, New Orleans.

Akther, S.H., Bhuiyan, A.H., Hussain, M., and Imam, M.B., 1998, Turbidite sequence located in SE Bangladesh: Oil and Gas Journal, v.96, p.109-111.

Bize, E., Bernier, P., Hussain, M., and Dalongeville, R., 1998, A Diagenetic Study of the Holocene Sediments from Al Uqayr Lagoon System, Arabian Gulf, and Implications to Paleohydrology and Sea Level Fluctuations: Programs with Abstracts, 5<sup>th</sup> Meeting, Saudi Society for Earth Scientists, October 26-29, p.41.



Babalola, L.O., Hussain, M., and Khandaker, N.I., 1998, Origin of Ironstone Horizons in the Paleozoic Wajid Sandstone, Asir: Programs with Abstracts, 5<sup>th</sup> Meeting, Saudi Society for Earth Scientists, October 26-29, p.36.

Hussain, M., 1998, RCRA Protocols for Contaminated Ground Water Sampling and Monitoring: An Overview: Proceeding of the First National Workshop on Water Conservation in the Kingdom., Research Institute, King Fahd University of Petroleum and Minerals, Dhahran, May 23-24, p.11-20.

Hussain, M., and Khandaker, N.I., 1998, The Wajid Sandstone as Exposed Along the Road Sections of the Abha and Khamis Mushayt Area, South Western Saudi Arabia: Field Guide, Dhahran Geological Society, 18p.

Hussain, M., and Osinowo, T.O., 1997, Texas Natural Resources Conservation Commission (TNRCC) protocols for conducting risk-based assessments at leaking petroleum storage tank (LPST) sites: Proceedings of the symposium on Civil Engineering and Environment, British Council and Saudi Society of Civil Engineers, Dhahran, May 3-5, pp.199-212.

Hussain, M., and Khandaker, N.I., 1997, The Wajid Sandstone in the Asir Region: An example of petrologically immature braided river system on the Arabian Shield: Abstracts with Programs, Fourth Annual Meeting, Saudi Society of Earth Sciences, Jeddah, October 13-16, pp.25.

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**1990-95 - Employed in the industry (please see the list of consulting projects)**

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Hussain, M., and Warren, J.K., 1991, Source rock potential of shallow-water evaporites: An investigation in Holocene-Pleistocene Salt Flat sabkha (playa), west Texas-New Mexico: Carbonates and Evaporites, v.6, 19.

Hussain, M., and Bloom, M.A., 1991, Pyrolysis and hydrocarbon source bed potential of the Upper Devonian Woodford Shale, Hovey Channel, southern Permian Basin, west Texas: American Association of Petroleum Geologists Bulletin, Abstracts with Programs, v. 75, p.599.

Hussain, M., and Amos, C.L., 1990, Heavy minerals, provenance and dispersion of the Holocene-Pleistocene fluvio-glacial sediments in the Chignecto Bay, eastern Canada: Bulletin Geological Society of America, Abstracts with Programs, v.67, p.315.

Hussain, M., McDaniel, B.K., and Forsythe, L.M., 1990, The nature and distribution of clays in the flysch sequences of the Marathon Basin: an x-ray diffraction and scanning electron microscopic (SEM) study: West Texas Geological Society Bulletin, v.29, pp.5-9.

Mohammed, K., and Hussain, M., 1989, Strontium geochemistry and the original depositional phase of the Castile Evaporites: Bulletin Geological Society of America, Abstracts with programs, v.21, p.43.

Haneef, M., Tanoli, S.K., and Hussain, M., 1989, The origin of iron specks in ancient clastic sequences: An interpretation based on a study of the Silurio-Devonian Hissartang Formation, Attock-Cherat Range, Northwest Pakistan: Bulletin Geological Society of America, Abstracts with Programs, v.21, p.86.

Hussain, M., 1989, Source rock potential of shallow-water continental evaporites: An investigation from the Holocene-Pleistocene evaporite-carbonate sequences of the Salt Flat playa, west Texas-New Mexico: American Association of Petroleum Geologists Bulletin, v.73, p.366.

Mohammed K., and Hussain, M., 1989, Brushite in the Castile evaporites and its possible paleohydrological significance: Bulletin West Texas Geological Society, v.29, pp.5-7.

Hussain, M., and Warren, J.K., 1989, Nodular and enterolithic gypsum: The "Sabkha-Tization" of Salt Flat playa, west Texas: Sedimentary Geology, v.63, pp.13-24.

Hussain, M., and Warren, J.K., 1988, Dolomitization in sulfate-rich environment: A modern example from Salt Flat sabkha (dried playa lake) in west Texas-New Mexico: *Carbonates and Evaporites*, v.3, pp.473-482.

Scott, A.R., and Hussain, M., 1988, Organic geochemistry, source rock potential, and oil-source rock correlation of the Permian Spraberry Formation, Northern Midland Basin, Jo Mill Field, Borden County, Texas: *Studies to Hydrocarbon Exploration: Special Publication 88-28*, Society of Economic Paleontologists and Mineralogists (SEPM), Permian Basin Section, pp.33-51.

Hussain, M., 1988, n-alkane in continental evaporite-carbonate sequences and its possible implications in paleoclimate study: A study in Salt Flat sabkha, west Texas-New Mexico: *Bulletin Geological Society of America, Abstracts with Programs*, v.20, p.347.

Hussain, M., and Rohr, D.M., and Warren, J.K., 1988, Depositional Environments and facies in a Quaternary continental sabkha, west Texas: 1988 Field Seminar Guide Book: Guadalupe Mountains: West Texas Geological Society, pp.177-185.

