

BULLETIN

Corpus Christi Geological Society



and

Coastal Bend Geophysical Society



**April
2024
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CORPUS CHRISTI GEOLOGICAL SOCIETY

P.O. BOX 1068* C.C.TX. 78403

2023-2024

www.ccgeo.org

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COASTAL BEND GEOPHYSICAL SOCIETY
P.O. BOX 2741 *C.C. TX. 78403
2023-2024

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**Visit the geological
web site at
www.ccgeo.org**

CCGS/CBGS JOINT MEETING SCHEDULE 2023-2024

September 2023							October 2023							November 2023						
S	M	T	W	Th	F	S	S	M	T	W	Th	F	S	S	M	T	W	Th	F	S
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10	11	12	13	14	15	16	15	16	17	18	19	20	21	12	13	14	15	16	17	18
17	18	19	20	21	22	23	22	23	24	25	26	27	28	19	20	21	22	23	24	25
24	25	26	27	28	29	30	29	30	31	26	27	28	29	30						

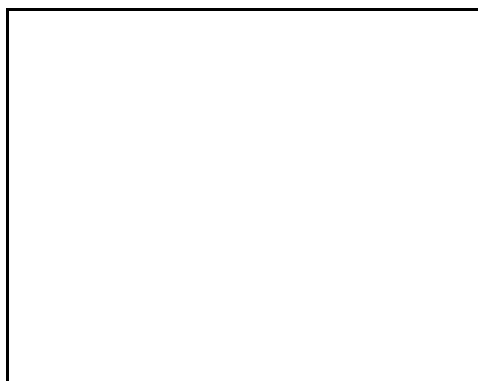
2023-24 Membership Kickoff— Nueces Brewing Co. Downtown, Thursday Sept. 14 5:00p.m.-til 8:00p.m.	Meeting at Joe’s Crab Shack Downtown. 11:00 Bar, 11:45 lunch, 12:00 speaker. Speaker: William DeMis— Rochelle Court LLC, “Commodity Super Cycle of Oil & Gas.”	Meeting at Joe’s Crab Shack Downtown. 11:00 Bar, 11:45 lunch, 12:00 Speaker: Mohamed Ahmed/Grad Student
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December 2023							January 2024							February 2024						
S	M	T	W	Th	F	S	S	M	T	W	Th	F	S	S	M	T	W	Th	F	S
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10	11	12	13	14	15	16	14	15	16	17	18	19	20	11	12	13	14	15	16	17
17	18	19	20	21	22	23	21	22	23	24	25	26	27	18	19	20	21	22	23	24
24	25	26	27	28	29	30	28	29	30	31	25	26	27	28	29					
31																				

	Meeting at Joe’s Crab Shack Downtown. 11:00 Bar, 11:45 lunch, 12:00 speaker Speaker: Mark Thompson, Volcanoes role in opening of Gulf of Mexico	Meeting at Joe’s Crab Shack Downtown. 11:00 Bar, 11:45 lunch, 12:00 speaker Speaker: Robin Dommissie/BEG
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CCGS/CBGS Joint Meeting Schedule 2023-2024

March 2024							April 2024							May 2024						
S	M	T	W	Th	F	S	S	M	T	W	Th	F	S	S	M	T	W	Th	F	S
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10	11	12	13	14	15	16	14	15	16	17	18	19	20	12	13	14	15	16	17	18
17	18	19	20	21	22	23	21	22	23	24	25	26	27	19	20	21	22	23	24	25
24	25	26	27	28	29	30	28	29	30					26	27	28	29	30	31	
31																				



Meeting at Joe's Crab Shack
downtown. 11:00 Bar, 11:45
lunch, 12:00 speaker
Speaker: Amir Ismail,
"Integration of Machine
Learning & Seismic Attributes
for improving Subsurface
Interpretation in Hydrocarbon
Exploration"

Meeting at Joe's Crab Shack
downtown. 11:00 Bar, 11:45
lunch, 12:00 speaker
Speaker: Dan A. Pedrotti

Calendar Of Meetings and Events

- Corpus Christi Geological/Geophysical Society..... Third Wed.—11:30a.m.
- SIPES Corpus Christi Luncheons..... Last Tues.—11:30a.m.
- South Texas Geological Society Luncheons..... Second Wed—noon San Antonio
- San Antonio Geophysical Society Meetings..... Fourth Tuesday
- Austin Geological Society..... First Monday
- Houston Geological Society Luncheons..... Last Wednesday
- Central Texas Section of Society of Mining, Metallurgy & Exp..... 2nd Tues every other month in San Antonio



CCGS President's Letter

Greetings to All

Spring is upon us. The mild winter did not help prices for natural gas. Oil seems to be holding up.

I would like to take the time this month to discuss leadership. Your society needs you to step up and volunteer and take the lead. Leaders do more than preside over a position, they hopefully come up with new or unique ways to approach the challenges we will face in the future. Working in geology and its many different branches, we at the CCGS have a very diverse group. Our group has experience and youth. Together we have an interesting portfolio of potential. You are challenged daily and utilize your integrity and leadership qualities. OK, I will get off my soapbox.

Our last couple of talks leaned very heavily on computing power. These talks seemed to also point out that AI will not replace the mind of anyone in our profession. One of our future talks will feature Dan Pedrotti. This man has lead companies and our society. I am very excited about this talk in May.

April will be a busy month. The CCGS will award scholarships to deserving students, A total solar eclipse, and GEOGULF in San Antonio. We also will be awarding "Honorary Life Member" status to a very deserving individual.

SIPES is holding their national convention in Corpus Christi June 10-12. Sponsorships and advertising space is available. Prices range from \$60 to \$4000. Contact Zac Corcoran for information (361)658-5850.

It is an honor for me to be president. Thank you to those who volunteered to fill openings on the scholarship committee. PLEASE consider a few hours of volunteering. Besides doing a good thing, it looks good on that resume.

Remember our society depends on YOU.

Dennis O. Moore

President CCGS 2023-24

The Houston Geological Society wants to hear your story!

HGS members are interested to hear what's new and notable in exploration and production from your region: new play or prospect ideas? Successes or learning opportunities?

Don't miss an opportunity to have your story published in the HGS Bulletin. You can write your own technical article or give an interview to the Editor.

Contact editor@hgs.org for more information



REGISTRATION IS OPEN!!!

GeoGulf in San Antonio, Texas

April 10-12, 2024

The week of the TOTAL April 8 Eclipse

A conference of the
Gulf Coast Association of Geological Societies

All current information at www.geogulf2024.org

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18 Hole Golf Tournament
\$20 Per Player - \$100 for a team of 4
72 ENTRIES / 18 TEAMS OF 4
April 9, 2024

EVENTS

CONFERENCE SOCIAL EVENT
ROCK and Bowl with...
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1st place LEGO Founder Guitar
THURSDAY EVENING
PINSTACK

THE STATESBORO REVUE

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REGISTRATION IS OPEN

www.geogulf2024.org



The Society of Petroleum Engineers – Gulf Coast Section (SPE-GCS) is pleased to inform you that it is organizing the **14th** semi-annual Energy Professionals Hiring Event for professionals of energy and upstream oil & gas disciplines. The Spring 2024 Hiring Event will be held face-to-face on **May 9, 2024**, at the Offshore Technology Conference (OTC) in Houston. **We are inviting CCGS to join as a collaborating professional society.** Thanks for participating as a collaborating society in Fall 2023. There is no charge to collaborate; we just ask that you communicate the news about the event to your members and their associated employers. In return, your professional current members will be entitled to participate as job seekers.

- The Hiring Event is one of the most remarkable happenings that bring together experienced and talented professionals with energy industry employers and recruiters from various sectors, thereby serving as the platform for open and vast-ranging employment opportunities.
- Experienced energy professionals who are members of one of the collaborating organizations can participate in both events as jobseekers by registering in advance. For more information about the event, location, time, registration, and participants, visit our website: <https://www.spegcs.org/hiring-event/>.
- Registration for employers is open: <https://www.spegcs.org/events/6825/>

Please reply with your intent to participate as a collaborating organization. You're invited to attend a virtual meeting for volunteers on Feb. 21: <https://www.spegcs.org/events/6845/>

**C. Susan Howes, PE, PHR
President**

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SCA's 2024 [Training Course Catalog](#)

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CBGS President's Letter

CBGS Board 2023-2024

- President- Dr. Mohammed Ahmed
- Vice President- Dr. Subbarao Yelisetti
- Secretary/Treasurer-Charles Benson

CBGS Presentations

Dr. Amir Ismail, a postdoc working with Dr. Mohamed Ahmed at TAMU-CC is presenting his latest research titled "Integration of Machine Learning and Seismic Attributes for Improving Subsurface Interpretation in Hydrocarbon Exploration" at the April 2024 CBGS/CCGS professional luncheon.

CBGS Business

- CBGS currently has 28 active members, 2 honorary members, and 40 student members.

Academic Programs and Research Activities at TAMU-CC and TAMUK

- TAMU-CC faculty R. Coffin and I. Pecher are leading researcher on a project composed of a 4-university team conducting Earth carbon cycling with a focus on polar warming in the Ross Sea, Antarctica. Collaborative universities include University of Texas, Dauphin Island, and University of West Florida. For additional info, contact Dr. Richard Coffin: Richard.Coffin@tamucc.edu at TAMU-CC.
- TAMU-CC faculty L. Prothro is currently participating in a two-month research cruise in Antarctica.
- TAMU-CC's geology program recently underwent an external evaluation. For additional information contact Dr. Valeriu Murgulet (Valeriu.Murgulet@tamucc.edu) at TAMU-CC.
- TAMU-CC's geology curriculum is constantly being refreshed with new courses but this academic year we are looking to add additional tracks such as Marine and Climate Geosciences, Planetary Geosciences and Biogeosciences. For additional information contact Dr. Valeriu Murgulet (Valeriu.Murgulet@tamucc.edu) at TAMU-CC.
- Five graduate students from the TAMU-CC Geophysics Lab will be presenting their recent research at the 2023 AGU meeting. For details, contact Dr. Mohamed Ahmed at Mohamed.ahmed@tamucc.edu.
- Dr. Mohamed Ahmed at TAMU-CC extended an invitation to Mr. Randy Bissell to deliver a presentation in Ahmed's geophysics class. Mr. Bissell's presentation focused on "The Concept of Stratigraphic Correlation - Applying Imagination: Understanding and Expanding the Perception of Extensive Geological Information with Limited Data."
- In the Fall of 2023, the Department of Physics and Geosciences at TAMUK was pleased to host Dr. Matthew Loocke, director of the Chevron Geomaterials Characterization Laboratory at Louisiana State University. Dr. Loocke presented on research activities in his group and insights on the development of courses for geology undergraduates. Dr. Loocke's mineralogy class joined TAMUK and Del Mar Community college in the October 2023 field trip to Central Texas where students learned about magmatic processes and significant ore body mineralization.
- In early November, students from the Geology Club (TAMUK Association of Geosciences) hosted Randy Bissel from the CCGS on a very entertaining and informative lecture about sea level changes and the impact on coastal landscapes.

- TAMUK is pleased to announce that we had 15 graduating seniors at the end of the 2023 academic year in the Bachelor of Science in Geology program. The majority of those students also obtained their GIS certification, and at least 5 of them are working on their drone pilot license. They were very dedicated students. All are currently employed and 2 of the 15 went on to the University of Texas – San Antonio for graduate studies.

Student News:

- Ramadan Abdelrehim at TAMU-CC won first place for the second consecutive year in the 2024 Invent for The Planet Competition.
- Ramadan Abdelrehim, Mohamed Abdrabou, and Alan Innes have confirmed their acceptance to present abstracts at the SAGEEP 2024 meeting.
 - Innes, A., Ahmed, M., 2024, Assessing Effectiveness of Modern Smartphone Magnetometers in Mapping Buried Utilities: Symposium on the Application of Geophysics to Engineering and Environmental Problems (SAGEEP), Tucson, AZ, March 2024.
 - Abdelrehim, R., Ahmed, M., 2024, Characterization of Freshwater Lens on Barrier Islands Using Time Domain Electromagnetic Survey: A Case Study from Padre Island, Texas, USA: Symposium on the Application of Geophysics to Engineering and Environmental Problems (SAGEEP), Tucson, AZ, March 2024.
 - Abdrabou, M., Ahmed, M., 2024, Structural Characteristics of the Complex Gulf of Suez Rift-Related Basins: Insights from Passive Seismic and Gravity Surveys: Symposium on the Application of Geophysics to Engineering and Environmental Problems (SAGEEP), Tucson, AZ, March 2024.
- Dr. Mohamed Ahmed and his students at TAMU-CC co-authored an article titled "Impacts of the Grand Ethiopian Renaissance Dam on the Nile River's Downstream Reservoirs," published in the Journal of Hydrology 2024.
- Ahmed Omar at TAMU-CC has an abstract accepted for presentation at the TAMUCC Symposium for Student Innovation, Research, and Creative Activities on April 26, 2024.
- Petrophysics student Taiwo Osunrinde (presenter) and Dr. Subbarao Yelisetti and Dr. Veronica Sanchez at TAMUK co-authored an abstract for a poster presentation at IMAGE in August 2023 in Houston. The work dealt with CO2 storage evaluation.
- In November 2023 Taiwo Osunrinde and Dr. Subbarao Yelisetti and Dr. Veronica Sanchez at TAMUK published research in *The Leading Edge* focusing on the significance of understanding and evaluating the depositional environment of CO2 long-term storage sites (The Leading Edge, vol. 42, issue 11, pp. 737-747).
- In December, Dr. Sanchez and undergraduate geology major, Cathy Downs, presented a poster at the annual American Geophysical Union (AGU) which focused on reconstructing the (complex) history of Grenville rocks from central Texas using geochemical data.

Meetings & Events


- The 2024 SAGEEP meeting: <https://www.eegs.org/sageep-2024-program>
- The 2024 IMAGE meeting: <https://www.imageevent.org/>

Mohamed Ahmed

President, CBGS

Mohamed.ahmed@tamucc.edu

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**CORPUS CHRISTI GEOLOGICAL SOCIETY
COASTAL BEND GEOPHYSICAL SOCIETY**



LUNCHEON MEETING ANNOUNCEMENT

April 17th, 2024

- Location:** Joe's Crab Shack, 444 North Shoreline Dr.,
Corpus Christi, TX 78401
- Student Sponsors:** Viper Exploration, Imagine Resources,
Mary DeMis. Thank you!
- Time:** 11:30 AM Social, Lunch follows at 11:45 AM,
Speaker at 12:00 PM
- Cost:** \$35.00 (additional \$10.00 surcharge without
reservation: NO SHOW may be billed.)
- Reservations:** Please RSVP by 11:00 AM on Monday, April 15th
before the meeting!

Email: arrangements@ccgeo.org

Please note that luncheon RSVPs are a commitment to Joe's Crab Shack (Shoreline Drive) and must be paid even if you can't attend the luncheon.

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Integration of Machine Learning and Seismic Attributes for Improving Subsurface Interpretation in Hydrocarbon Exploration

Amir Ismail^{1,2}

¹ Department of Physical and Environmental Sciences, Texas A&M University-Corpus Christi, Corpus Christi, Texas 78412, USA

² Geology Department, Faculty of Science, Helwan University, Cairo, P.O. 11795, Egypt

This talk focuses on the application of machine learning to 2D and 3D seismic data analysis. Case studies from the offshore Nile Delta of Egypt and New Zealand show how supervised and unsupervised learning can be used with optimally chosen attributes to build a 3D structural model, gas chimneys, small-scale faults, gas channel detection, and better identification and classification of subtle stratigraphic features. The work also highlights the importance of using ML techniques and multi-attribute analysis as a powerful reservoir description tool to show reservoir distribution and heterogeneity within the channel geometry.

Keyword: Self-organizing maps; seismic attributes; principal component analysis; unsupervised machine learning; supervised machine learning.

BIOGRAPHY



Amir Ismail received a B.Sc. (2007) in geophysics and seismology from Helwan University, Egypt. His M.Sc. (2014) and Ph.D. (2020) from Helwan University, Egypt focused on seismic data processing, seismic stratigraphy, seismic attributes, rock physics, seismic inversion, and machine learning, offshore Nile Delta, Egypt. He was a part of the research team in Università di Napoli Federico II, Department of Physics "Ettore Pancini", Italy for two years (2018-2020). He awarded a research fellowship for six months (2021-2022) from which he has more involved in seismic imaging of the Solfatara crater (Campi Flegrei caldera, southern Italy) project to detect evidence of the fluid's migration

pathways in the shallow structures. Recently, he has received a Fulbright scholarship, and he is currently working in the Geophysics Lab with Dr. Mohamed Ahmed at the Department of Physical and Environmental Sciences, Texas A&M University—Corpus Christi. He is an active member of the EAGE and AAPG and still affiliated with Helwan University, Egypt as a lecturer of Geophysics.

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**CORPUS CHRISTI GEOLOGICAL SOCIETY
COASTAL BEND GEOPHYSICAL SOCIETY**



LUNCHEON MEETING ANNOUNCEMENT

May 15th, 2024

- Location:** Joe's Crab Shack, 444 North Shoreline Dr.,
Corpus Christi, TX 78401
- Student Sponsors:** Viper Exploration, Imagine Resources,
Mary DeMis. Thank you!
- Time:** 11:30 AM Social, Lunch follows at 11:45 AM,
Speaker at 12:00 PM
- Cost:** \$35.00 (additional \$10.00 surcharge without
reservation: NO SHOW may be billed.)
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Email: arrangements@ccgeo.org

Please note that luncheon RSVPs are a commitment to Joe's Crab Shack (Shoreline Drive) and must be paid even if you can't attend the luncheon.

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60 Years of an Independent Geologist

Daniel A. Pedrotti

Dan received his bachelor of Science Degree in Geology from Texas A & M University in May 1953. He spent three years as a Jet Fighter Pilot in the United States Air Force then went back to A&M where he earned a Master of Science Degree in Geology in 1958. He was hired in February by The Texas Company (Texaco) to work as an exploration geologist in the Corpus Christi District Office.

In September 1965 rather than take a transfer to Houston Dan went Independent. He teamed up with a geologist, Bill Miller and several landmen where he discovered a number of small producers; a one-million-barrel Oil field; turned the acreage that led to the discovery of the 100 Bcf El Gato gas field; and through company partnerships participated in several fifty plus Bcf discoveries.

He was a partner in the acquisition of the First State Bank from Clint Murchison and served on the boards of three different banks. He and partner, Bill Miller assembled and purchased two full city blocks and with partners promoted the development of One Shoreline Plaza a two tower 28 story premier office building and the upscale Hershey Hotel now known as the Omni Bayfront.

They joined the Mormac group in the acquisition of Bagget Drilling company to form the five rig Cinco Drilling Company, later sold to Delhi International in exchange for company stock.

He along with his geologist partner, Bill Miller incorporated Suemaur Corporation and Suemaur Exploration, and developed a number of small oil discoveries. In 1990 he with partner Bill Miller and another independent, J M Smith, acquired the Exploration assets of Harkins Drilling Company, hired the management team along with the exploration staff and created the Suemaur Exploration and Production Company. This Company based on the "Exploration Cooperative Concept" became very successful and a major player among small independents.

He also joined as a venture partner in LMP Petroleum Exploration, his son, Mike's company where several very commercial oil and gas fields were developed.

In 2,000, believing that natural gas prices would not rally he sold out his interest in Suemaur, but due to residual interests in prospects developed while still a partner he continues to participate in a number of successful discoveries.

JOIN!



The Desk & Derrick Club of Corpus Christi is a dynamic organization that promotes the education of the petroleum, energy and allied industries and advances the professional

Member Benefits:

- Learn from energy industry experts.
- Network with energy industry leaders and colleagues.
- Attend regional and national meetings.
- Receive critical updates and information about the energy industry.
- Enhance communication and leadership skills.
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For more information about the Desk & Derrick Club of Corpus Christi and to learn about member eligibility, go to www.addc.org or contact Jena Nelson at 361-844-6726 or email at jena@amshore.com

The Desk & Derrick Club of Corpus Christi is a proud affiliate of the Association of Desk And Derrick Clubs, www.addc.org



Carl D Musgrove

December 15, 1932 – December 26, 2023

Carl D Musgrove, a beloved husband, father, grandfather, and respected geologist, passed away December 26, 2023, in Corpus Christi at the age of 91. Born on December 15, 1932, in Paden, Oklahoma, Carl lived a full life with passion for his profession and love for nature.

Following his patriotic spirit and sense of duty, Carl served his country as a veteran in the United States Army from 1953 to 1955. After his honorable discharge, he pursued his academic endeavors and earned a master's degree in Geology from the University of Oklahoma in 1963. With his thirst for knowledge and dedication to his field, he embarked on a fulfilling career that spanned several decades.

For thirty years, Carl worked as a geologist for Exxon Company USA. His expertise and commitment to excellence earned him great respect among his colleagues. Afterward, he became an independent consulting geologist and provided invaluable insights to numerous organizations until June 2020. His contributions were instrumental in shaping the landscape of the geological field.

Outside of work, Carl had a profound appreciation for nature's beauty. As a nature lover at heart, he delighted in spending time outdoors engaging in activities such as hunting and fishing. These moments brought him joy and tranquility while allowing him to connect with the natural world he held dear.

On January 8, 2024, family and friends will gather to pay their final respects to Carl at the Coastal Bend State Veterans Cemetery in Corpus Christi. The graveside service will commence at 1:00 PM local time.

Carl held a special place in the hearts of those who knew him personally. He is survived by his loving wife Billie Ruth Musgrove, who supported him throughout their journey together. Together they built a beautiful family that brought joy into their lives.

He is also survived by his daughters, Carol (Marty) Evans and Patti (Stan) Soles, who will always cherish the memories they shared with their father. Carl's grandchildren, Jeff Evans, Kelly Dean, Pam McLeod, and Melanie Liu brought him immense pride and joy. Additionally, he leaves behind ten great-grandchildren who will carry his legacy forward.

The loss of Carl D Musgrove is deeply felt by all those fortunate enough to have known him. Carl's memory will forever be treasured in the hearts of his loved ones as they find solace in the legacy he leaves behind.

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PHILIP LAURANCE DAVIDSON OBITUARY

Philip Laurance Davidson went to be with his Lord and Savior on Friday, January 5, 2024. He joined parents, Harold and Mabel Davidson; Brother, Richard Davidson; Sis, Frances Davidson Mayfield; grandson, Tyler Davidson; and wife, Dorothy Van Gerpen Davidson.

He is survived by his children: daughter, Susan Ann (Barbara Liedloff) Davidson; sons, Steven Laurance (Lisa) Davidson and Thomas Paul (Andrea) Davidson; grandchildren, Christi Davidson (Landon) Gibbs, Carri Davidson (Joseph) Mecca, Cameron (Heather) Davidson Stephanie Davidson (Michael) Cartwright and Eric (Kasey) Davidson Stephanie Davidson (Michael) Cartwright and Eric (Kasey) Davidson; and great grandchildren, Emma, Tyler, Jack, Jace, Elliot, Caroline, Katy, Pierce, Camille, Peyton and Avery.

Phil was born in Hardy, Nebraska on July 2, 1932. He attended Superior High School in Superior, Nebraska where he was quarterback for the town's first undefeated State Football Champions team of 1949. After graduating from Superior High School in 1950, Phil attended Midland College on football and academic scholarships where he met his wife, Dorothy, at a school dance. They were married on January 29, 1953 at First Baptist Church in Fremont, Nebraska.

Phil transferred to the University of Nebraska, where he was a member of the Sigma Chi fraternity, and received his Bachelors of Science degree in Geology in 1956. Upon graduation, Phil and Dorothy moved the Midland, Texas where he took a job as a petroleum geologist with Texaco. He joined Cosden Petroleum in 1960, moving his family to Corpus Christi, Texas. He became an independent geologist in 1963.

Phil and Dorothy were both active volunteers and supporters of both the Corpus Christi and Horseshoe Bay, Texas communities. They were long-running members of First Baptist Church of Corpus Christi, and founding member of the Church at Horseshoe Bay. Phil was a faithful, life-long testament to Luke 12:48; a humble steward, always helping others.

Phil received many academic, professional, and community achievements throughout his life; but if you asked him what his singular, greatest achievement was, he would answer his family. He was a loving father and doting grandfather and great-grandfather. His hobbies often mirrored his children's passions; from coaching Little League teams, or competing in MORF sailing races in the Gulf of Mexico, to spending time with family and friends on the golf course. He was a life-long learner, lover of history, and an active reader. He loved to fly and became an Instrument Rated pilot. His final days were spent reading through nearly an entire dictionary, writing down words he thought his great-grandchildren should learn.

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539 N Carancahua St, Suite 1100, Corpus Christi, TX 78401
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William Payne Obituary

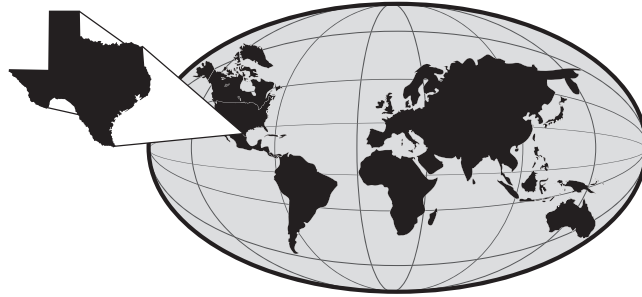
William Ross Payne, age 90, devoted husband and father, went to be with his Lord and Savior December 26, 2023, in [Seguin, Texas](#). Bill's life was guided by the things he learned at an early age from his faithful mother. She taught him about the love of Jesus Christ and how He laid down His life as a sacrifice for mankind's sins.

Bill received a B.A. in Geology from Baylor University in 1955. After serving several years as a 2nd Lieutenant in the Air Force as a Navigational Instructor, he returned to Baylor to receive a M.A. in 1960. He began his career in 1960 as a geologist with the Bureau of Economic Geology in [Austin, Texas](#), where he worked on a High Calcium Limestone Project. He was employed by Texaco, Inc. in 1961 in [Corpus Christi, Texas](#), then with Southland Royalty Company, and became an independent geologist in 1972.

Bill was deacon of Grace Bible Church and Corpus Christi Bible Church. He was a member of Corpus Christi Geological Society, Gulf Coast Geological Society and American Association of Petroleum Geology. He enjoyed gardening, was a Master Gardener and member of South Texas Botanical Gardens, and YMCA of the Coastal Bend.

He is survived by his wife of 68 years, Deanna Stephens Payne, daughter Sharon Payne Franklin and her husband Anthony Morgan Franklin, grandson Joseph Travis Franklin and wife Kirby Gillespie Franklin, daughter Kristen Payne Lyons and her husband Christopher Edward Lyons and stepson Connor Patrick Lyons, daughter Kerrie Payne Olsen and her husband Eric Robert Olsen. He is predeceased by his parents William Douthitt Payne and Norma Broyles Payne, son Stephen Ross Payne, and grandson Anthony Ross Franklin.

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Jackson	Austin Chalk	Pearsall
Yegua	Eagle Ford	Sligo
Wilcox	Buda	Cotton Valley
Olmos	Georgetown	Smackover

Thunder is currently seeking non-operated working interest participation in projects and prospects.

**Contact Walter S. Light Jr.
President/Geologist**

713.823.8288

EMAIL: wthunderx@aol.com

The Balcones Igneous Province of South Central Texas: Revisions To The Age Of Volcanism and Suggestions For An Emplacement Mechanism

Mark E. Thompson Geologist

San Antonio, Texas

PRESENTATION ABSTRACT

Exposures of Cretaceous alkalic igneous rocks along the northern margin of the Texas Gulf Coast have been well documented since the earliest geological surveys of Texas. Intrusive exposures extend southward into the subsurface where igneous deposits become characterized by extrusive volcanic tuff mounds. All igneous deposits, both intrusive and extrusive are collectively known as the Balcones Igneous Province (BIP). The general geology of the BIP rocks is discussed along with a description of their composition which is dominated by ultramafic classifications.

Data obtained on the subsurface portion of the BIP from an active, ongoing oil and gas exploration program is used to prepare a series of detailed stratigraphic cross sections which permit dating of the volcanic events by stratigraphic methods. Volcanic eruptions in the BIP are documented to have commenced significantly earlier in the Cretaceous and to occur over a much longer duration of 24 Ma (late Cenomanian to early Maastrichtian) than the 8 Ma duration from age dates (late Santonian to Mid Campanian) offered by recently published geochronology studies. This revised age range for the BIP expands the time frame for BIP emplacement which has implications on geologic interpretations of Late Cretaceous plate movements in the northern Gulf of Mexico.

The tectonic history of south-central Texas is described and the relationship between the BIP and the Mesoproterozoic Llano Front, the late Paleozoic Ouachita Orogenic Front, and the early Mesozoic opening of the Gulf of Mexico is discussed.

Petrogenesis of the BIP requires eruption at the surface of deep-seated ultramafic magmatism on a passive continental plate margin with no evidence for the involvement of either subduction nor a "hot spot" thermal plume. A suggestion is offered for an edge convection mechanism that satisfies this requirement.

BIOGRAPHY

Mark was born and raised in a very small dairy farming town in south-central Wisconsin. He attended the University of Wisconsin at Oshkosh where he received a Bachelor of Science degree in Geology and he then enrolled in graduate school at the University of Wisconsin at Milwaukee where he earned the Master of Science degree in Geology.

He has a 46-year career as a professional geologist which began in the mining industry in the Lake Superior area and continued in the oil and gas business in Texas. His years in Dallas, Houston and then in San Antonio involved employment by both large and small companies and also time spent on his own as an independent petroleum geologist. Mark owns Bastrop Energy Group, a San Antonio based exploration and production company, and in addition to operating oil properties he originates, leases and sells drill prospects in central Texas.

Mark is an active member of the South Texas Geological Society, AAPG, GSA and he has published numerous articles on the geology of south-central Texas. Mark and Jane, his wife of 44 years, have 2 children and 4 grandchildren.

BALCONES IGNEOUS PROVINCE OF SOUTH CENTRAL TEXAS

An Alkaline Ultramafic Volcanic Province

WHAT IS IT?

WHAT IS ITS AGE?

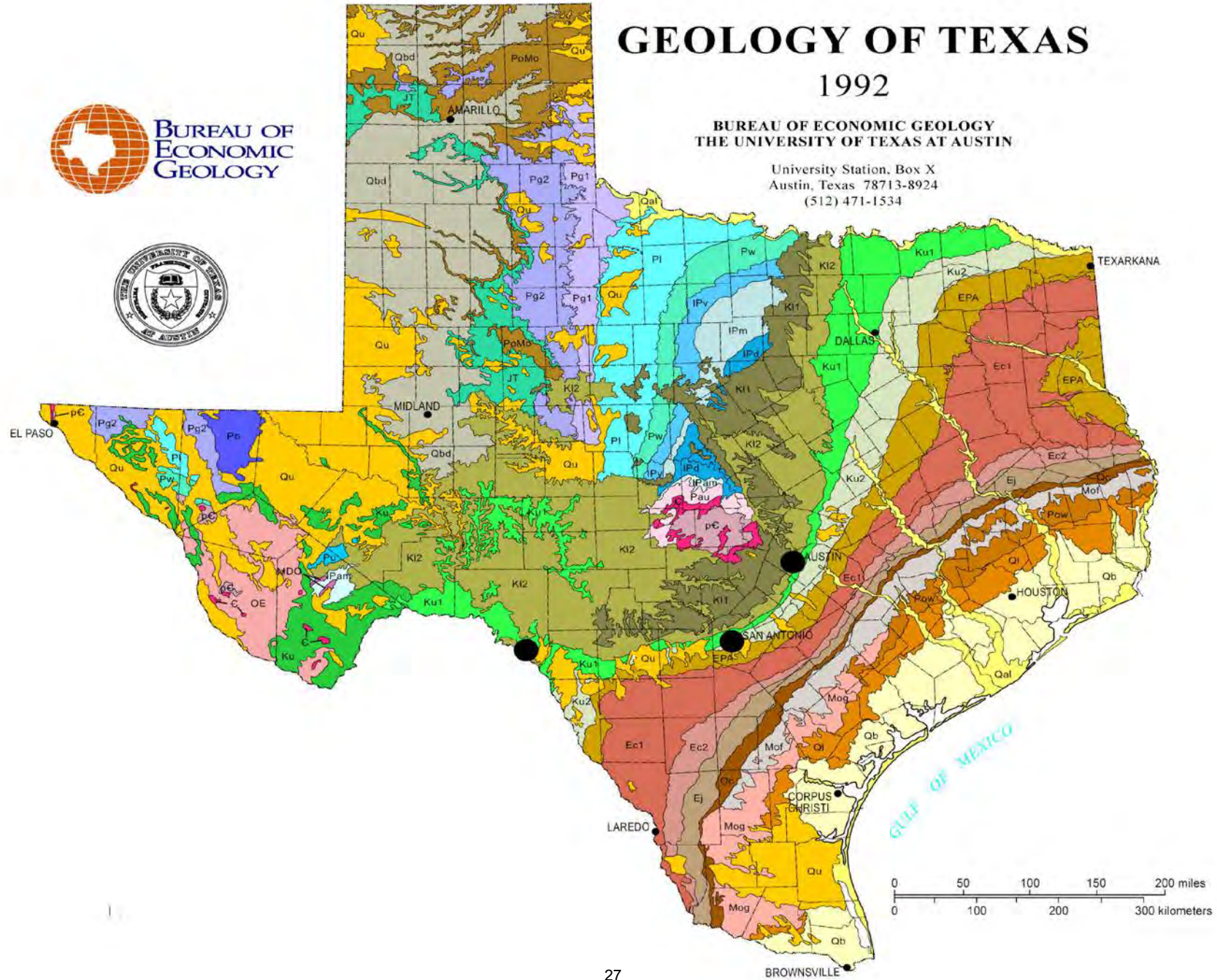
**WHAT IS THE EMPLACEMENT
MECHANISM?**

GEOLOGY OF TEXAS

1992

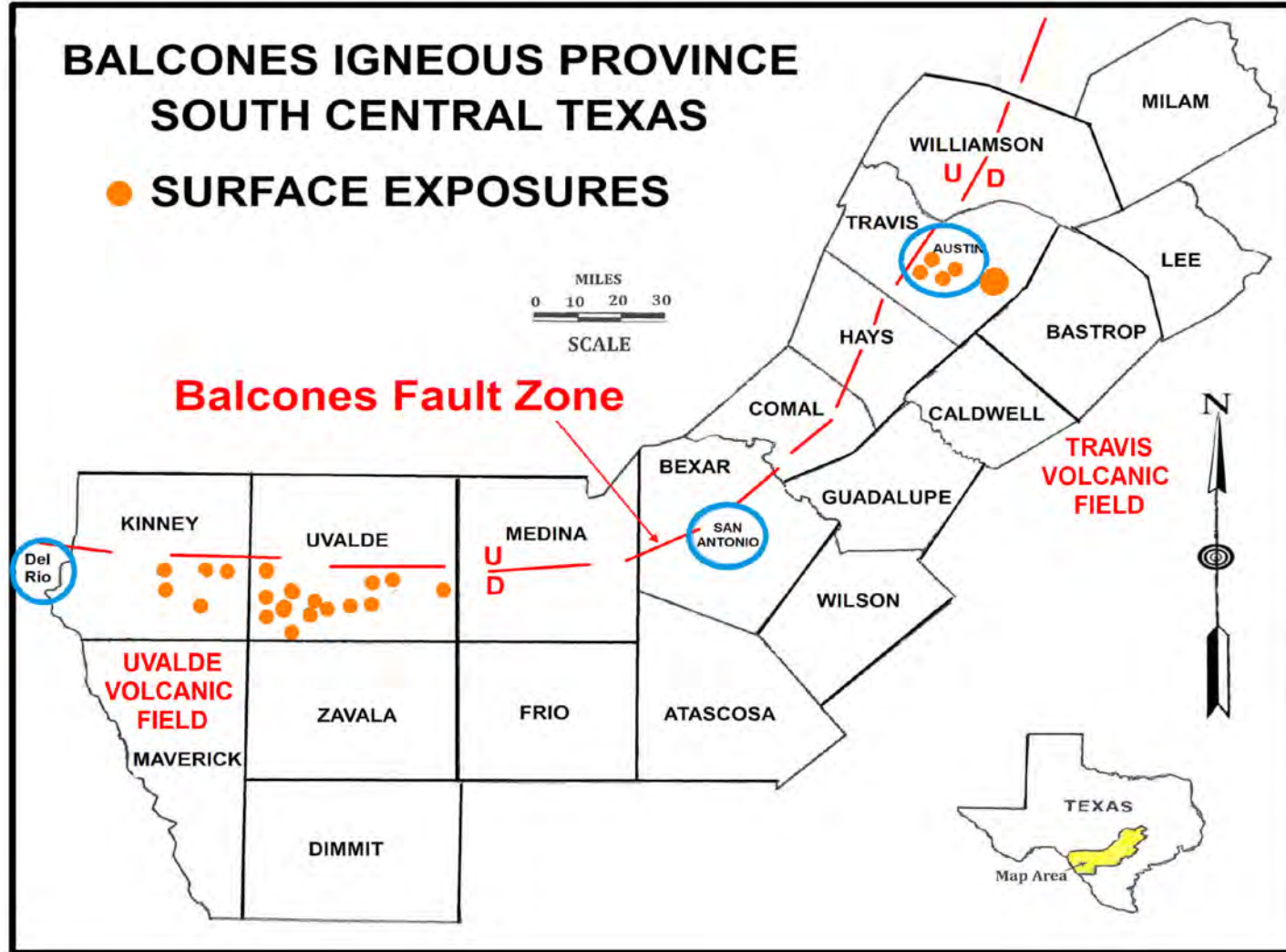
BUREAU OF ECONOMIC GEOLOGY
THE UNIVERSITY OF TEXAS AT AUSTIN

University Station, Box X
Austin, Texas 78713-8924
(512) 471-1534



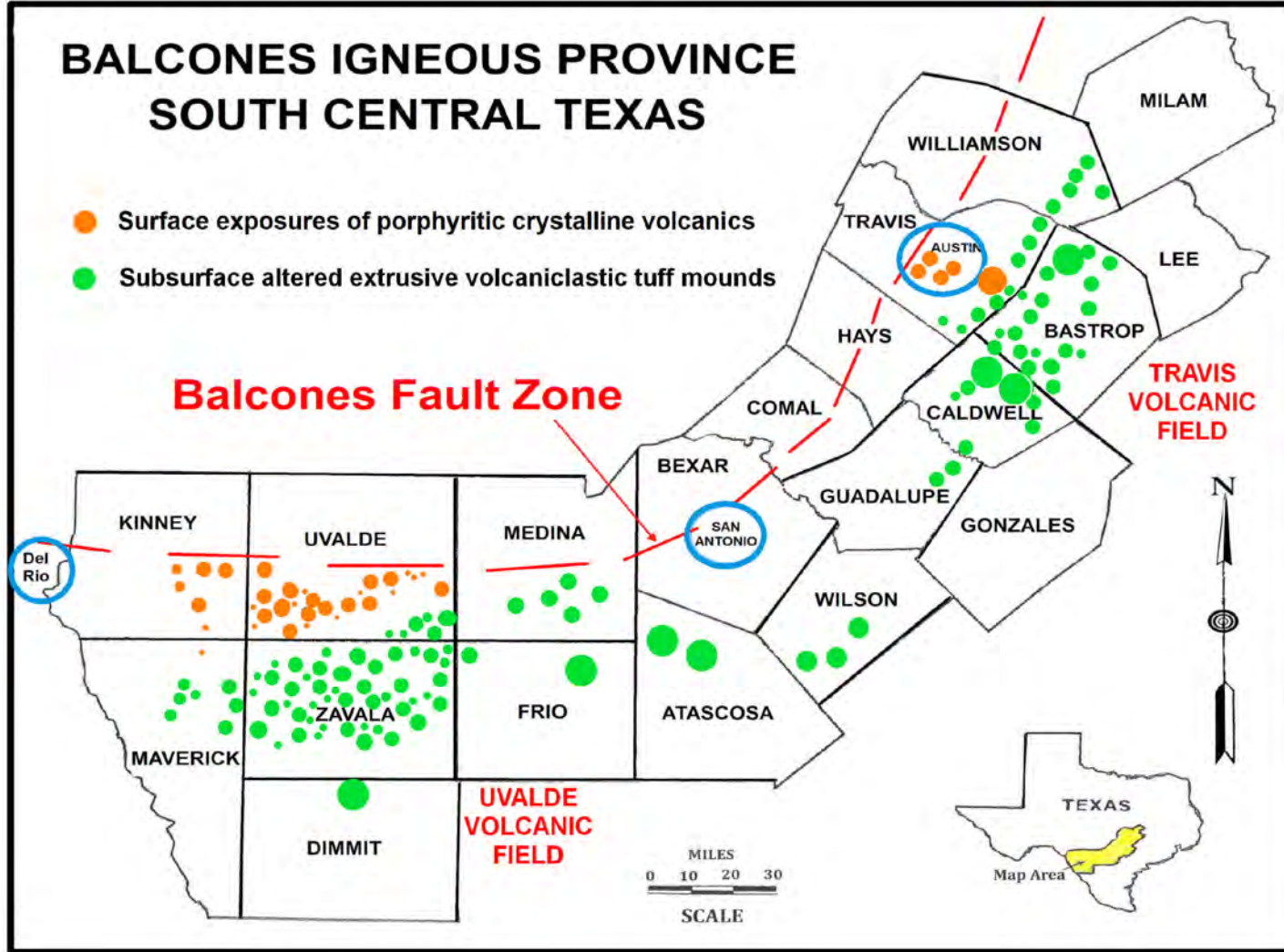
BALCONES IGNEOUS PROVINCE SOUTH CENTRAL TEXAS

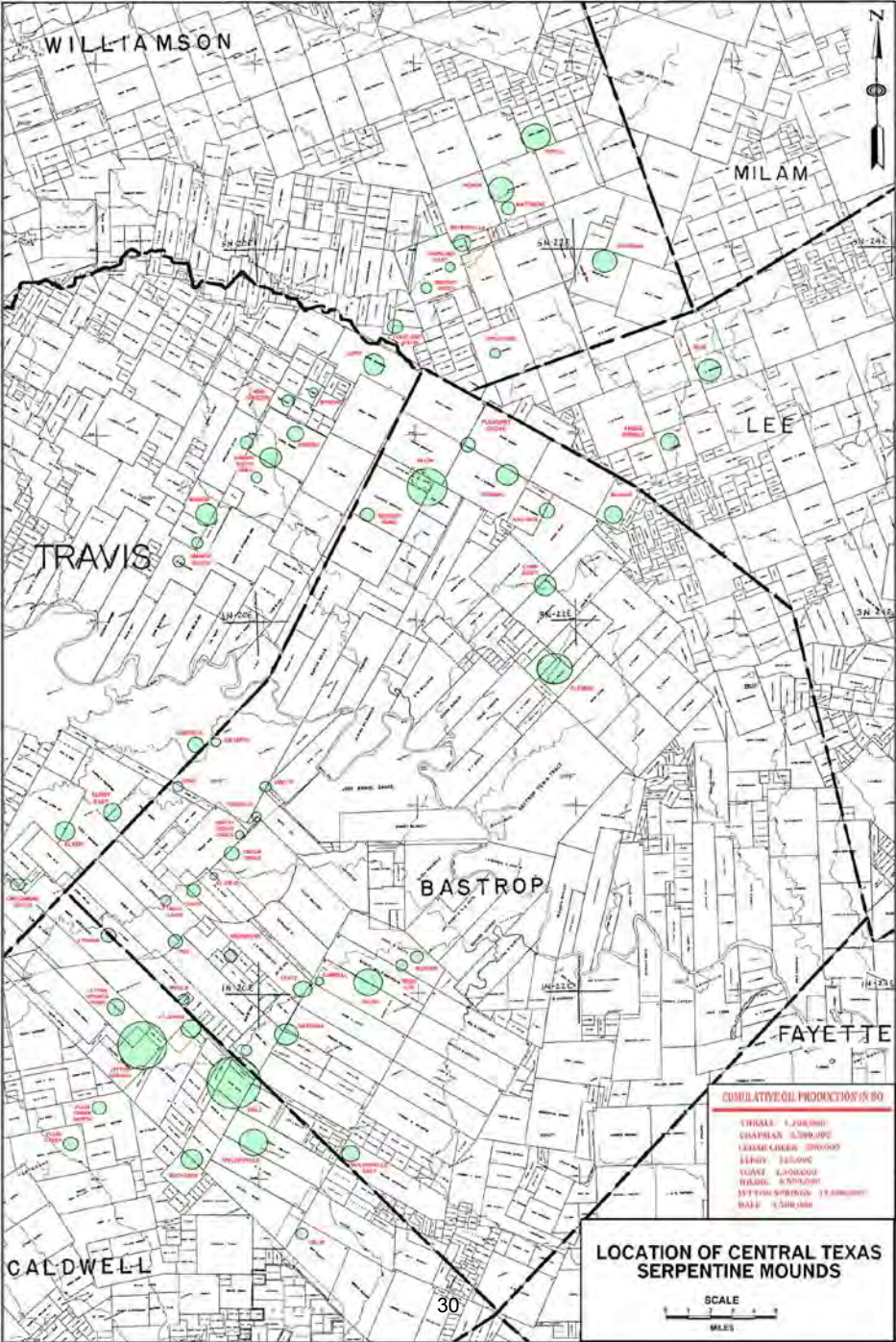
● SURFACE EXPOSURES

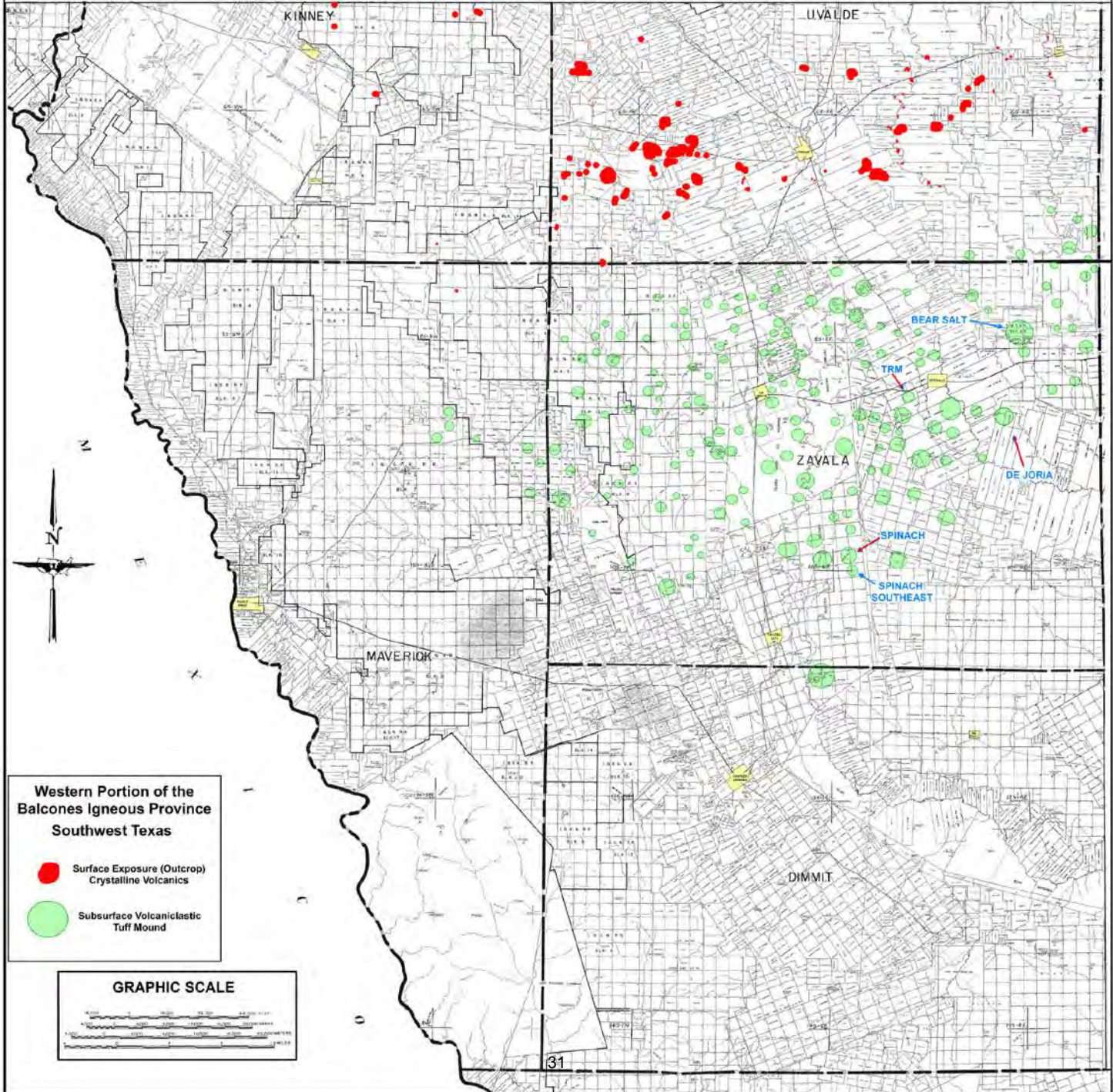


BALCONES IGNEOUS PROVINCE SOUTH CENTRAL TEXAS

- Surface exposures of porphyritic crystalline volcanics
- Subsurface altered extrusive volcanoclastic tuff mounds