Hussain, M., 1986, Evaporite mineralogy of the Salt Flat playas, west Texas: Texas Academy of Science, 89th Annual Meeting, Kingsville, Texas: *Abstracts with Programs*, v.29, p.36.

Hussain, M., and Warren, J.K., 1986, Brine evolution, mineralogy, and diagenesis in a Holocene-Pleistocene continental sabkha sequence in Salt Flat playa, west Texas-New Mexico: Third Annual Mid-year Conference, Society of Economic Paleontologists and Mineralogists (SEPM), *Abstracts with Programs*, v.3, p.56.

Hussain, M., and Warren, J.K., 1985, Origin of laminae in Holocene-Pleistocene evaporite sequences of Salt Flat playa, west Texas and New Mexico: *American Association of Petroleum Geologists Bulletin*, v.16, p.116.

Hussain, M., and Warren, J.K., 1984, Dolomites in Salt Flat playa, Texas: *Abstracts with Programs, American Association of Petroleum Geologists Bulletin (South-central Section)*, v.16, p.116.

## LIST OF CONSULTING PROJECTS (1990-1995)

- Project Manager and the principal author for a \$20 million Phase II remedial investigation field sampling and analysis plan (FSAP) for 24 potentially contaminated sites at a Naval installation in the Bay Area: researched available information, formulated conceptual models, identified data gaps, and proposed soil and ground water sampling and analyses to define the extent of contamination. Interfaced regularly with regulatory agencies (RWQCB, DHTSC, etc.).
- Screened remedial technologies for soil and ground water at 24 potentially contaminated sites at a Naval Station in the Bay Area: evaluated the applicability, effectiveness, implementability and cost of various chemical, thermal, physical, biological, containment and disposal technologies. Formulated remedial alternatives.
- Provided technical support for a bioremediation treatability study and in-situ soil washing treatability study to investigate the potential of these two technologies for treatment of soil and ground water at a disposal site contaminated with petroleum hydrocarbons, solvents, and heavy metals at a Naval installation in San Francisco. Oversaw the design (work plans, cost estimates, schedules, sampling and analysis plans) of the two studies at a bench-and-pilot-scale level.
- Worked as a Senior Hydrogeologist and Task (Project) Manager for the underground storage tank (UST) program for two Naval installations in California (total 52 USTs): prepared plans and specifications for removals/closures, coordinated field activities, incorporated the UST program into RI program, wrote closure reports, delivered presentations to regulatory agencies.
- Served as the Project/Task Manager for the Comprehensive Ground-Water Monitoring Plan (CGM) and Phase II RI Field Sampling and Analysis Plan for Mare Island Naval Station. The CGM involved detailed evaluation of over 200 ground water monitoring wells at this installation. The wells were evaluated to determine the adequacy of the quarterly monitoring as required by the Regional Water Quality Control Board (RWQCB), California. Recommendations were made for installation of additional monitoring wells to cover all three water-bearing zones and integrate the wells in Phase II Remedial Investigation. Because of high natural background levels for certain contaminants, recommendation was also made to install a total of 18 background monitoring wells. These wells have since been completed and a quarterly monitoring program is in place.
- Conducted a base-wide survey of all (over 200) monitoring wells at Mare Island NSY. The survey involved detailed assessment of these wells in terms of physical integrity, compliances to installation standards, and adequacy to support of a monitoring plan recommended by the RWQCB, California.
- Served as the Task/Project Manager for the facility wide ground water monitoring plan, quarterly well monitoring for OU-II, Naval Station Treasure Island, Hunters Point Annex, San Francisco, California. This project also involved integration of facility hydrogeological data in relevance to compliance requirements.
- Served as a senior member of the PRC group involved in engineering evaluation of the pesticide reinstate area, Naval Post Graduate School Monterey (NPGS), Monterey, California. A total of four alternatives, (1) limited action (\$480,000.00), (2) excavate soil and incinerate off-site (\$1,930,000.00), (3) excavate soil and bioremediate on-site (\$335,000.00), and (4) excavate soil and treat on-site by solvent extraction (\$1,133,000.00), were considered. Based on the consideration of cost effectiveness and technicality, Alternative 3 was selected. Dr. Hussain was the Task Manager to prepare the work plan and detail cost estimate to implement the proposal.
- As a Project Hydrogeologist for BCM Engineers, Inc., prepared work plan, cost estimate, and sampling and analysis plan for the removal of four (4), 1,000-gallon petroleum storage tank and remediation of hydrocarbon-contaminated soil and ground-water. Soil-vapor extraction methodology was used to remove VOCs from soil in the vadose zone. Air parsing, a vapor-extraction technique was used to reduce the VOC

concentrations in ground-water. Six monitoring wells were installed and monitored for hydrocarbon contamination for a period of 18 months.

- Performed a total of over 30 ESAs nationwide. The projects involved site reconnaissance, sampling, analysis and report writing and regulatory interface. The Phase II ESA involved subsurface investigation involving ground penetrating radar (GPR), soil boring and monitoring well installation.
- Wrote approximately 15 work plan and RI/FS reports including, Phase II RI for Mare Island Naval Shipyard, Comprehensive Ground-Water Monitoring Plan for Mare Island NSY, Basewide Survey and Evaluation of Ground-Water Monitoring Wells, Hydrogeologic Integration Work Plan for Hunter's Point Annex.
- Performed QA/QC for over 50 Environmental Site Assessment (ESA), asbestos survey, Special Resources reports. Also, served as a Technical Reviewer for the Resolution Trust Corporation (RTC) and reviewed over 20 ESA and Comprehensive Asbestos Survey (CAS) reports.