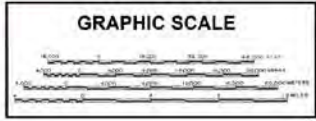






**Western Portion of the
Balcones Igneous Province
Southwest Texas**

- Surface Exposure (Outcrop)
Crystalline Volcanics
- Subsurface Volcaniclastic
Tuff Mound



INTRUSIVE SURFACE EXPOSURES

**BLACK COLOR
HARD
DENSE
HEAVY: SPEC. GRAV. = 3.25
COMMONLY MAGNETIC**

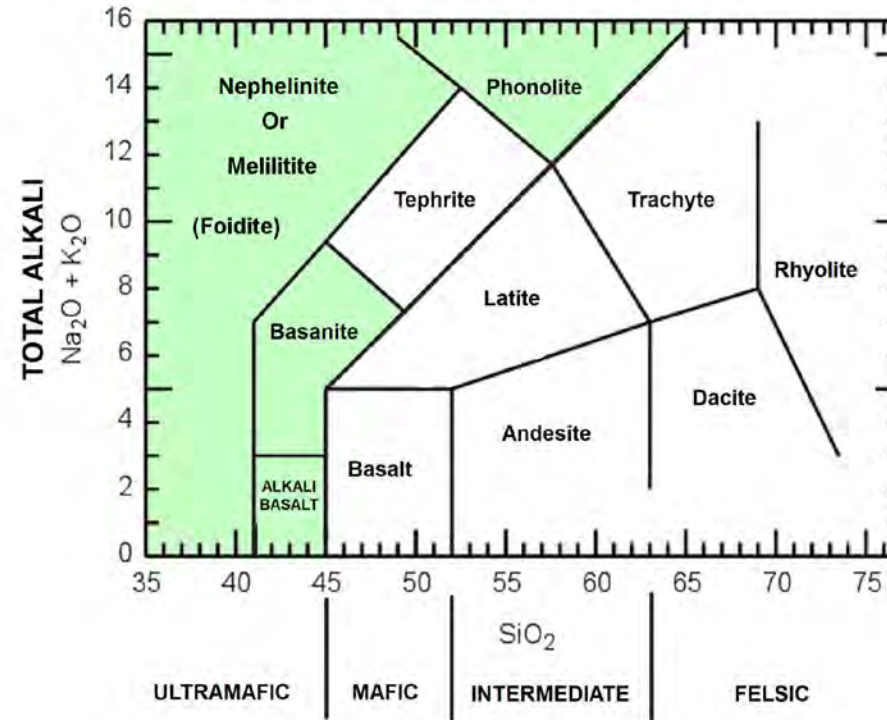
**Black Groundmass, Porphyritic With
5-20 vol. % Phenocrysts of Olivine & Augite**

**The Groundmass Under The Microscope is
Augite, Olivine, Magnetite and
Feldspathoids (Nepheline & Melilite).**

**Feldspar is Totally Lacking In Most Of The
Ultramafic Intrusives Other Than Minor
Amounts of Ca-Plagioclase.**



CLASSIFICATION OF B.I.P. PORPHYRITIC IGNEOUS ROCKS USING TOTAL ALKALI VS SILICA



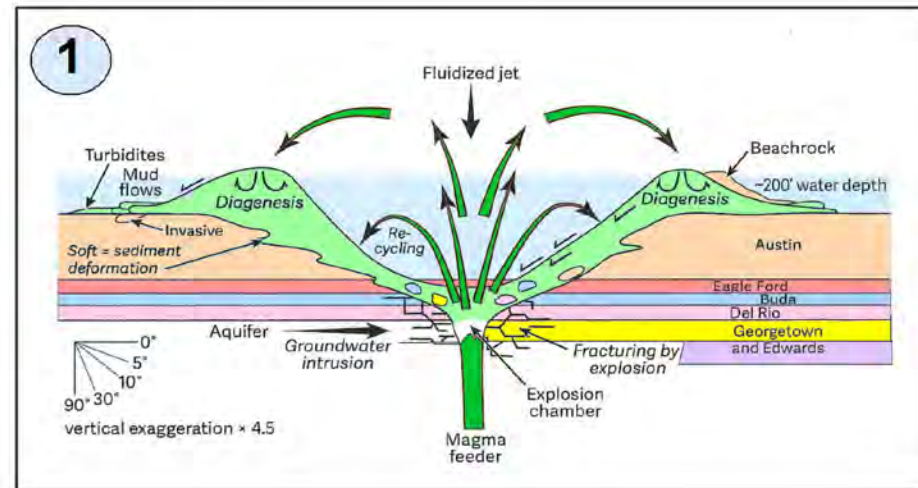
FIVE CRYSTALLINE ROCK TYPES OF BIP



EXTRUSIVE SUBSURFACE MOUNDS

EXPLOSIVE, SUBMARINE ERUPTIONS EXCAVATE A CRATER

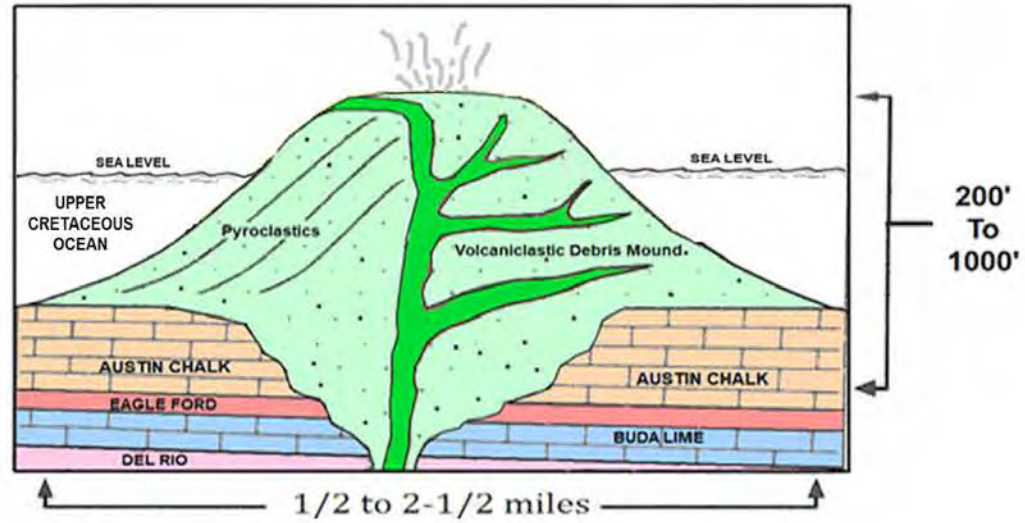
STRATIFIED ASH
TUFFS AND LAPILLI TUFFS
VOLCANICLASTIC DEBRIS
PYROCLASTICS, LAHARS, MUD FLOWS



The Crater Is Filled With Volcanics Debris And A
Cone Forms Above The Filled Crater

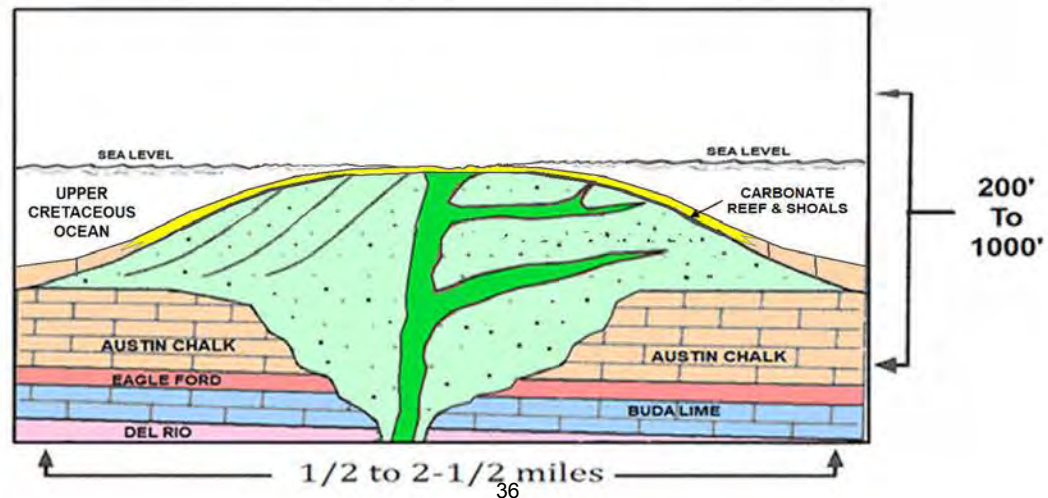
2

Volcanic Eruption Ends



3

Top Eroded Off Carbonates Cover Top & Flanks



EXTRUSIVE SUBSURFACE MOUNDS

The Mound Is Composed Of

**Stratified Ash, Volcanic Tuff, Lapilli Tuff,
Volcaniclastic Debris, Pyroclastic Debris,
Lahars, Mud Flows**

**The Entire Volcanic Pile Undergoes
Diagenesis By The Sea Water To Create
A Mixture Of Green, Hydrous Minerals
commonly Mg-Fe rich.**

**Smectite Nontronite Vermiculite
Saponite Chlorite**

AND

Chrysolite Magnetite Xenotlite Serpentine

**The Diagenetic Process Creates Secondary
Porosity In The Volcanic Mounds Which Is
Favorable For Entrapment Of Hydrocarbons.**

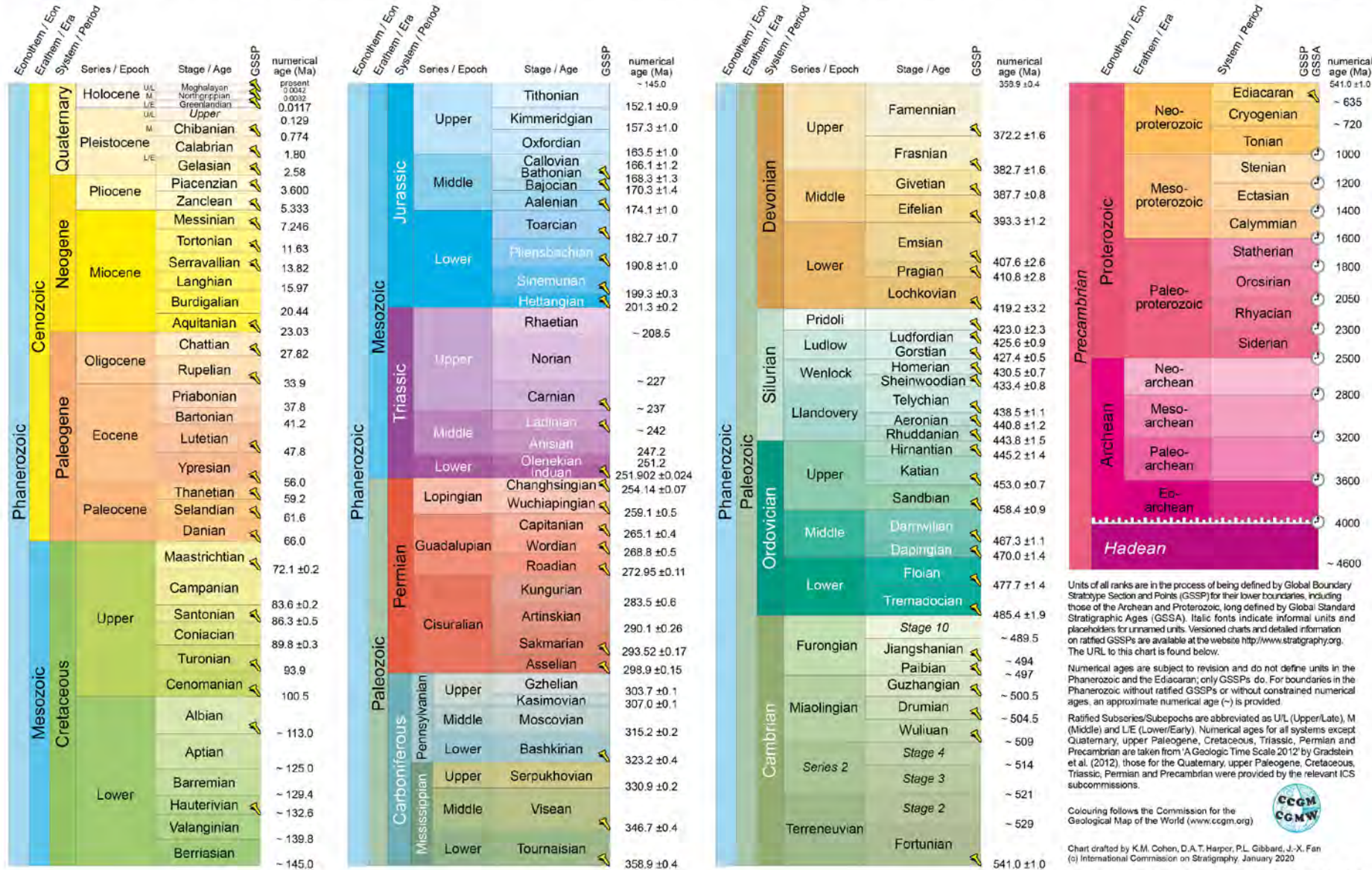


INTERNATIONAL CHRONOSTRATIGRAPHIC CHART

www.stratigraphy.org

International Commission on Stratigraphy

v 2020/01



Units of all ranks are in the process of being defined by Global Boundary Stratotype Section and Points (GSSP) for their lower boundaries, including those of the Archean and Proterozoic, long defined by Global Standard Stratigraphic Ages (GSSA). Italic fonts indicate informal units and placeholders for unratified units. Versioned charts and detailed information on ratified GSSPs are available at the website <http://www.stratigraphy.org>. The URL to this chart is found below.

Numerical ages are subject to revision and do not define units in the Phanerozoic and the Ediacaran; only GSSPs do. For boundaries in the Phanerozoic without ratified GSSPs or without constrained numerical ages, an approximate numerical age (~) is provided.

Ratified Subseries/Subepochs are abbreviated as UL (Upper/Late), M (Middle) and L/E (Lower/Early). Numerical ages for all systems except Quaternary, upper Paleogene, Cretaceous, Triassic, Permian and Precambrian are taken from 'A Geologic Time Scale 2012' by Gradstein et al. (2012); those for the Quaternary, upper Paleogene, Cretaceous, Triassic, Permian and Precambrian were provided by the relevant ICS subcommissions.

Colouring follows the Commission for the Geological Map of the World (www.ccgw.org)



Chart crafted by K.M. Cohen, D.A.T. Harper, P.L. Gibbard, J.-X. Fan (c) International Commission on Stratigraphy, January 2020

To cite: Cohen, K.M., Finney, S.C., Gibbard, P.L. & Fan, J.-X. (2013), updated! The ICS International Chronostratigraphic Chart. Episodes 36: 189-204.

URL: <http://www.stratigraphy.org/ICSchart/ChronostratChart2020-01.pdf>

AGE DATING ROCKS

- 1) Paleontology - Fossil Fauna Zonation
- 2) Isotopic Geochronology -
Absolute Age Date in Years
- 3) Stratigraphic Correlation -
Using Law of Superposition

CRETACEOUS STRATIGRAPHIC SECTION SOUTH CENTRAL TEXAS

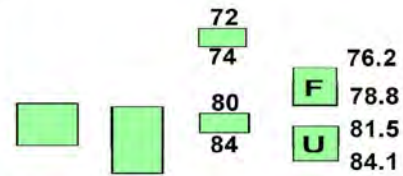
		EUROPEAN STAGES		FORMATIONS		GROUP
				UVALDE FIELD	TRAVIS FIELD	
CRETACEOUS	GULFIAN	MAESTRICHtian	66	ESCONDIDO	CORSICANA	NAVARRO
		CAMPANIAN	72	OLMOS	BERGSTROM	TAYLOR
				SAN MIGUEL	PEGAN GAP	
				ANACACHO	DALE	
			SANTONIAN	83	AUSTIN CHALK	
		CONIACIAN	86			
	TURONIAN	90	EAGLE FORD		EAGLE FORD	
	COMANCHEAN	CENOMANIAN	94	BUDA	WASHITA	
				DEL RIO		
				GEORGETOWN		
		ALBIAN	102	EDWARDS A	FREDERICKS-BURG	
				EDWARDS B		
				GLEN ROSE		
APTIAN		113	PEARSALL	TRINITY		
		SLIGO				
BARREMIAN	126	HOSSTON				

* Isotopic Time Scale Ages in m.y.

CRETACEOUS STRATIGRAPHIC SECTION SOUTH CENTRAL TEXAS

		EUROPEAN STAGES		FORMATIONS		GROUP
				UVALDE FIELD	TRAVIS FIELD	
CRETACEOUS	GULFIAN	MAESTRICHTIAN	66	ESCONDIDO	CORSICANA	NAVARRO
		CAMPANIAN	72	OLMOS	BERGSTROM	TAYLOR
				SAN MIGUEL	PECAN GAP	
				ANACACHO	DALE	
		SANTONIAN	83	AUSTIN CHALK		AUSTIN
		CONIACIAN	86			
	TURONIAN	90				
	COMANCHEAN	CENOMANIAN	94	EAGLE FORD		EAGLE FORD
				BUDA		WASHITA
				DEL RIO		
		ALBIAN	102	GEORGETOWN		FREDERICKS-BURG
				EDWARDS A		
				EDWARDS B		
				GLEN ROSE		
APTIAN	113	PEARSALL		TRINITY		
		SLIGO				
BARREMIAN	126	HOSSTON				

SELLARDS, 1932
 YOUNG, 1985
 Ammonite Zonation
 MIGGINS, et al, 2004
 Ar40 / Ar39
 GRIFFIN, et al, 2010
 Zircon U-Pb &
 Ar40 / Ar39



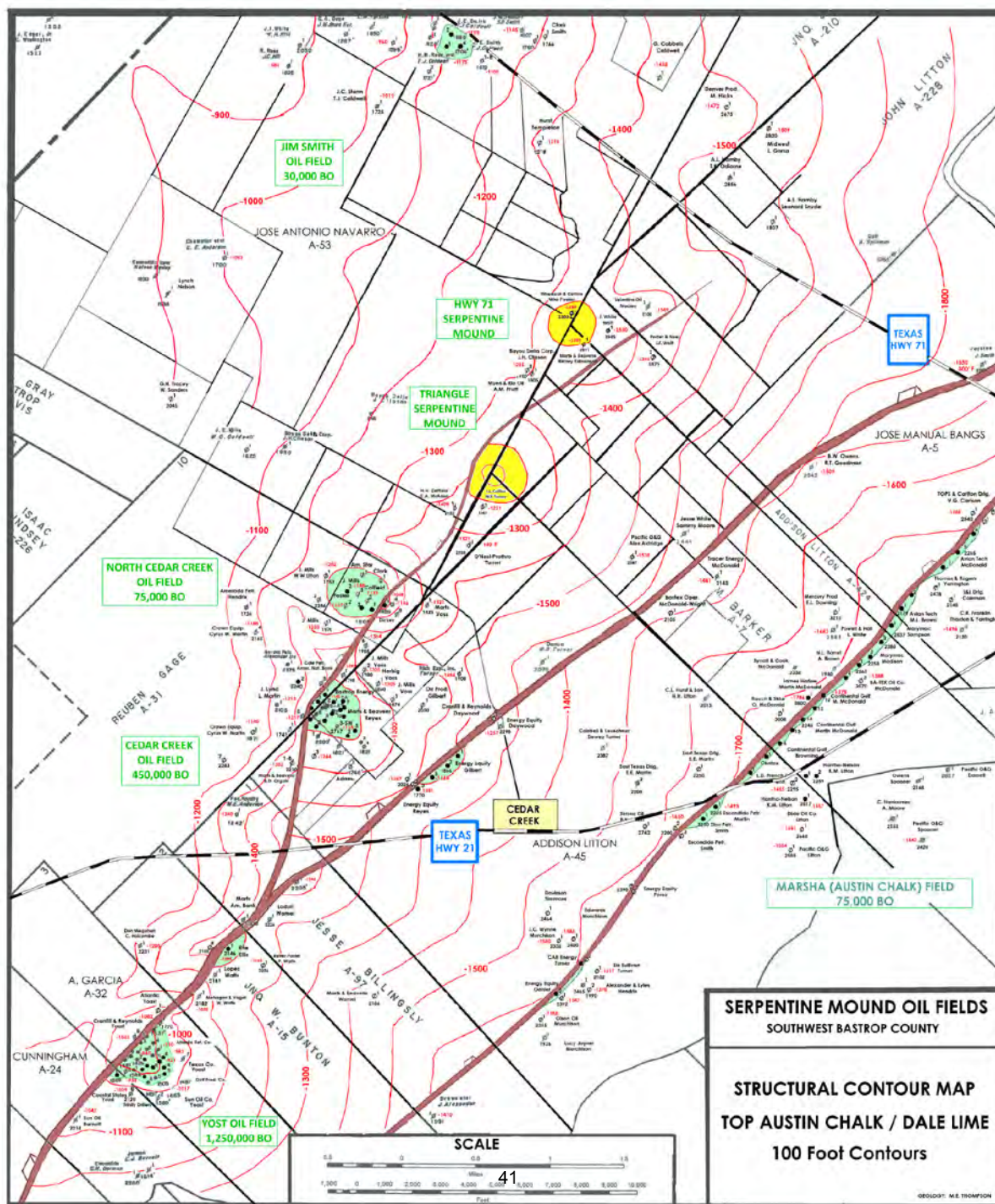
PIERCE, et al, 2016

Mafic Ash Beds In
 Eagle Ford and
 Lower Austin



**DATING THE B.I.P.
 IGNEOUS ERUPTIONS
 USING
 PALEONTOLOGY AND
 ISOTOPIC GEOCHRONOLOGY**

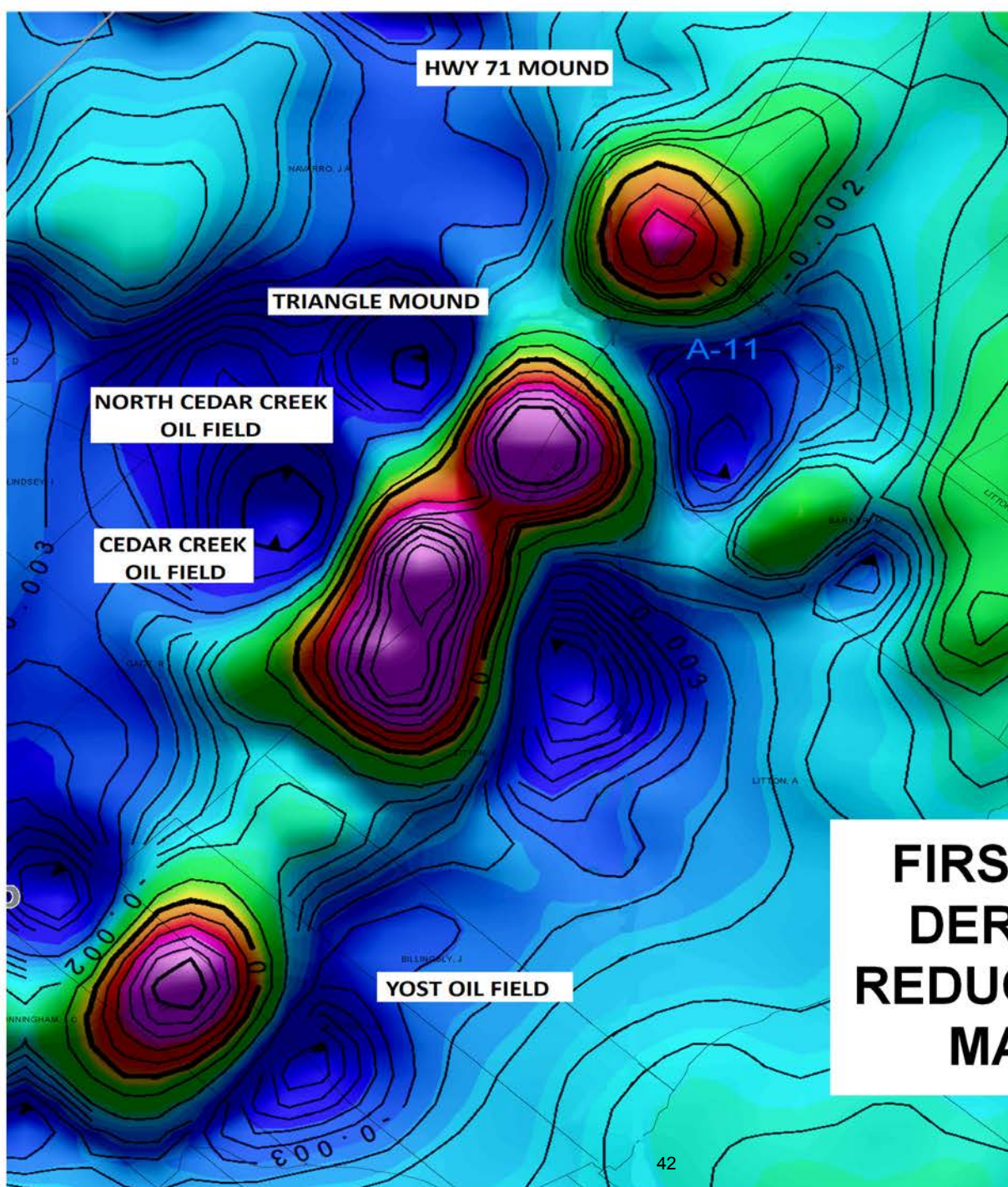
* Isotopic Time Scale Ages in m.y.



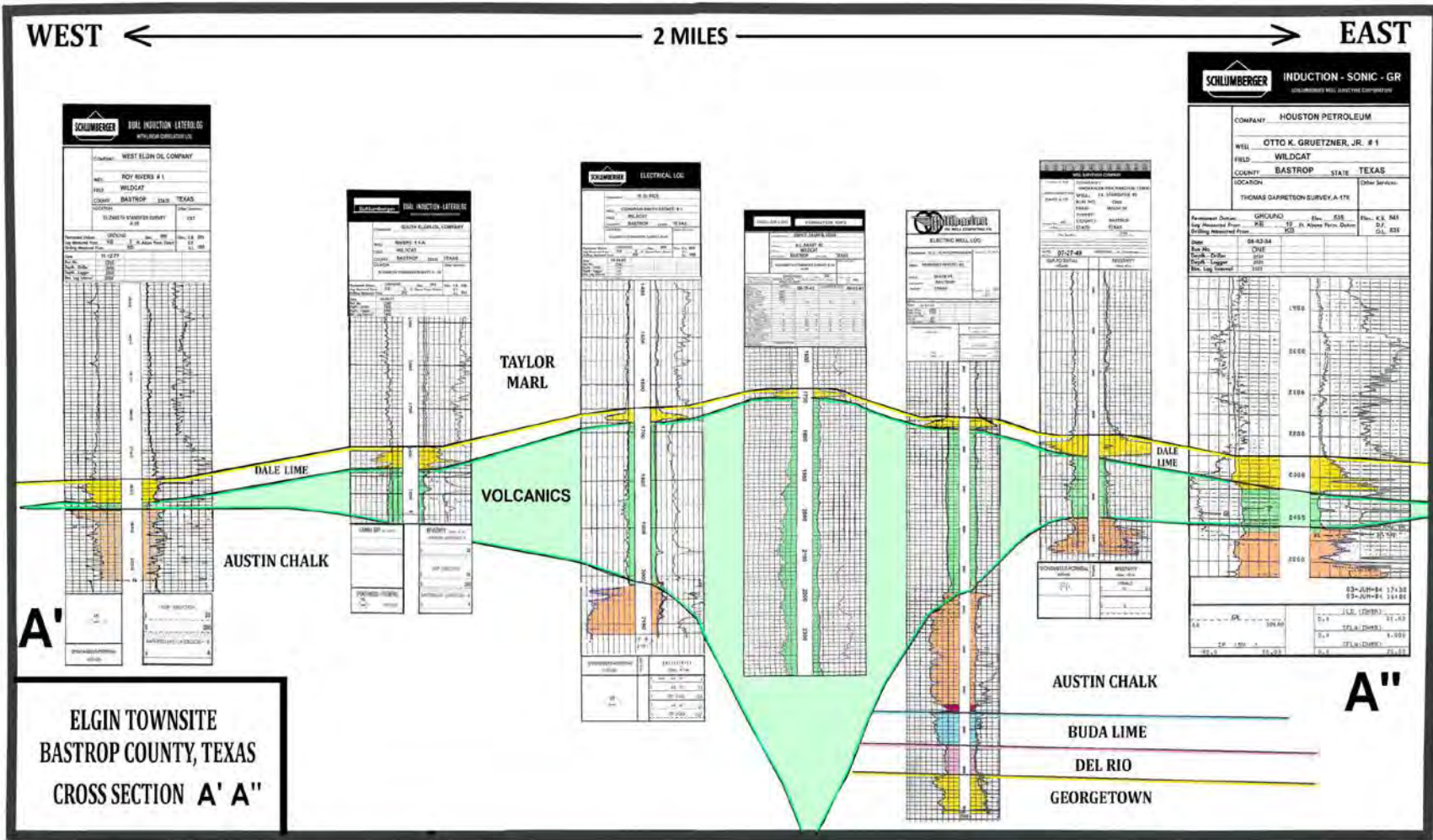
SERPENTINE MOUND OIL FIELDS
SOUTHWEST BASTROP COUNTY

STRUCTURAL CONTOUR MAP
TOP AUSTIN CHALK / DALE LIME
100 Foot Contours





**FIRST VERTICAL
DERIVATIVE OF
REDUCED TO POLE
MAGNETICS**



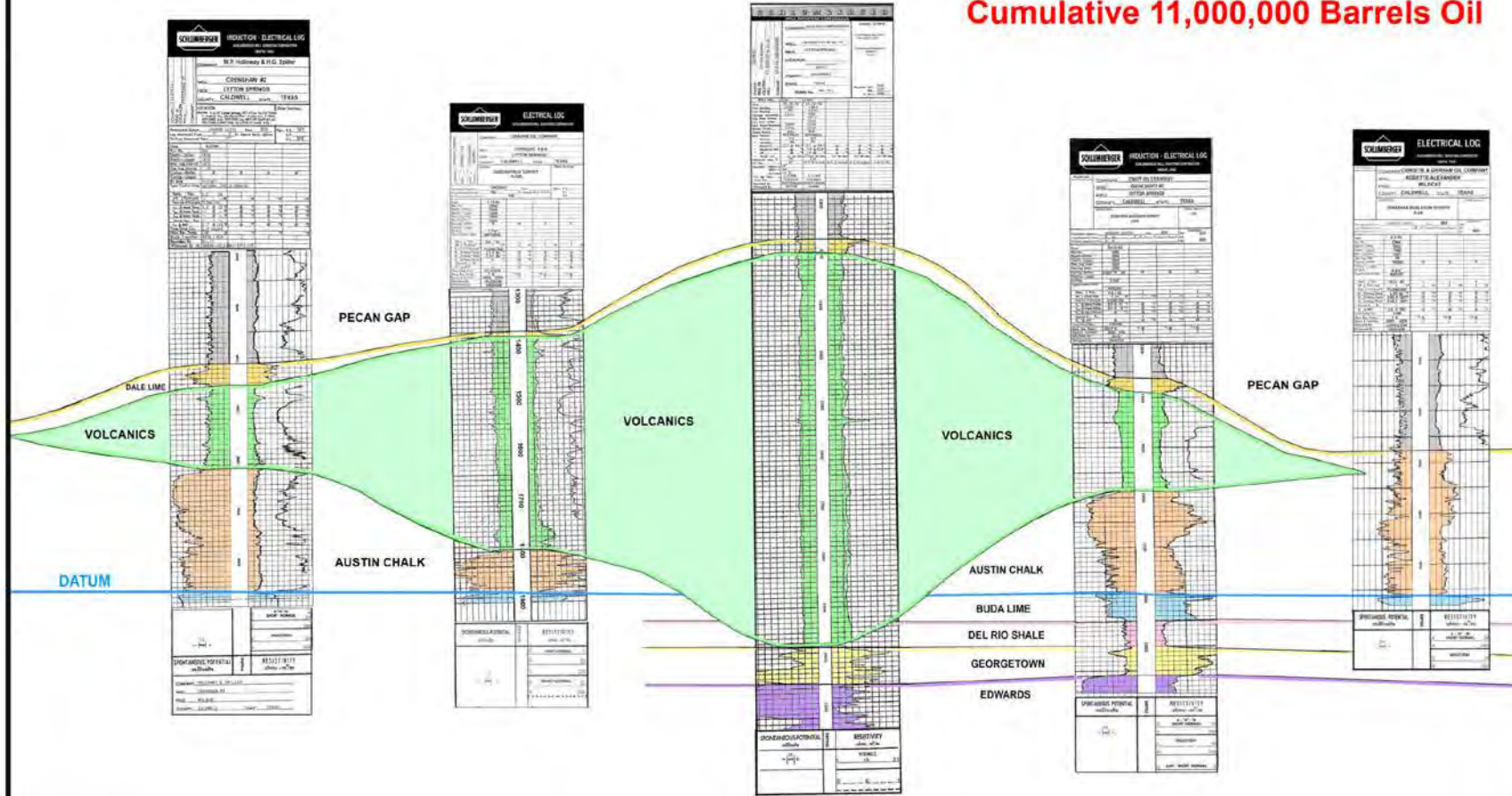
NE

SW

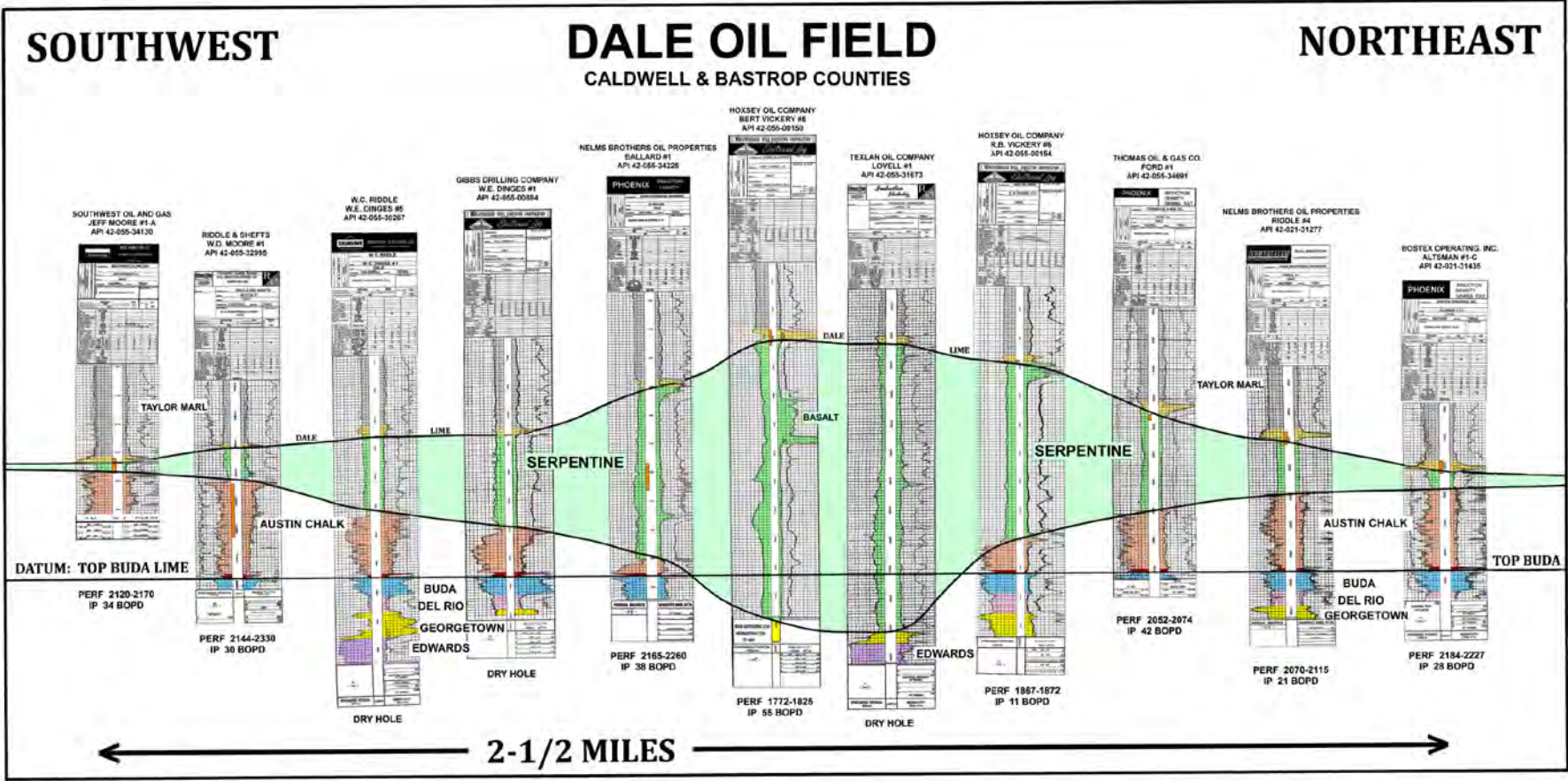
STRATIGRAPHIC CROSS SECTION

LYTTON SPRINGS OIL FIELD CALDWELL COUNTY, TEXAS

Discovered 1925
Cumulative 11,000,000 Barrels Oil



2-1/2 MILES



NORTH

STRATIGRAPHIC CROSS SECTION

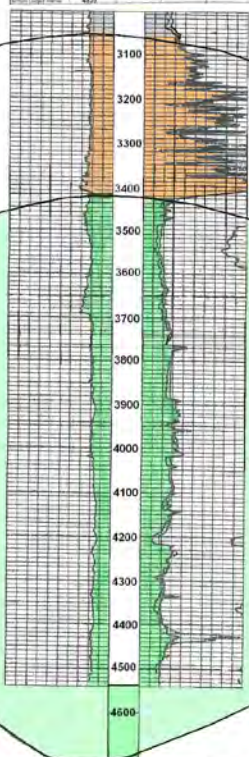
SOUTH

CAMP SWIFT VOLCANIC MOUND BASTROP COUNTY

WESTERN ATLAS
DUAL INDUCTION FOCUSED LOG
MULTIPOLE ARRAY ACUSTILOG
GAMMA RAY LOG

COMPANY: KCS RESOURCES, INC.
WELL: CAMP SWIFT #1
FIELD: WILDCAT
COUNTY: BASTROP STATE: TEXAS
LOCATION: DAVID HOLDERMAN SURVEY, A-192

DATE: 08-41-98
LOG NO: 150221
WELL NO: 474 MD
TVD: 4444 TVD



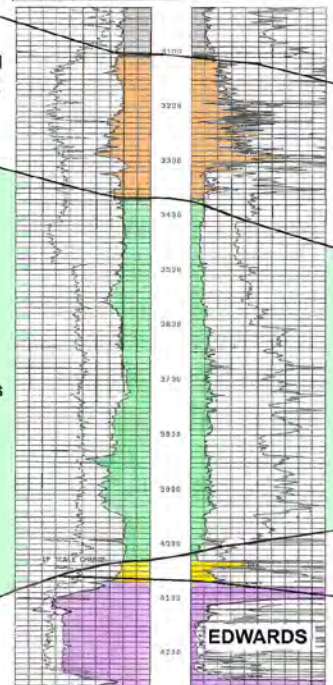
DRILLER TD 4714 MD, 4444 TVD

SPONTANEOUS POTENTIAL (mV)	DEPTH (MD)	RESISTIVITY (ohm m)
20	3100	10
0	3200	2
0	3300	10
0	3400	100

PRECISION
SIMULTANEOUS TRIPLE INDUCTION / SPECTRAL DENSITY / NEUTRON LOG

COMPANY: TANGLEWOOD OIL & GAS
WELL: CAMP SWIFT #6
FIELD: WILDCAT
COUNTY: BASTROP STATE: TEXAS
LOCATION: DAVID HOLDERMAN SURVEY, A-192

DATE: 08-AUG-2005
LOG NO: 348290
WELL NO: 476 MD
TVD: 4278

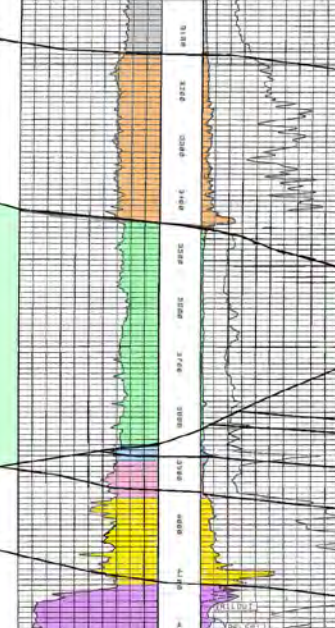


SPONTANEOUS POTENTIAL (mV)	DEPTH (MD)	RESISTIVITY (ohm m)
20	3100	20
0	3200	4
0	3300	20
0	3400	150

Drillmaster
Combination Logging Systems
DUAL INDUCTION FOCUSED LOG
MULTIPOLE ARRAY ACUSTILOG
GAMMA RAY LOG

COMPANY: KCS RESOURCES, INC.
WELL: CAMP SWIFT #3
FIELD: WILDCAT
COUNTY: BASTROP STATE: TEXAS
LOCATION: DAVID HOLDERMAN SURVEY, A-192

DATE: 17-AUG-98
LOG NO: 150221
WELL NO: 474 MD
TVD: 4214

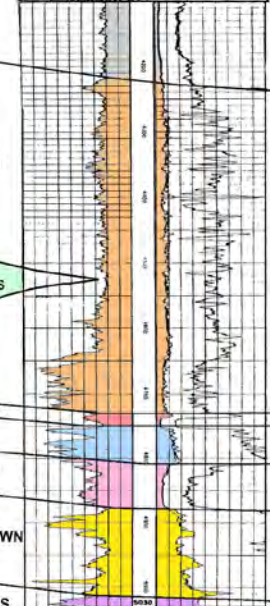


SPONTANEOUS POTENTIAL (mV)	DEPTH (MD)	RESISTIVITY (ohm m)
20	3100	100
0	3200	10
0	3300	100
0	3400	1000

Schlumberger Well Services Corporation
Electrical Log

COMPANY: KCS RESOURCES, INC.
WELL: D. B. SANDER, A.R.
FIELD: WILDCAT
LOCATION: DAVID HOLDERMAN SURVEY, A-192
COUNTY: BASTROP STATE: TEXAS

DATE: 08/18/98
LOG NO: 150221
WELL NO: 474 MD
TVD: 4214



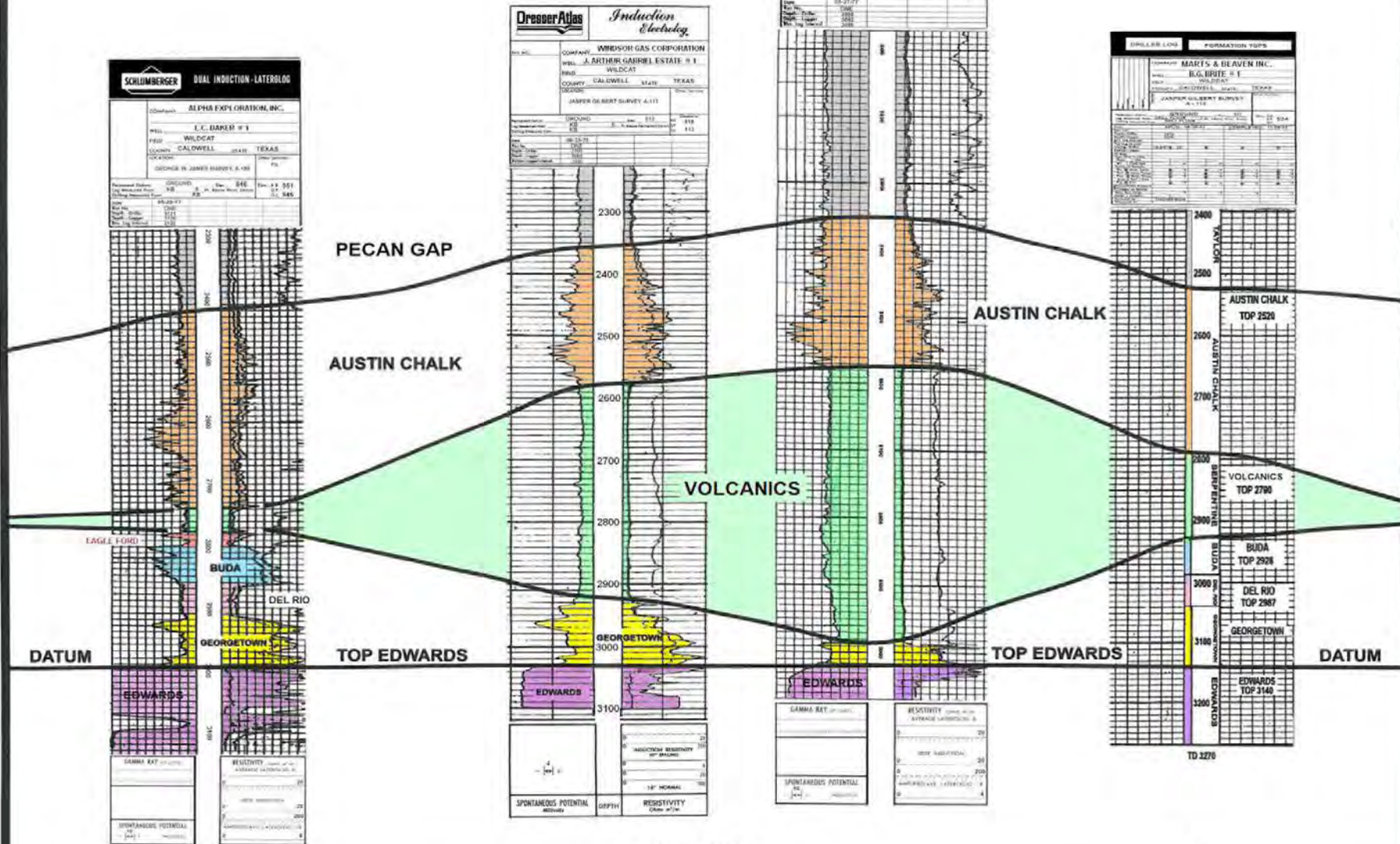
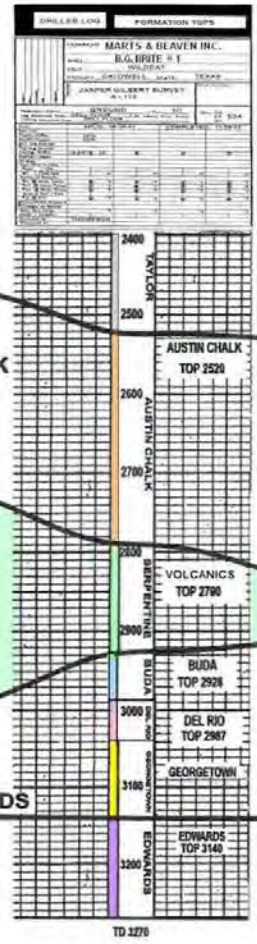
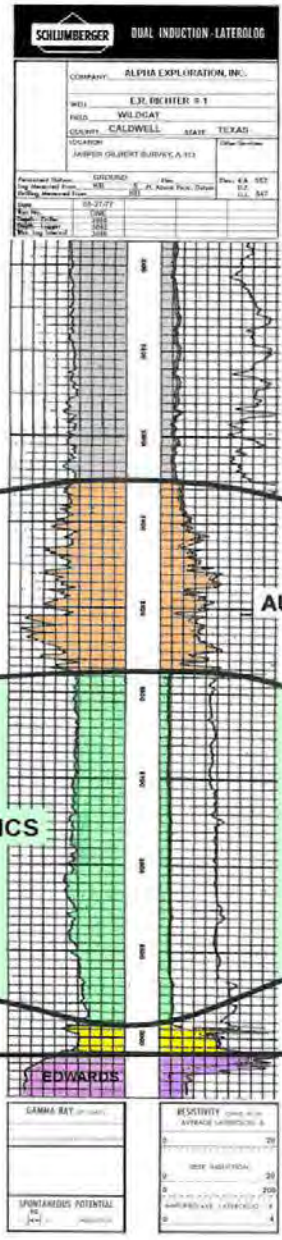
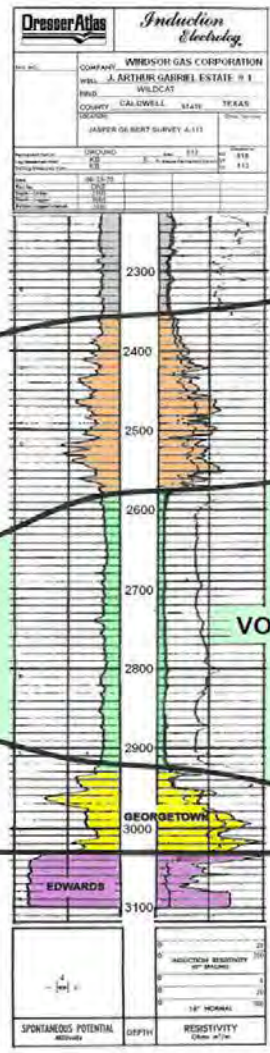
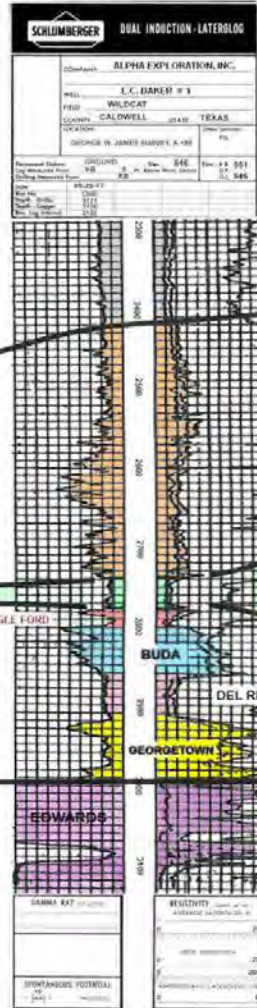
SPONTANEOUS POTENTIAL (mV)	DEPTH (MD)	RESISTIVITY (ohm m)
20	3100	100
0	3200	10
0	3300	100
0	3400	1000

The #1 Camp Swift has a deviated well bore.
The log is modified to portray TVD depths.
Base Volcanics = 4700 MD = 4430 TVD.

SW

NE

TAYLORSVILLE VOLCANIC MOUND CALDWELL COUNTY, TEXAS



ONE MILE

SOUTHWEST

NORTHEAST

NELMS BROS. OIL PROP. HILL #1
 API 42-021-31336

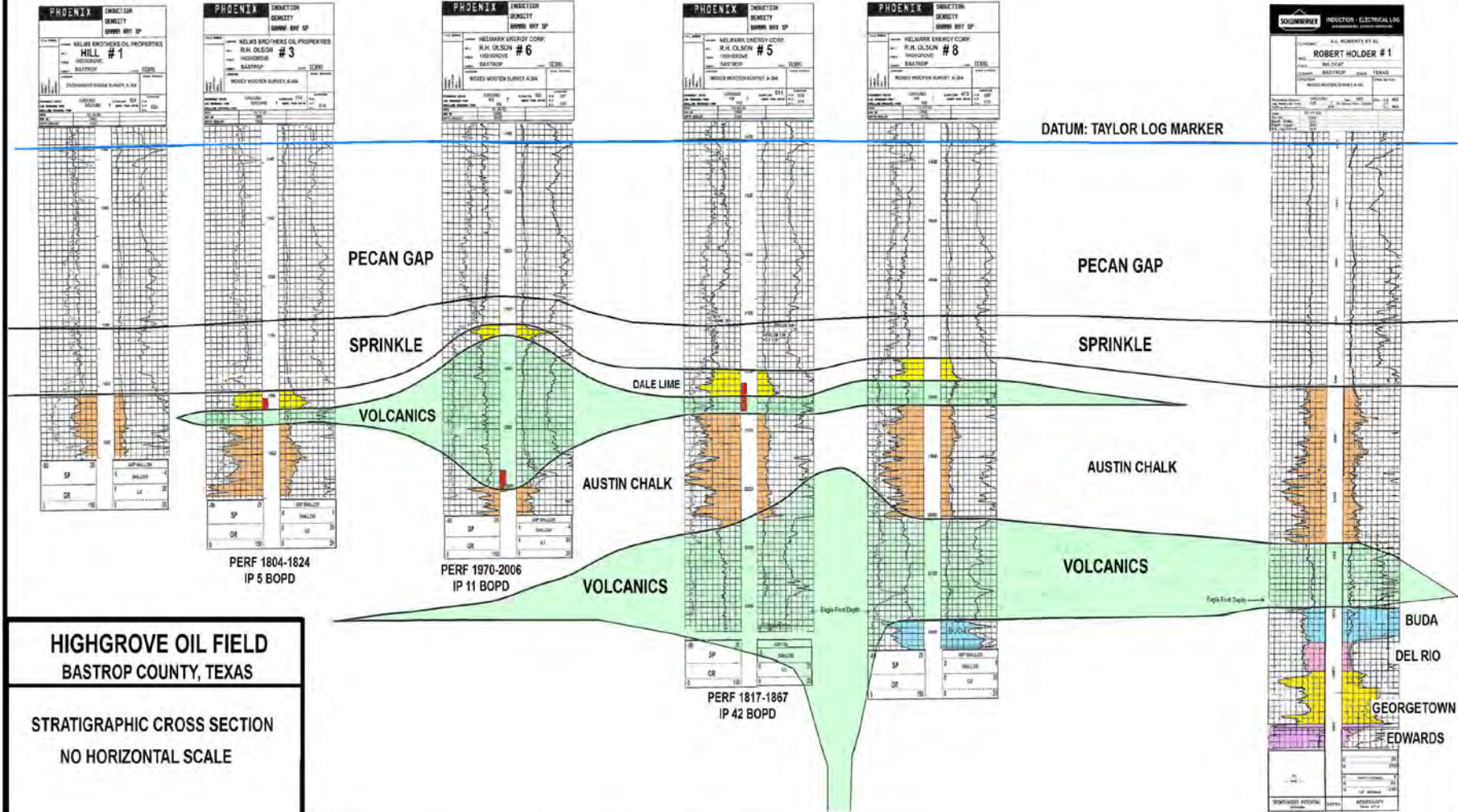
NELMS BROS. OIL PROP. R.H. OLSON #3
 API 42-021-31347

NELMARK ENERGY CORP. R.H. OLSON #6
 API 42-021-31457

NELMARK ENERGY CORP. R.H. OLSON #5
 API 42-021-31433

NELMARK ENERGY CORP. R.H. OLSON #8
 API 42-021-31536

A.L. ROBERTS ROBERT HOLDER #1
 API 42-021-00860



HIGHGROVE OIL FIELD
 BASTROP COUNTY, TEXAS

STRATIGRAPHIC CROSS SECTION
 NO HORIZONTAL SCALE

CRETACEOUS STRATIGRAPHIC SECTION SOUTH CENTRAL TEXAS

		EUROPEAN STAGES	FORMATIONS		GROUP	
			Uvalde Field	Travis Field		
CRETACEOUS	GULFIAN	MAESTRICHTIAN	66	ESCONDIDO	CORSICANA	NAVARRO
		CAMPANIAN	72	OLMOS	BERGSTROM	TAYLOR
				SAN MIGUEL	PECAN GAP	
				ANACACHO	DALE	
		SANTONIAN	83	AUSTIN CHALK		AUSTIN
		CONIACIAN	86			
	TURONIAN	90	EAGLE FORD		EAGLE FORD	
	COMANCHEAN	CENOMANIAN	93	BUDA		WASHITA
				DEL RIO		
			GEORGETOWN			
		ALBIAN	102	EDWARDS A		FREDERICKS-BURG
				EDWARDS B		
			GLEN ROSE			
	APTIAN	113	PEARSALL		TRINITY	
SLIGO						
126		HOSSTON				

Age of BIP
using isotopic
geochronology
76.2 - 84.1 Ma



DATING THE B.I.P.
IGNEOUS ERUPTIONS
USING SUBSURFACE
STRATIGRAPHIC
CORRELATION IN
TRAVIS FIELD
76 - 94 Ma

* Isotopic Time Scale Ages in m.y.

SOUTH

SKIDMORE ENERGY, INC.
WEST #3
API 42-507-32581

SKIDMORE ENERGY, INC.
WEST #2
API 42-507-32542

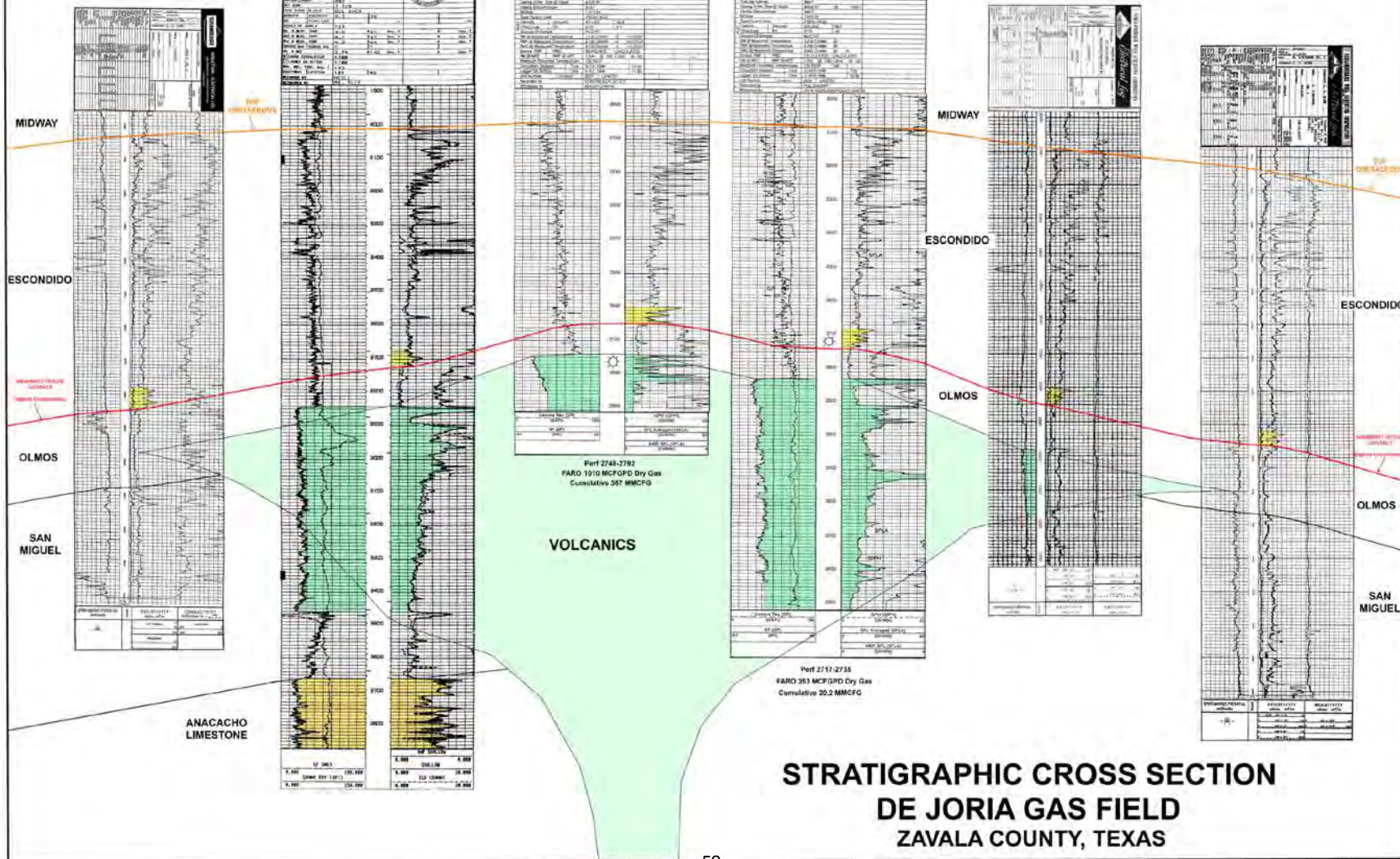
SKIDMORE ENERGY, INC.
WEST #1
API 42-507-32536

NORTH

C.C. WINN
BOYKIN #1
API 42-507-00183

UNION OIL CO OF
CALIFORNIA
RICHARD KIRCHNER #1
API 42-507-00186

C.C. WINN
RICHARD KIRCHNER #1
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NORTHWEST



McGARR & TRUSLER
CHESTER KIEFER #1
API 42-507-00716



MWJ PRODUCING COMPANY
LAFFERRE #2
API 42-507-31727

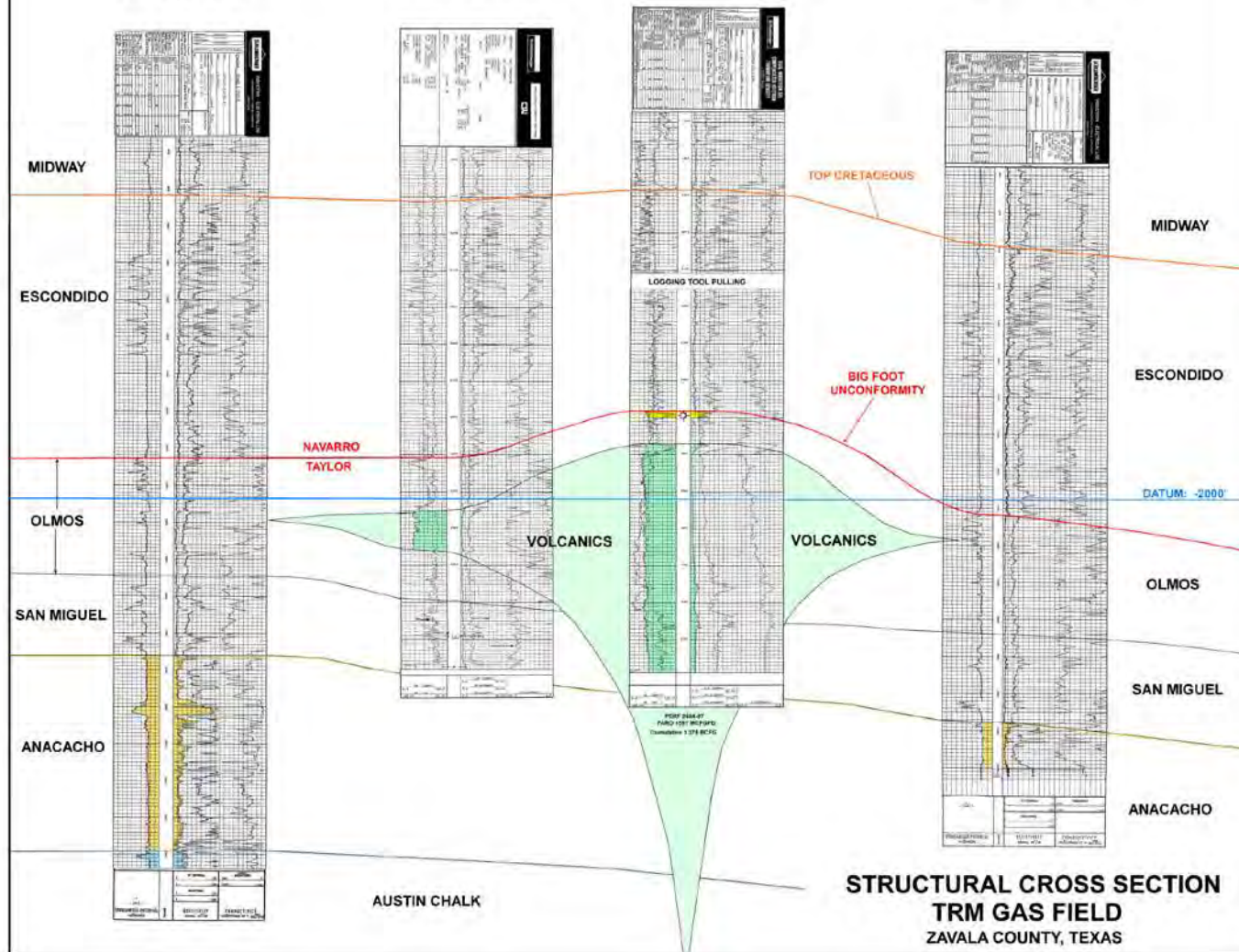


STRINGER OIL & GAS
ALBIN P. SLOVAK #1
API 42-507-31329

SOUTHEAST



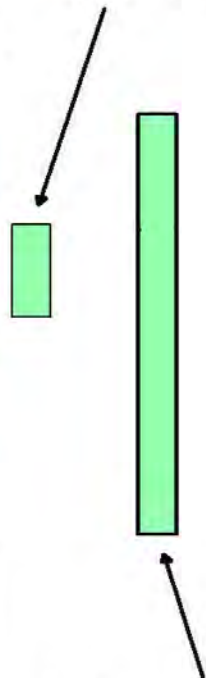
LIPAN OIL COMPANY
ELIZABETH BARTLETT #1
API 42-507-00223



CRETACEOUS STRATIGRAPHIC SECTION SOUTH CENTRAL TEXAS

		FORMATION		GROUP		
		EUROPEAN STAGES	Uvalde Field		Travis Field	
CRETACEOUS	GULFIAN	MAESTRICHTIAN	66	ESCONDIDO	CORSICANA	NAVARRO
		CAMPANIAN	72	OLMOS	BERGSTROM	TAYLOR
				SAN MIGUEL	PECAN GAP	
				ANACACHO	DALE	
		SANTONIAN	83	AUSTIN CHALK		AUSTIN
		CONIACIAN	86			
	TURONIAN	90	EAGLE FORD	WOODBINE		
	COMANCHEAN	CENOMANIAN	93	BUDA	WASHITA	
				DEL RIO		
				GEORGETOWN		
		EDWARDS A	FREDERICKS- BURG			
		EDWARDS B				
		GLEN ROSE				
		APTIAN	113	PEARSALL	TRINITY	
SLIGO						
BARREMIAN	126	HOSSTON				

Age of BIP
using isotopic
geochronology
76.2 - 84.1 Ma



DATING THE B.I.P.
IGNEOUS ERUPTIONS
USING SUBSURFACE
STRATIGRAPHIC
CORRELATION IN
TRAVIS FIELD
AND UVALDE FIELD
70 - 94 Ma

* Isotopic Time Scale Ages in m.y.

INTRUSIVE SURFACE EXPOSURES

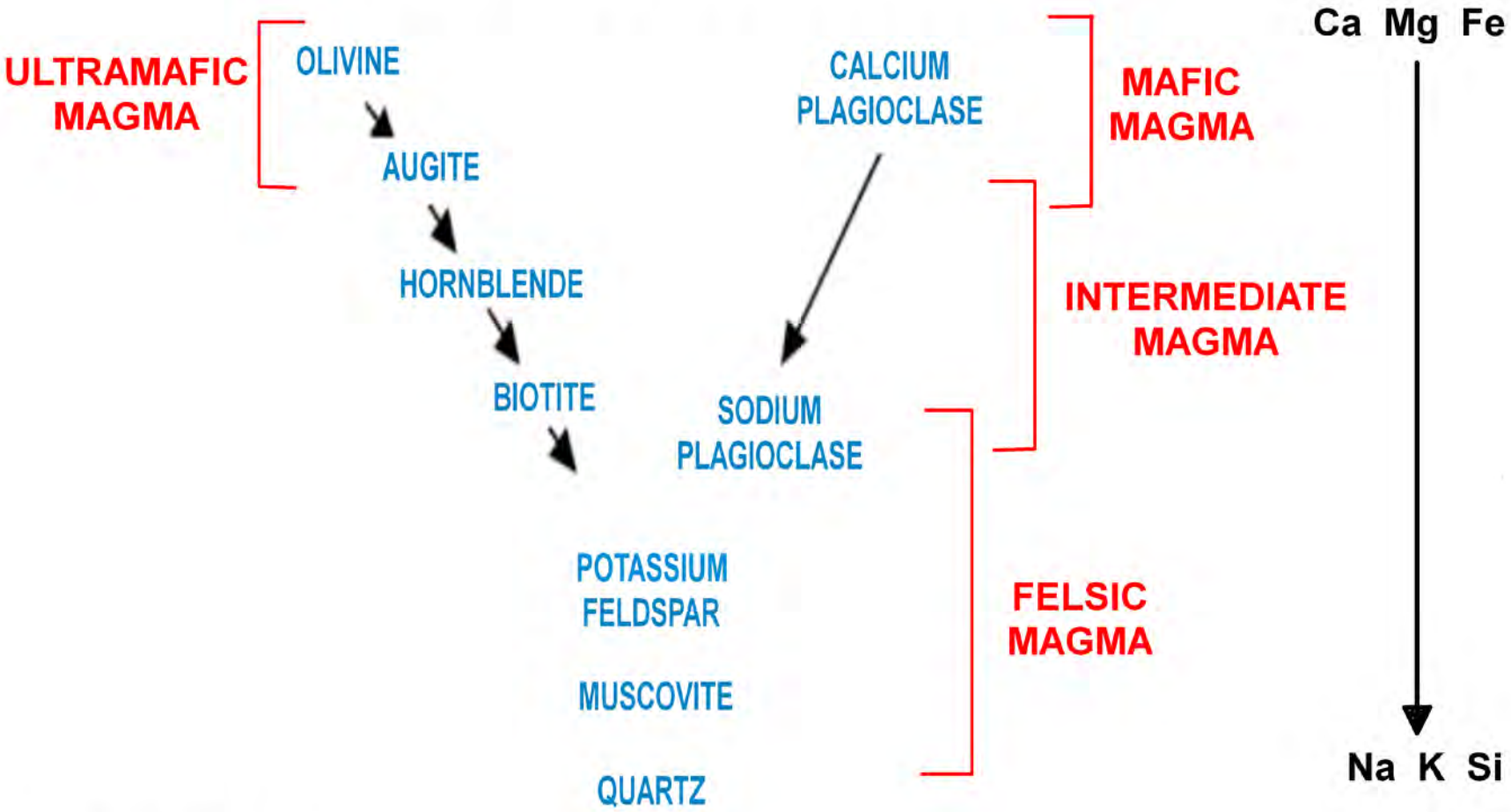
**BLACK COLOR
HARD
DENSE
HEAVY: SPEC. GRAV. = 3.25
COMMONLY MAGNETIC**

**Black Groundmass, Porphyritic With
5-20 vol. % Phenocrysts of Olivine & Augite**

**The Groundmass Under The Microscope is
Augite, Olivine, Magnetite and
Feldspathoids (Nepheline & Melilite).**

**Feldspar is Totally Lacking In Most Of The
Ultramafic Intrusives Other Than Minor
Amounts of Ca-Plagioclase.**

BOWEN'S REACTION SERIES



N.L. Bowen, 1922

CHARACTERISTICS OF WORLD WIDE OCCURRENCES OF ULTRAMAFIC ROCKS

Formed as large differentiated and layered plutonic intrusions

Old. Almost exclusively Archean & Proterozoic

**Phanerozoic ultramafics are rare other than
subduction zone ophiolites**

Volcanic ultramafics very rare

**Ultramafics are thought to originate in the Mantle or
Asthenosphere, which requires a Subduction Zone
or Mantle "Hot Spot" Thermal Plume
To Transport Magma Upward.**

SUMMARY OF BIP ROCK CHARACTERISTICS

The Individual Eruptions are small - only 1/4 mile to 2 miles in diameter covering 100 to 3000 acres

The Total Amount of Magma Involved in the Entire BIP is small, insufficient for significant magmatic differentiation.

The Ultramafics are high in Mg (8-18%) and high in Ni (150-600 ppm) due to low Olivine crystallization content. This suggests a primary melt.

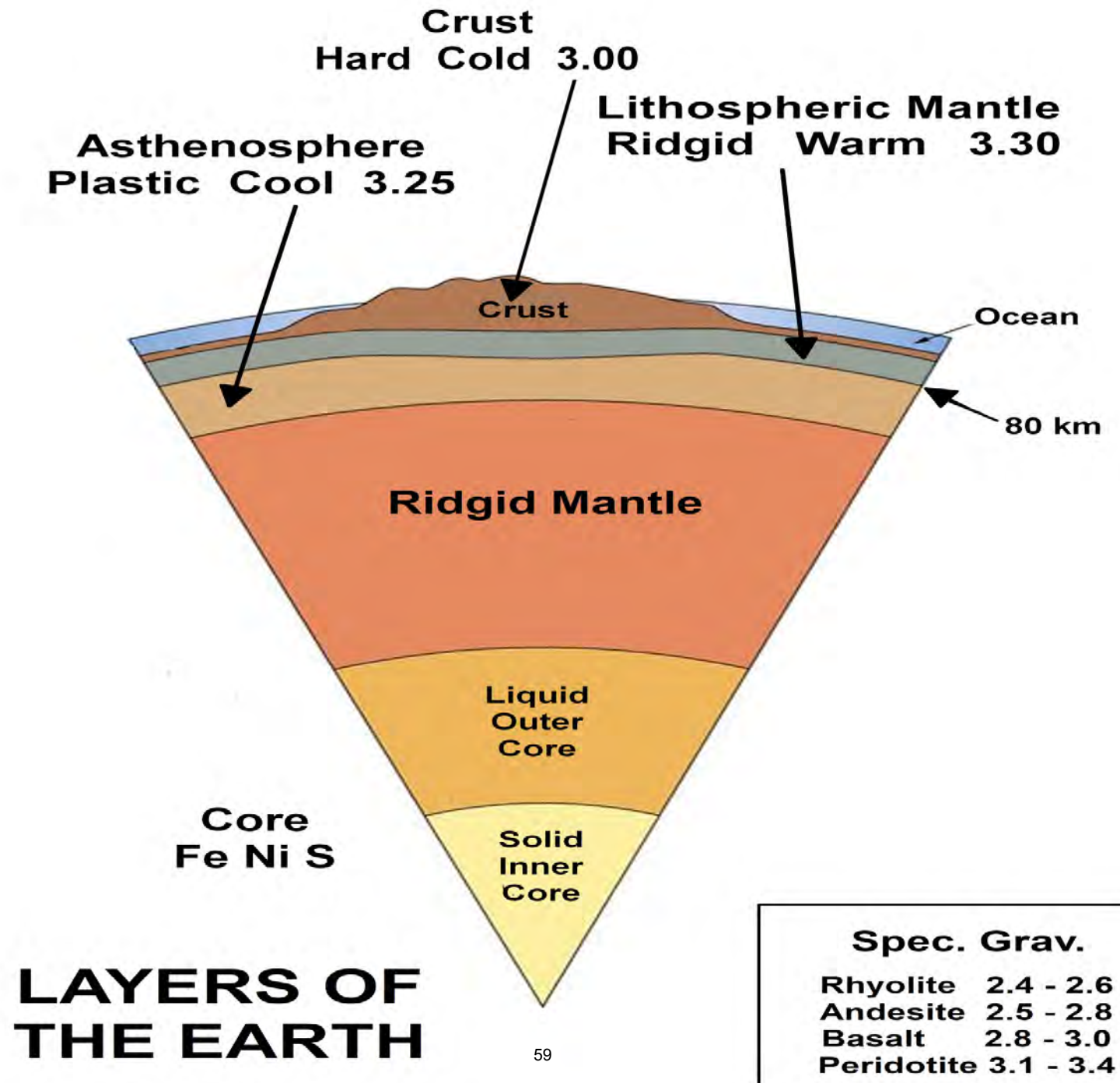
Sr 87 - Sr 86 ratios are 0.70313 to 0.70369 which are characteristic of mantle origin and no crustal mixing.

The Phonolites contain low Mg and Ni content, are high in Rb and Zr, and are younger than the ultramafics. This suggests they are derived from the Nephelinite Magma by fractional crystallization.

BIP rocks contain ultramafic Xenoliths of Spinel Peridotite, Dunite and Harzburgite suggesting a Mantle Source.

All Indications are that Bowen's Reaction Series Never Even Got Started.

Computer Modeling Indicates That Compositions present in the BIP can be formed by an enriched Asthenospheric Source undergoing 5-10% partial melting at a depth of 80-100 km.



The Formation And Emplacement of the BIP

The Origin of the BIP Magma was the Asthenosphere.

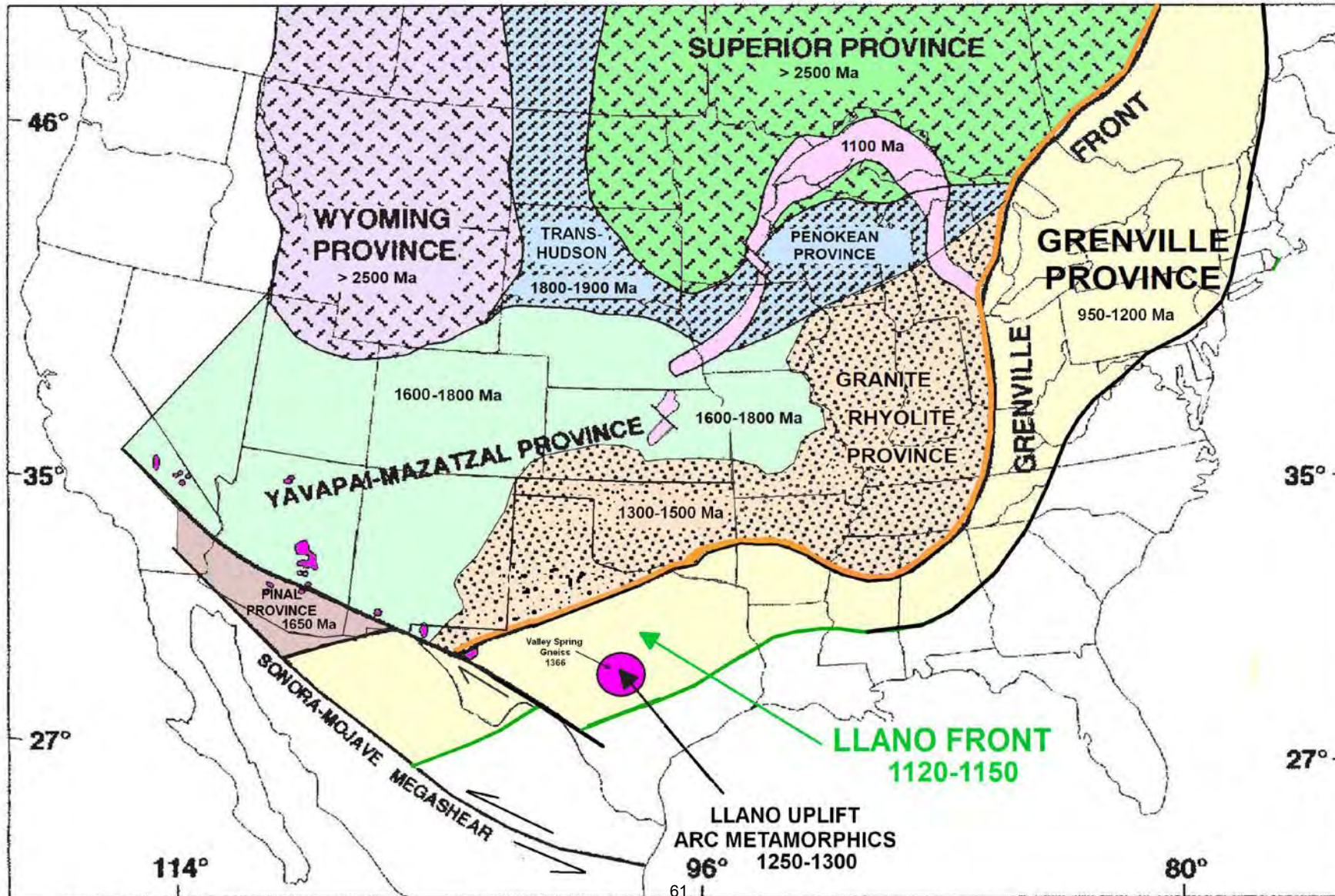
This requires a pathway for rapid upward movement of ultramafic magma from asthenosphere, but pathway must restrict total magma volume to only allow partial melting which limits formation of common basalts.

No evidence exists for crustal subduction or any type of "hot spot" thermal plume.

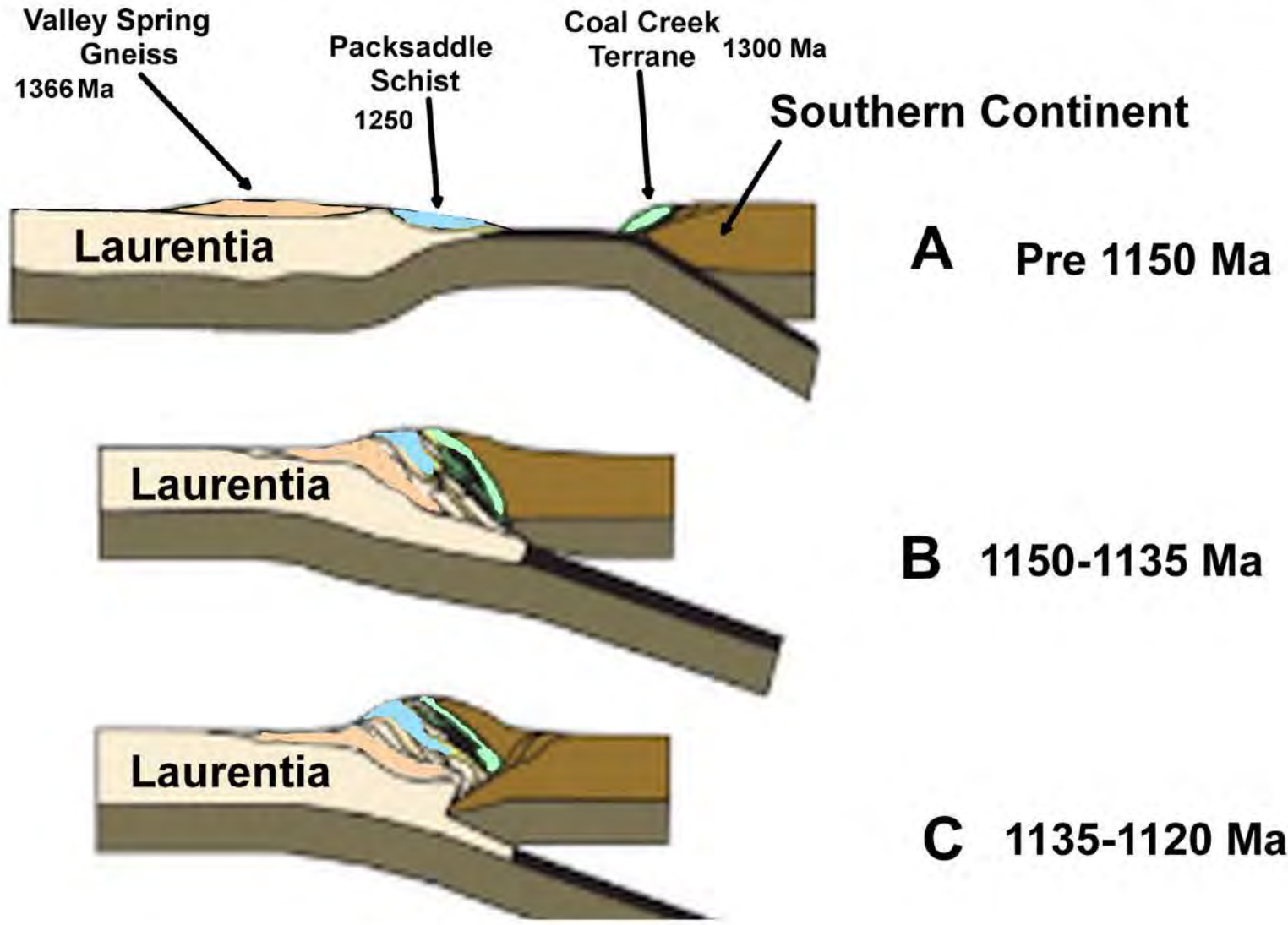
During the entire Cretaceous this area of south central Texas was a passive plate margin located on the north side of the newly formed Gulf of Mexico Basin.

**Need A Fracture Zone
Involving Incipient Rifting**

PRECAMBRIAN BASEMENT PROVINCE MAP OF SOUTHERN LAURENTIA

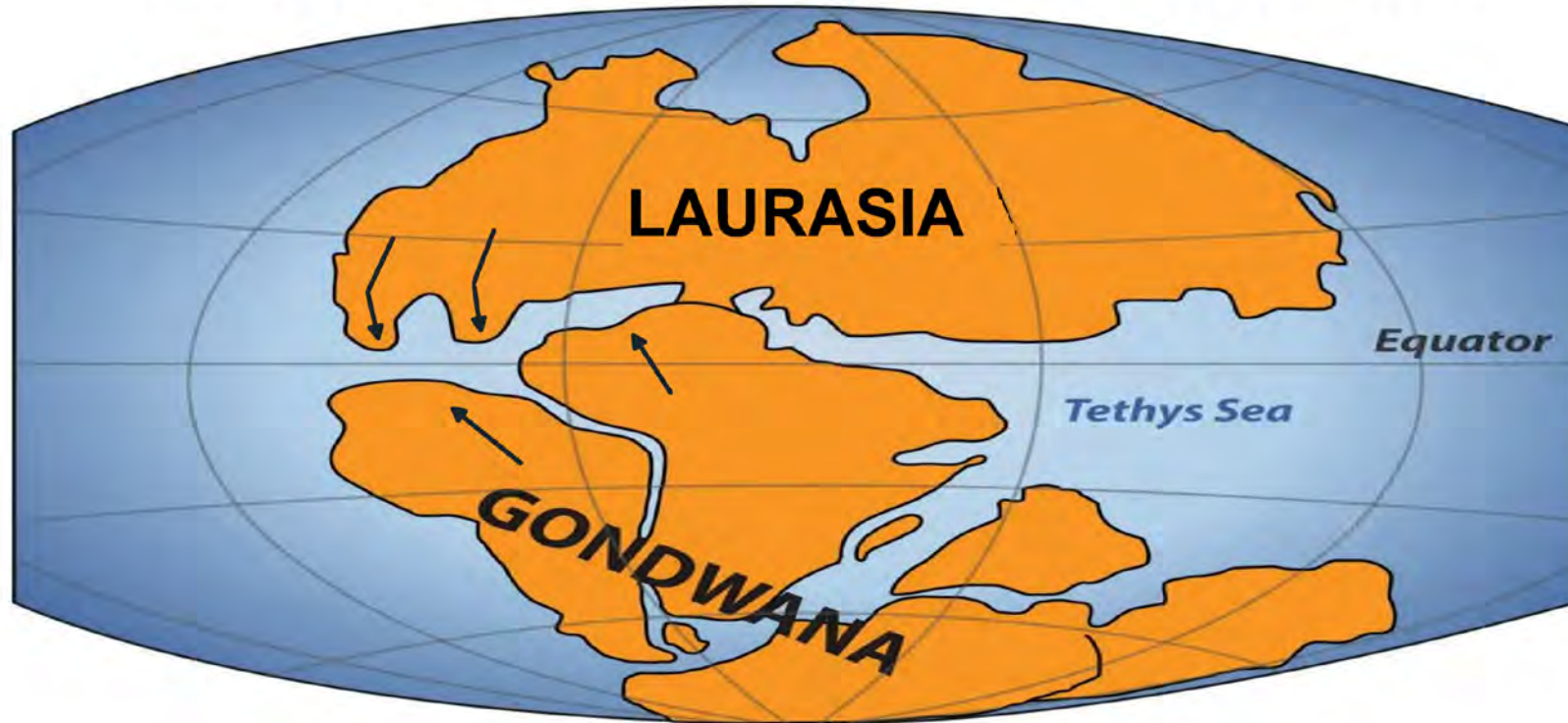


Rodinia



Llano Front - Grenville Orogenic Belt

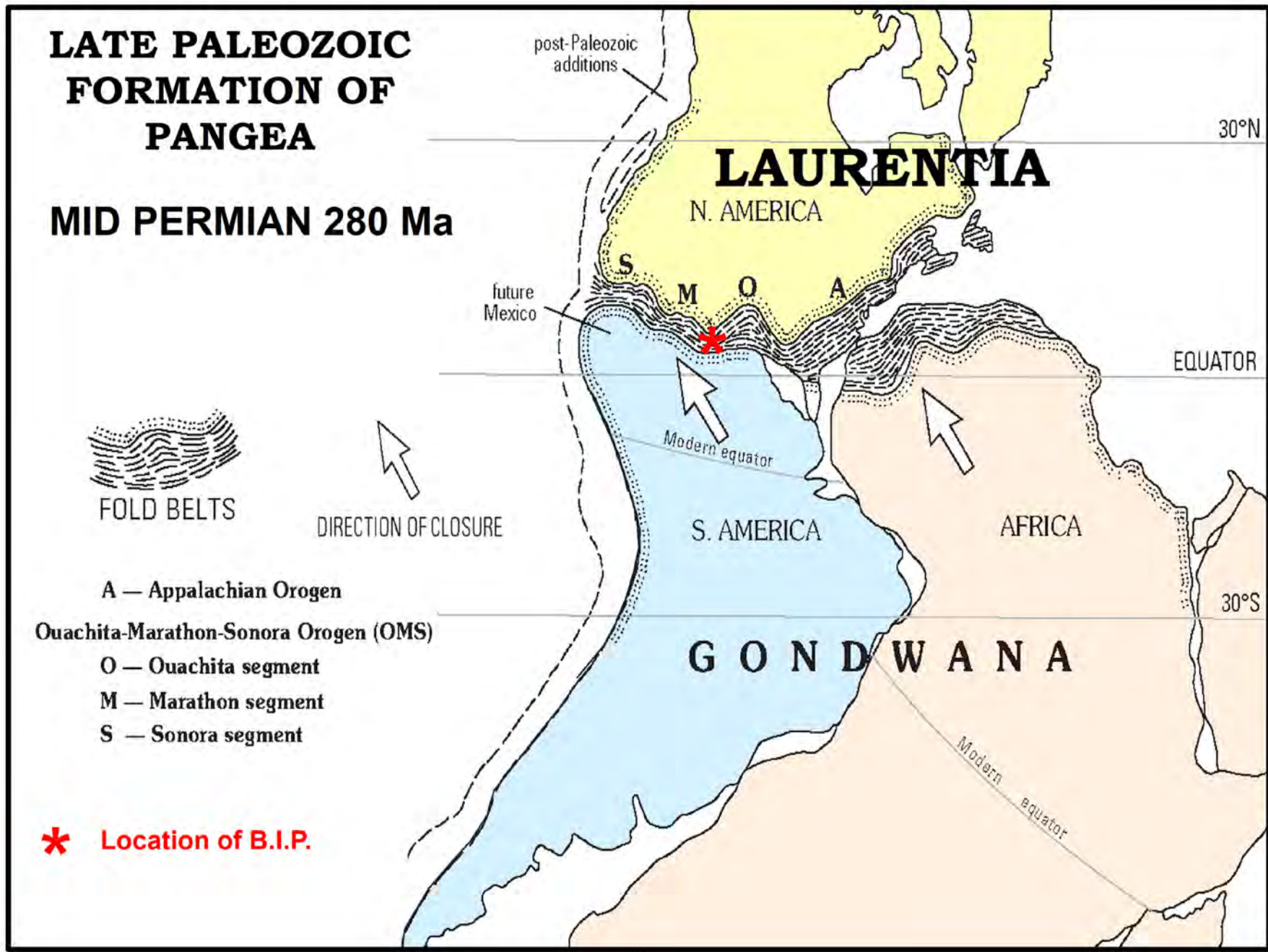
MISSISSIPPIAN - PENNSYLVANIAN 325 Ma



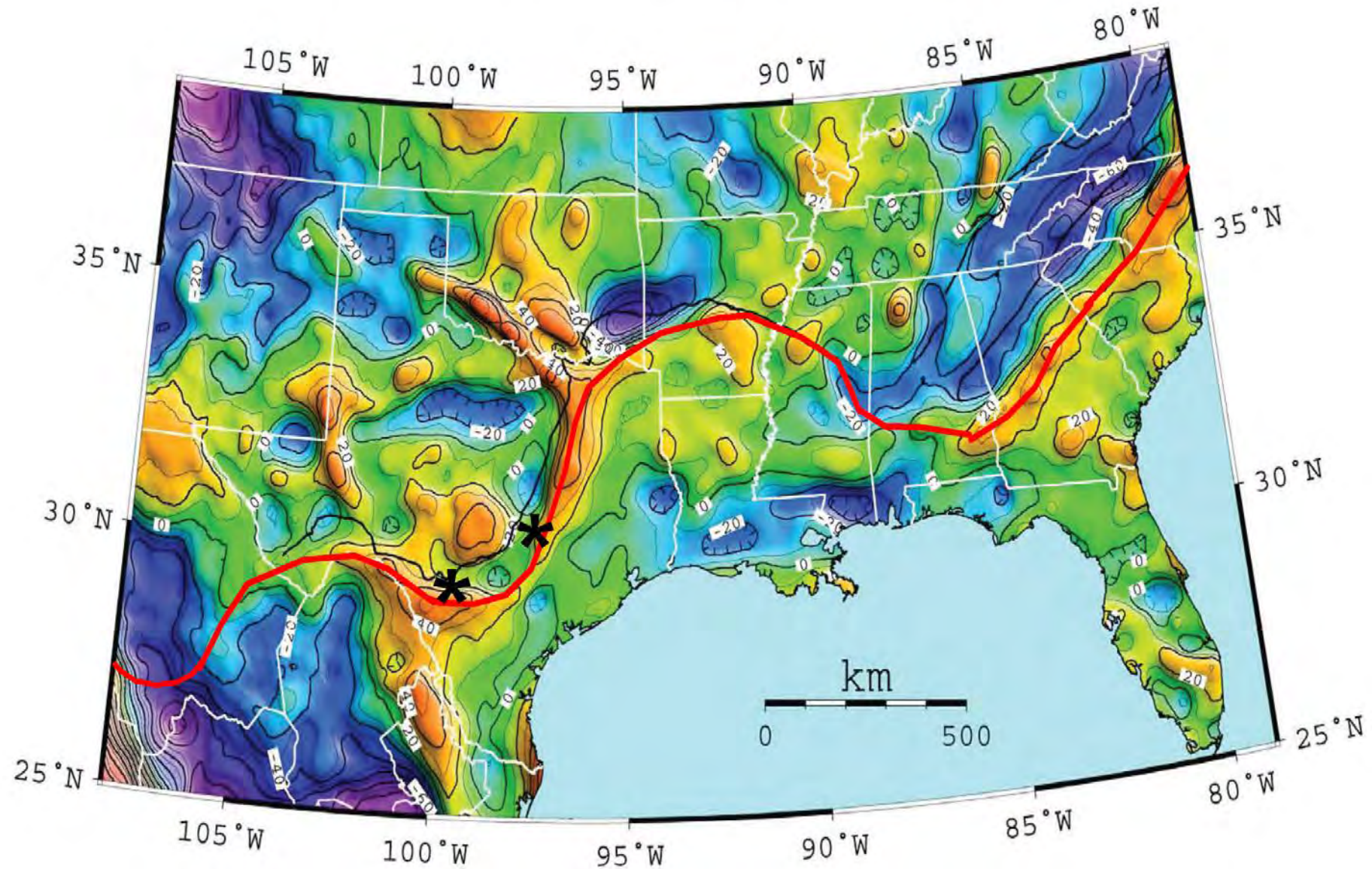
**GONDWANA COLLIDES WITH LAURASIA
TO FORM PANGAEA**

LATE PALEOZOIC FORMATION OF PANGEA

MID PERMIAN 280 Ma

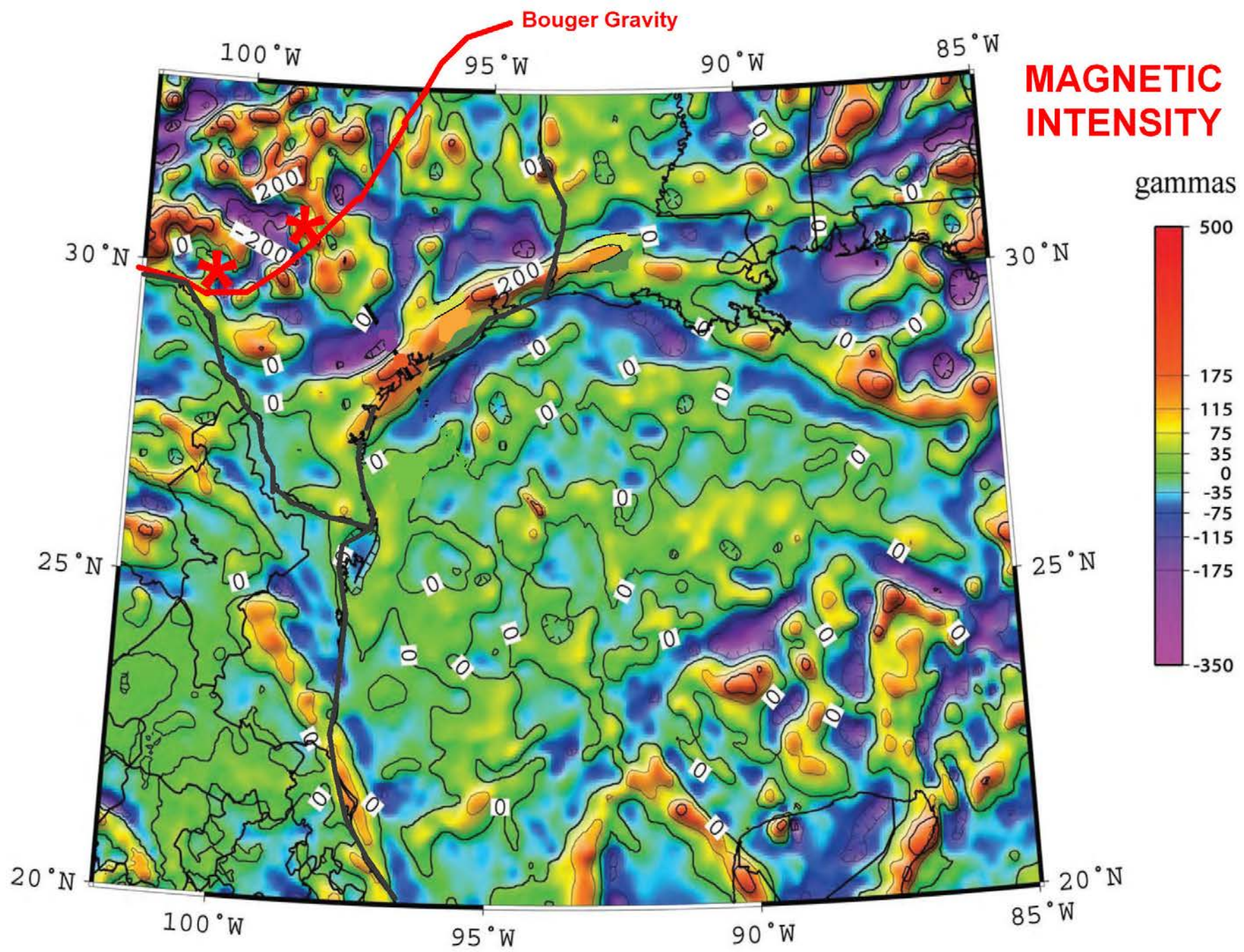


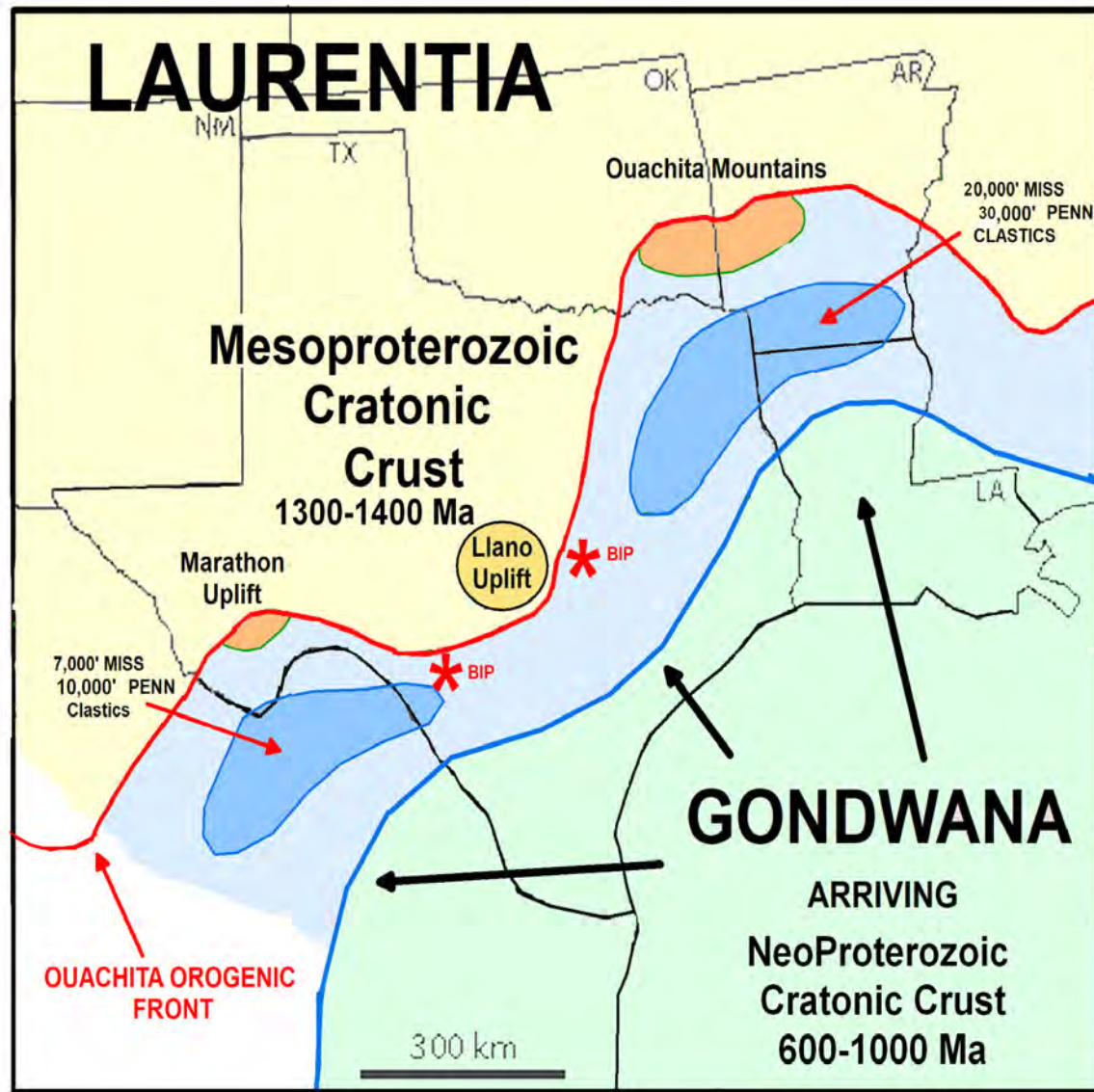
BOUGER GRAVITY ANOMALIES



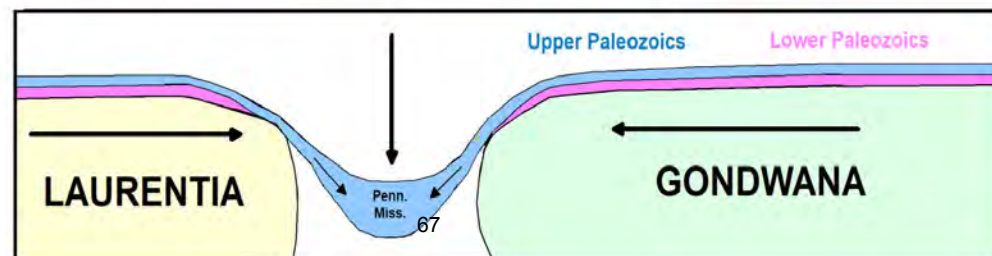
* BIP

APPALACHIAN-OUACHITA OROGENIC FRONT
GRAVITY MAXIMA

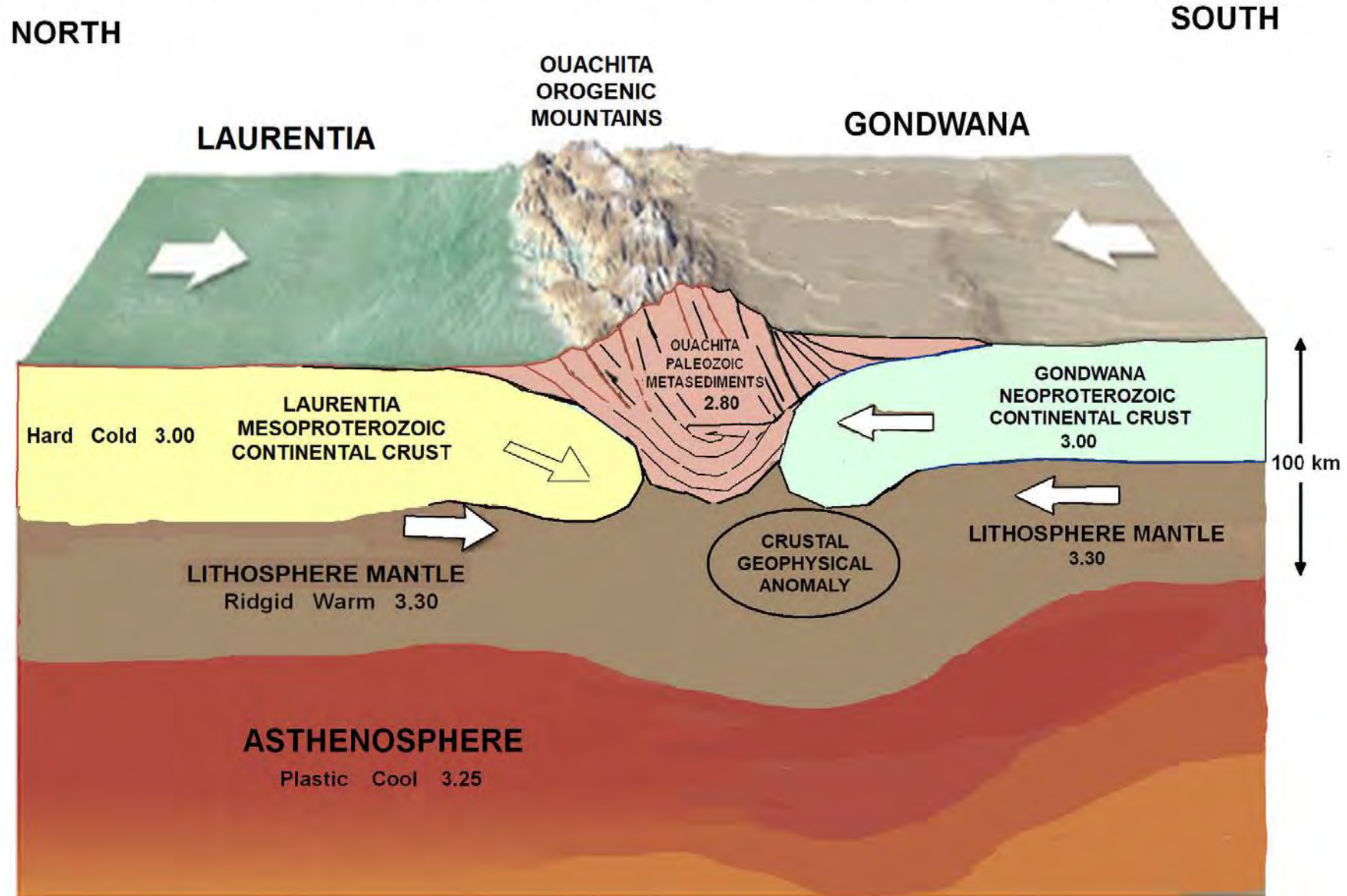




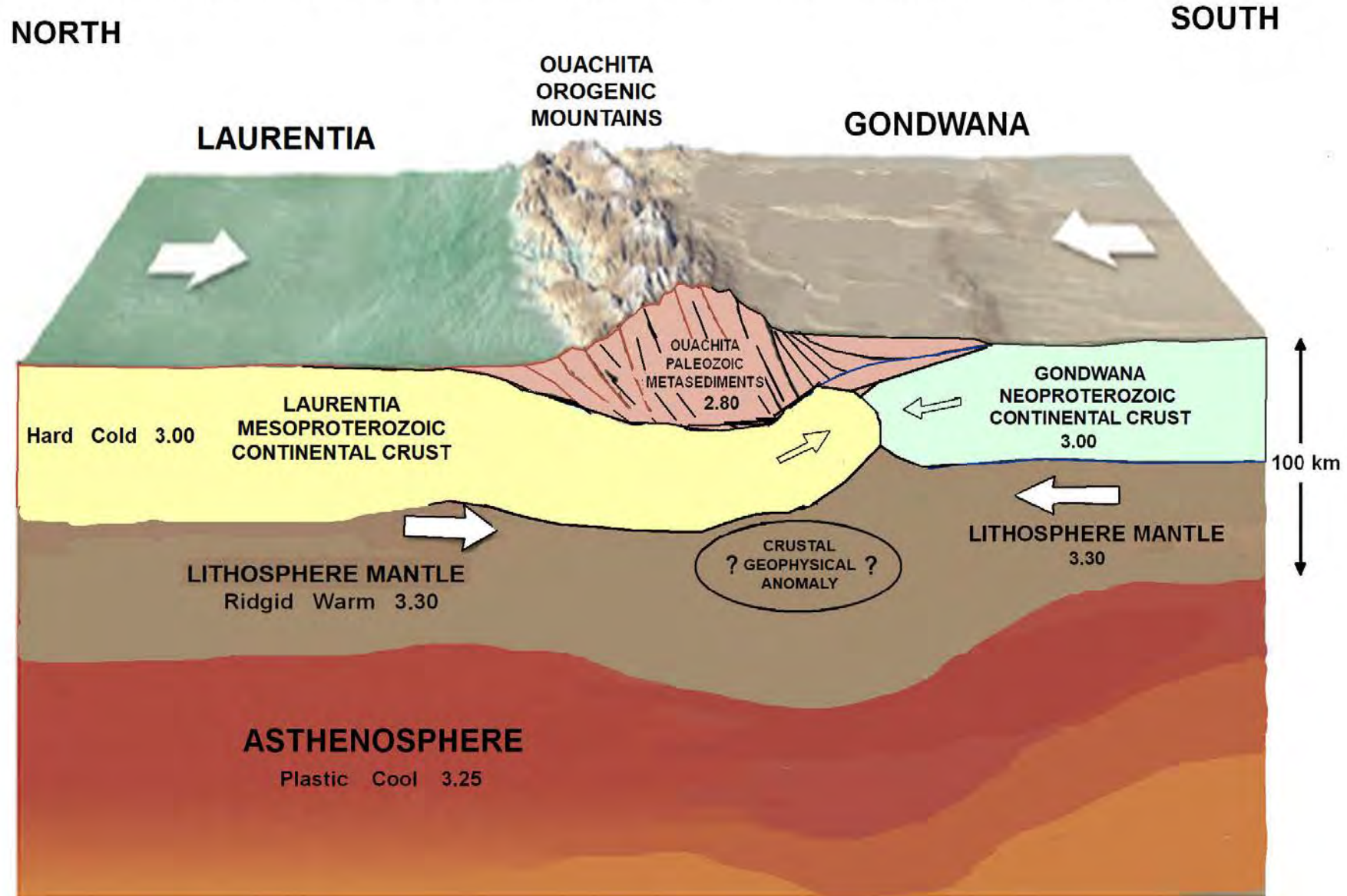
LATE PALEOZOIC COLLISION OF LAURENTIA & GONDWANA ALONG THE OUACHITA OROGENIC BELT



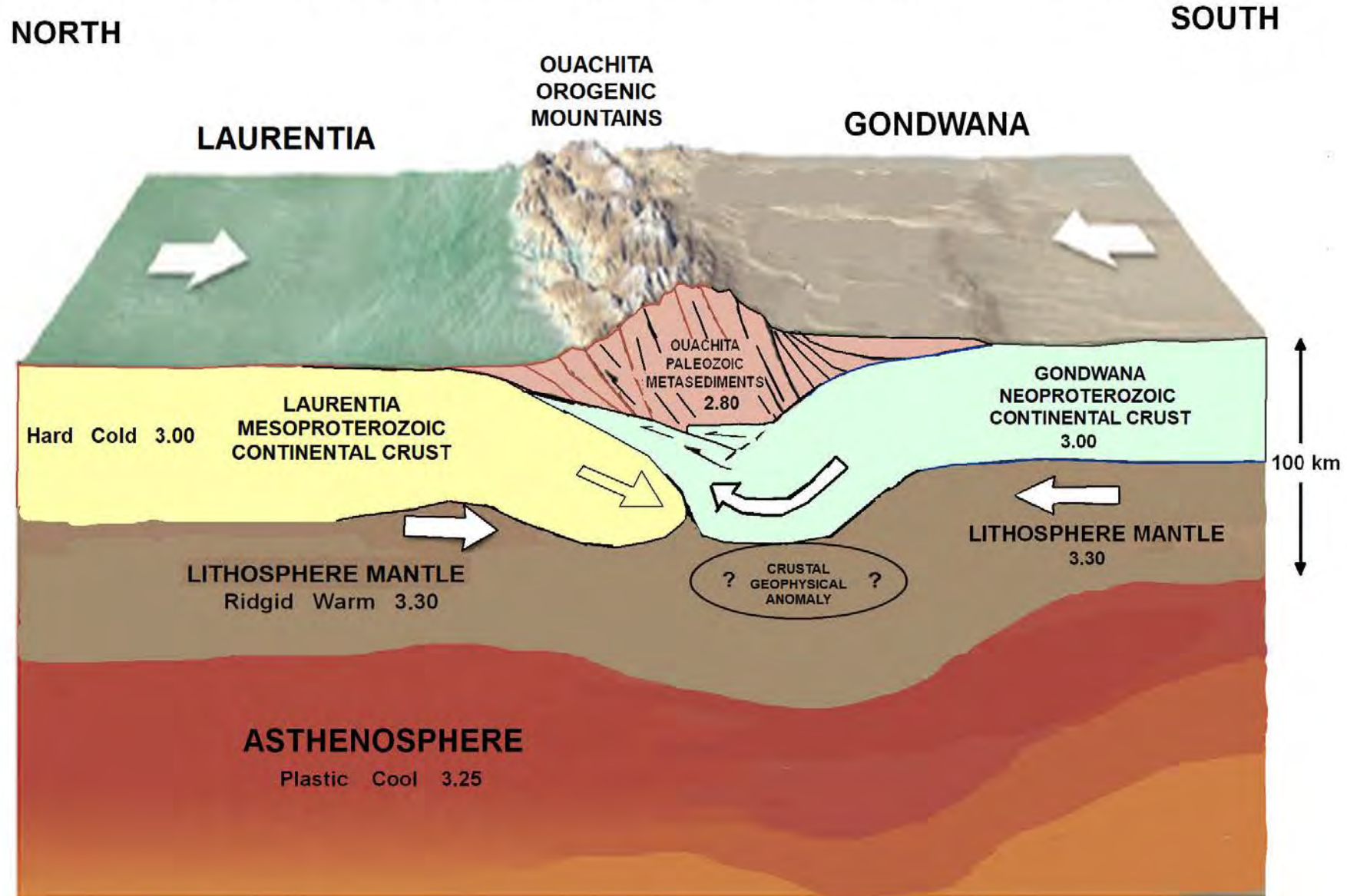
LATE PALEOZOIC PANGAEA

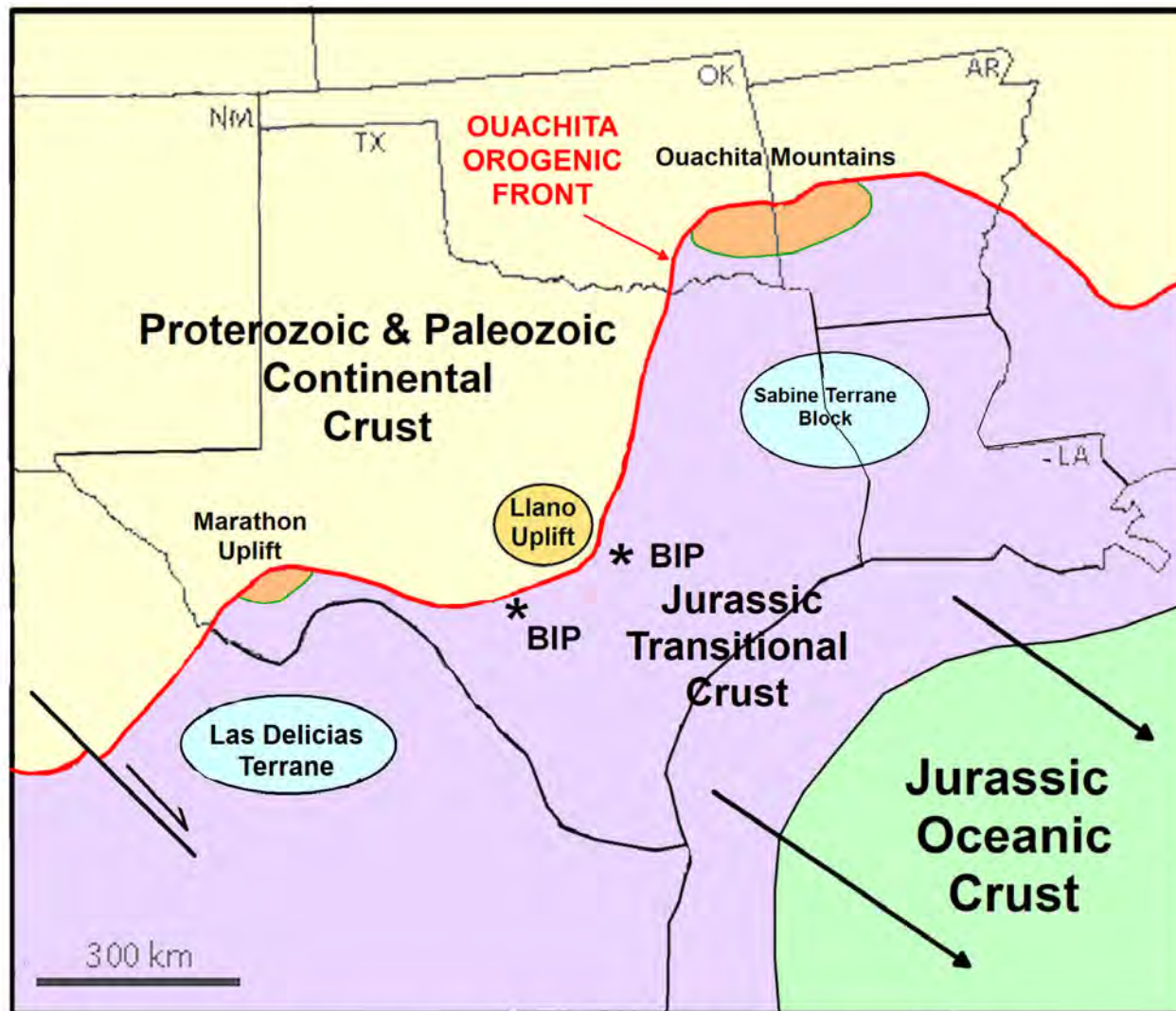


LATE PALEOZOIC PANGAEA



LATE PALEOZOIC PANGAEA



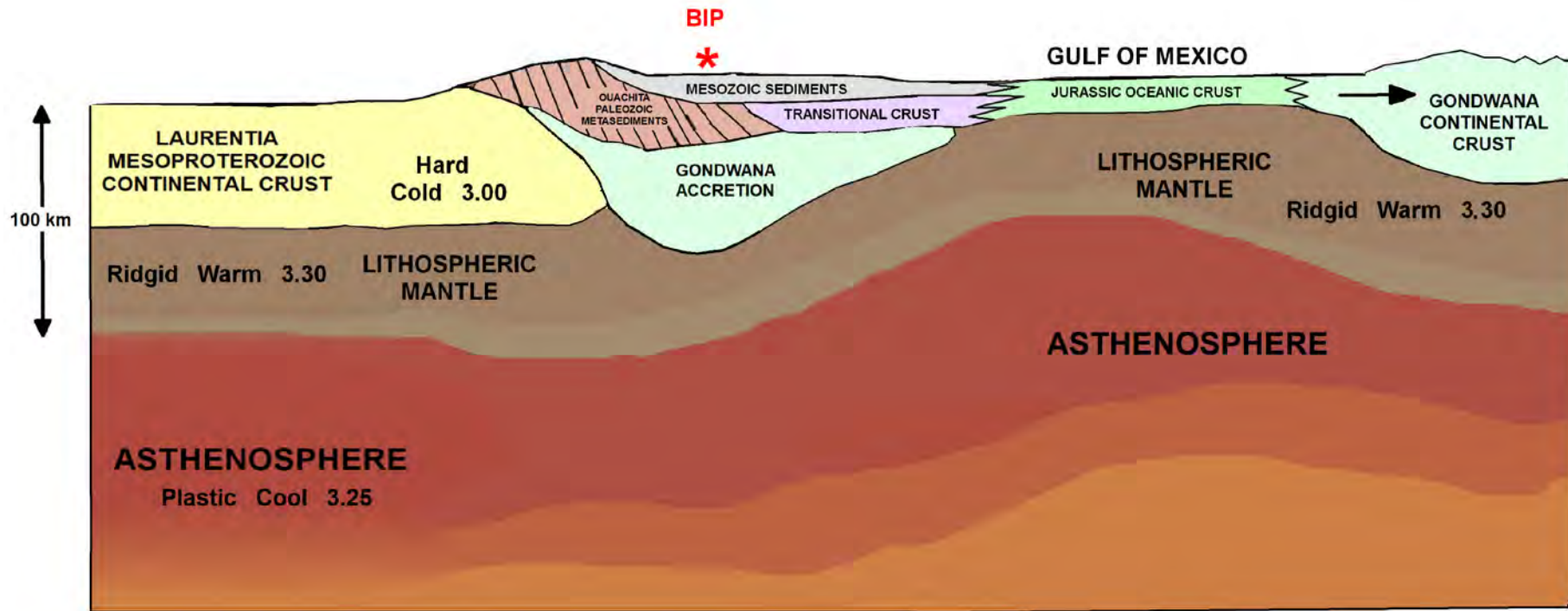


**MID MESOZOIC
(JURASSIC 160 Ma)
OPENING OF THE
GULF OF MEXICO**

**EXOTIC TERRANES
AT LAS DELICIAS ON
THE COAHUILA
PENINSULA & THE
SABINE TERRANE**

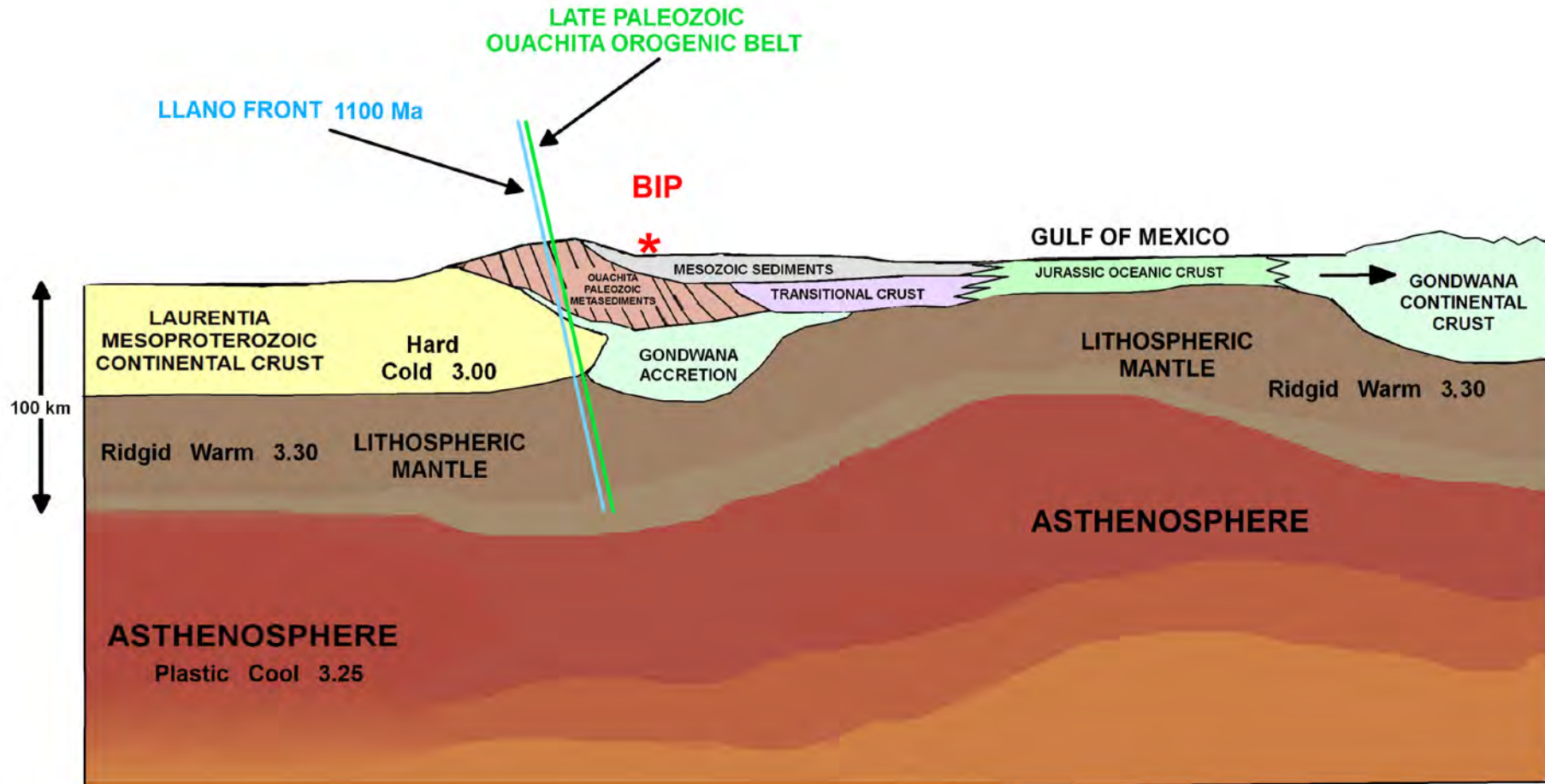
**Pennsylvanian Wildflysch - Melange Arc Sediments
Intruded By Triassic Plutons
Covered By Jurassic-Cretaceous Sediments
Folded & Faulted in Tertiary
Recent Studies Indicate Fragment From Gondwana**

MID MESOZOIC (JURASSIC 160 Ma) OPENING OF THE GULF OF MEXICO



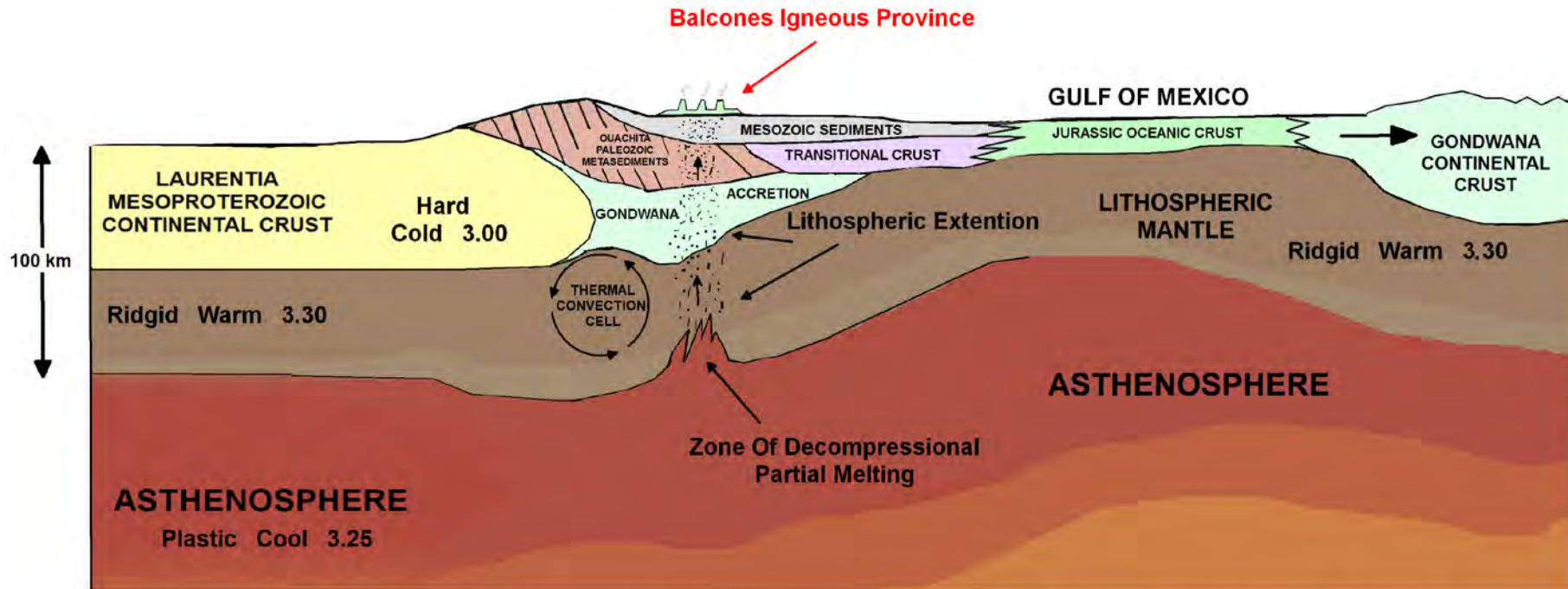
LATE CRETACEOUS 70-97 Ma

BIP VOLCANIC ERUPTIONS



PETROGENY OF THE BALCONES IGNEOUS PROVINCE

LATE CRETACEOUS 97-70 Ma



**EDGE DRIVE CONVECTION
THERMAL MODEL**

Adiabatic Heat Exchange Process With No Mantle Heat Plume or Heat Anomaly

Requires Juxtaposition of Cratonic & Oceanic Lithosphere

Requires Lithospheric Extension As Conduit For Low-scale Decompression Melting

KNIPPA QUARRY XENOLITHS

BIP Olivine Nephilinite Ultramafic host rock contains Xenoliths of coarse grained Peridotite, Dunite and Harzburgite.

These Xenoliths have mineral chemistries of a subcontinental Lithospheric Mantle too cool for Asthenospheric Mantle.

Within the Knippa Quarry Xenoliths are Xenocrystic Zircons which yield an age date of 558 to 982 Ma.

The Geophysical Anomaly under and south of the BIP likely represents Crustal Accretion Terraine derived from Gondwana during the Ouachita Orogenic Event.

Corpus Christi Geological Society Papers available for purchase at the Texas Bureau of Economic Geology

Note: Publication codes are hyperlinked to their online listing in [The Bureau Store](http://begstore.beg.utexas.edu/store/) (<http://begstore.beg.utexas.edu/store/>).

Cretaceous-Wilcox-Frio Symposia, D. B. Clutterbuck, Editor, 41 p., 1962.
[CCGS 002S](#) \$15.00

Type Logs of South Texas Fields, Vol. I, Frio Trend. Compiled by Don Kling. Includes 134 fields. 158 p., 1972. Ring binder.
[CCGS 015TL](#) \$25.00

Type Logs of South Texas Fields, Vol. II, Wilcox (Eocene) Trend. Compiled by M. A. Wolbrink. 98 p., 1979. Ring binder.
[CCGS 016TL](#) \$25.00

Field Trip Guidebooks

South Texas Uranium. J. L. Cowdrey, Editor. 62 p., 1968.
[CCGS 102G](#) \$12.00

Hidalgo Canyon and La Popa Valley, Nuevo Leon, Mexico. CCGS 1970 Spring Field Conference. 78 p., 1970.
[CCGS 103G](#) \$8.00

Padre Island National Seashore Field Guide. R. N. Tench and W. D. Hodgson, Editors. 61 p., 1972.
[CCGS 104G](#) \$5.00

Triple Energy Field Trip, Uranium, Coal, Gas—Duval, Webb & Zapata Counties, Texas. George Faga, Editor. 24 p., 1975.
[CCGS 105G](#) \$10.00

Minas de Golondrinas and Minas Rancherías, Mexico. Robert Manson and Barbara Beynon, Editors. 48 p. plus illus., 1978.
[CCGS 106G](#) \$15.00

Portrero Garcia and Huasteca Canyon, Northeastern Mexico. Barbara Beynon and J. L. Russell, Editors. 46 p., 1979.
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Modern Depositional Environments of Sands in South Texas. C. E. Stelling and J. L. Russell, Editors. 64 p., 1981.
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Geology of Peregrina & Novillo Canyons, Ciudad Victoria, Mexico, J. L. Russell, Ed., 23 p. plus geologic map and cross section, 1981.
[CCGS 109G](#) \$10.00

Geology of the Llano Uplift, Central Texas, and Geological Features in the Uvalde Area. Corpus Christi Geological Society Annual Spring Field Conference, May 7-9, 1982. Various paginated. 115 p., 53 p.
[CCGS 110G](#) \$15.00

Structure and Mesozoic Stratigraphy of Northeast Mexico, prepared by numerous authors, variously paginated. 76 p., 38 p., 1984.
[CCGS 111G](#) \$15.00

Geology of the Big Bend National Park, Texas, by C. A. Berkebille. 26 p., 1984.
[CCGS 112G](#) \$12.00

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<http://www.lib.utexas.edu/books/landsapes/index.php> Free service. Rare, fragile, hard-to-find, public domain documents covering various topics about the landscape of Texas. Includes the Texas Geological Survey from 1887 until 1894.

USGS TAPESTRY OF TIME AND TERRAIN <http://tapestry.usgs.gov> The CCGS is donating to all of the 5th and 6th grade schools in the Coastal Bend. Check it out--it is a spectacular map. You might want to frame one for your own office. The one in my office has glass and a metal frame, and It cost \$400 and it does not look as good as the ones we are giving to the schools.

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www.ermaper.com They have a great free downloadable viewer for TIFF and other graphic files called ER Viewer.

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NEW (2019)TYPE LOGS IN RED;

lost now found

ARANSAS COUNTY

Aransas Pass/McCampbell Deep
Bartell Pass
Blackjack
Burgentine Lake
Copano Bay, South
Estes Cove
Fulton Beach
Goose Island
Half Moon Reef
Nine Mile Point
Rockport, West
St. Charles
Tally Island
Tract 831-G.O.M. (offshore)
Virginia

BEE COUNTY

Caesar
Mosca
Nomanna
Orangedale(2)
Ray-Wilcox
San Domingo

Tulsita Wilcox

Strauch_Wilcox

BROOKS COUNTY

Ann Mag
Boedecker
Cage Ranch
Encintas
ERF

Gyp Hill
Gyp Hill West

Loma Blanca

Mariposa

Mills Bennett

Pita

Tio Ayola

Tres Encinos

CALHOUN COUNTY

Appling
Coloma Creek, North
Heyser

Lavaca Bay

Long Mott

Magnolia Beach

Mosquito Point

Olivia

Panther Reef

Powderhorn

Seadrift, N.W.

Steamboat Pass

Webb Point

S.E. Zoller

CAMERON COUNTY

Holly Beach

Luffles

San Martin (2)

Three Islands, East

Vista Del Mar

COLORADO COUNTY

E. Ramsey
Graceland N. Fault Blk
Graceland S. Fault Blk

DEWITT COUNTY

Anna Barre

Cook

Nordheim

Smith Creek

Warmley

Yorktown, South

DUVAL COUNTY

DCR-49

Four Seasons

Good Friday

Hagist Ranch

Herbst

Loma Novia

Petrox

Seven Sisters

Seventy Six, South

Starr Bright, West

GOLIAD COUNTY

Berclair

North Blanconia

Bombs

Boyce

Cabeza Creek, South

Goliad, West

St Armo

Terrell Point

HIDALGO COUNTY

Alamo/Donna

Donna

Edinburg, West

Flores-Jeffress

Foy

Hidalgo

LA Blanca

McAllen& Pharr

McAllen Ranch

Mercedes

Monte Christo, North

Penitas

San Fordyce

San Carlos

San Salvador

S. Santallana

Shary

Tabasco

Weslaco, North

Weslaco, South

JACKSON COUNTY

Carancahua Creek

Francitas

Ganado & Ganado Deep

LaWard, North

Little Kentucky

Maurbro

StewartSwan Lake

Swan Lake, East

Texana, North

West Ranch

JIM HOGG COUNTY

Chaparosa

Thompsonville,N.E.

JIM WELLS COUNTY

Freeborn

Hoelscher

Palito Blanco

Wade City

KARNES COUNTY

Burnell

Coy City

Person

Runge

KENEDY COUNTY

Candelaria

Julian

Julian, North

Laguna Madre

Rita

Stillman

KLEBERG COUNTY

Alazan

Alazan, North

Big Caesar

Borregos

Chevron (offshore)

Laguna Larga

Seeligson

Sprint (offshore)

LA SALLE COUNTY

Pearsall

HAWKVILLE:EAGLEFORD

LAVACA COUNTY

Hallettsville

Hope

Southwest Speaks

Southwest Speaks Deep

LIVE OAK COUNTY

Atkinson

Braslau

Chapa

Clayton

Dunn

Harris

Houdman

Kittie West-Salt Creek

Lucille

Sierra Vista

Tom Lyne

White Creek

White Creek, East

MATAGORDA COUNTY

Collegeport

MCMULLEN COUNTY

Arnold-Weldon

Brazil

Devil's Waterhole

Hostetter

Hostetter, North

NUECES COUNTY

Agua Dulce (3)

Arnold-David

Arnold-David, North

Baldwin Deep

Calallen

Chapman Ranch

Corpus Christi, N.W.

Corpus Christi West C.C.

Encinal Channel

Flour Bluff/Flour Bluff, East

GOM St 9045(offshore)

Indian Point

Mustang Island

Mustang Island, West

Mustang Island St.

889S(offshore)

Nueces Bay/Nueces Bay

West

Perro Rojo

Pita Island

Ramada

Redfish Bay

Riverside

Riverside, South

Saxet

Shield

Stedman Island

Turkey Creek

REFUGIO COUNTY

Bonnieview/Packery Flats

Greta

La Rosa

Lake Pasture

Refugio, New

Tom O'Connor

SAN PATRICIO COUNTY

Angelita East

Commonwealth

Encino

Enos Cooper

Geronimo

Harvey

Hiberia

Hodges

Mathis, East

McCampbell Deep/Aransas Pass

Midway

Midway, North

Odem

Plymouth

Portilla (2)

Taft

Taft, East

White Point, East

STARR COUNTY

El Tanque

Garcia

Hinde

La Reforma, S.W.

Lyda

Ricaby

Rincon

Rincon, North

Ross

San Roman

Sun

Yturria

VICTORIA COUNTY

Helen Gohike, S.W.

Keeran, North

Marcado Creek

McFaddin

Meyersville

Placedo

WEBB COUNTY

Aquilares/Glen Martin

Big Cowboy

Bruni, S.E.

Cabezon

Carr Lobo

Davis

Hirsch

Juanita

Las Tiendas

Nicholson

O'Ham

Olmitos

Tom Walsh

WHARTON COUNTY

Black Owl

WILLACY COUNTY

Chile Vieja

La Sal Vieja

Paso Real

Tenerias

Willamar

ZAPATA COUNTY

Benavides

Davis, South

Jennings/Jennings, West

Lopeno

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Pok-A-Dot

ZAVALA COUNTY

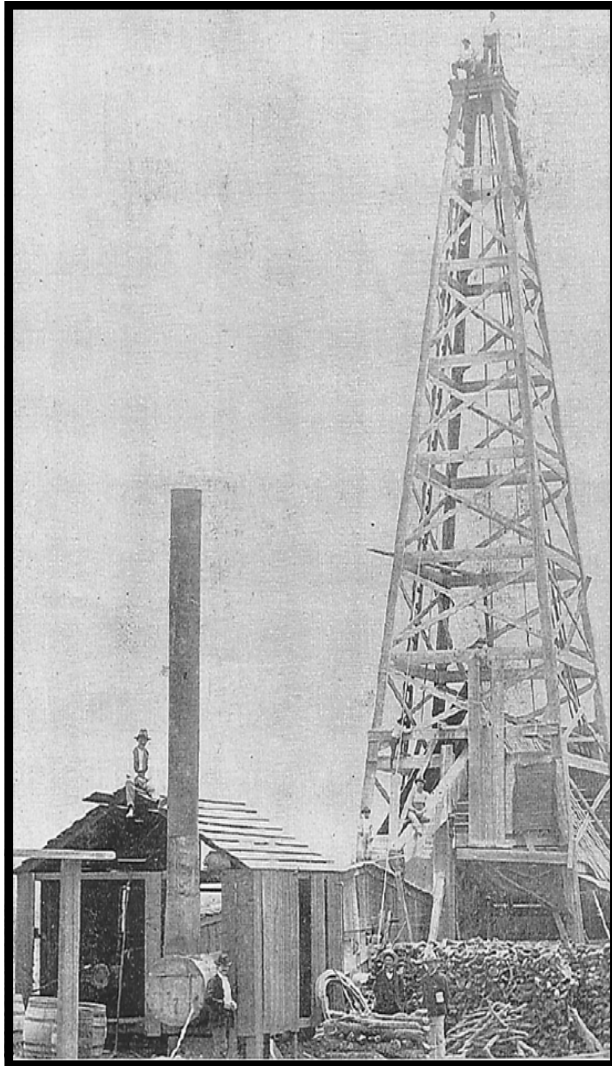
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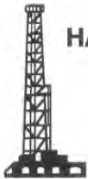
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