

BULLETIN

Corpus Christi Geological Society



**October
2026
ISSN0739 5620**

TABLE OF CONTENTS

Officers, Committees and Chairpersons for CCGS.....	2
CCGS Calendar of Meetings and Events.....	3-4
CCGS President's Letter.....	5-6
Student CCGS Membership.....	7
Membership Geologist, Geophysics, anyone in the business.....	8
Advertise in the Bulletin.....	9
Southern Geobiology Symposium.....	10
Geogulf 2027 call for papers.....	11
Geogulf 2027 Sponsorship Opportunities.....	12
Luncheon Meeting Announcement, Oct., Randy Bissell.....	14-15
Luncheon Meeting Announcement, Nov., Thomas E. Ewing.....	17-20
Remembering Walter Vernon Kramer.....	22
Geophysical Interpretation of Shell Middens: Karankawa Occupation Sites within the Welder Wildlife Refuge, San Patricio Co. Texas.....	24-37
CCGS Papers available for purchase at the Bureau of Economic Geology.....	40
Geo Link Post.....	41
Type Logs of South Texas Fields.....	42
Wooden Rigs Iron Men.....	43
Order Oil Men DVD.....	44
Professional Directory.....	45



CORPUS CHRISTI GEOLOGICAL SOCIETY

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

2026 - 2027

www.ccgeo.org

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Visit the geological website at www.ccgeo.org

CCGS MEETING SCHEDULE 2026-2027

September 2026							October 2026							November 2026						
S	M	T	W	Th	F	S	S	M	T	W	Th	F	S	S	M	T	W	Th	F	S
		1	2	3	4	5				1	2	3		1	2	3	4	5	6	7
6	7	8	9	10	11	12	4	5	6	7	8	9	10	8	9	10	11	12	13	14
13	14	15	16	17	18	19	11	12	13	14	15	16	17	15	16	17	18	19	20	21
20	21	22	23	24	25	26	18	19	20	21	22	23	24	22	23	24	25	26	27	28
27	28	29	30				25	26	27	28	29	30	31	29	30					
							Meeting Joe's Crab Shack Downtown. Gathering at 11:30, 12:00 speaker. A presentation and facilitated discussion - Randy Bissell "Gulf of Mexico – History with a Twist."							Meeting Joe's Crab Shack Downtown. Gathering at 11:30, 12:00 speaker (Thomas Ewing). "Laramide Deformation in Central & Southwest Texas: Balcones faulting, Wilcox unconformities the San Marcos Arch."						
December 2026							January 2027							February 2027						
S	M	T	W	Th	F	S	S	M	T	W	Th	F	S	S	M	T	W	Th	F	S
		1	2	3	4	5						1	2	1	2	3	4	5	6	
6	7	8	9	10	11	12	3	4	5	6	7	8	9	7	8	9	10	11	12	13
13	14	15	16	17	18	19	10	11	12	13	14	15	16	14	15	16	17	18	19	20
20	21	22	23	24	25	26	17	18	19	20	21	22	23	21	22	23	24	25	26	27
27	28	29	30	31			24	25	26	27	28	29	30	28						
							31													
No meeting																				

CCGS MEETING SCHEDULE 2026-2027

March							April							May						
S	M	T	W	Th	F	S	S	M	T	W	Th	F	S	S	M	T	W	Th	F	S
2027							2027							2027						
1	2	3	4	5	6					1	2	3								1
7	8	9	10	11	12	13	4	5	6	7	8	9	10	2	3	4	5	6	7	8
14	15	16	17	18	19	20	11	12	13	14	15	16	17	9	10	11	12	13	14	15
21	22	23	24	25	26	27	18	19	20	21	22	23	24	16	17	18	19	20	21	22
28	29	30	31				25	26	27	28	29	30		23	24	25	26	27	28	29
														30	31					
No meeting																				

Calendar Of Meetings and Events

Corpus Christi Geological/Geophysical Society..... Third Wed.—11:30 a.m.
 SIPES Corpus Christi Luncheons..... Last Tues.—11:30 a.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



Dear Colleagues,

I hope you had an enjoyable summer. It was definitely a summer of change! The two main reservoirs that supply us water have bounced back from the nearly catastrophic lows from a few months ago. There are also a number of changes associated with the CCGS, so let me take this opportunity to address the major ones.

One big change is in regards to our CCGS Bulletin. It will now be issued THREE times per year. Each issue will “preview” our next two meetings. The first Issue (October 1st) will preview October and November meetings. The second issue (January 1st) will preview January and February meetings. Our final issue (April 1st) will preview April and May meetings. A quick reminder: We don’t meet in December or March.

The CCGS Board of Officers has changed from last year. Robert Sterett is now Vice President, and we are delighted to have him on the board. Sebastian Wiedmann remains Treasurer, and Dennis Moore remains previous president. Rick Paige and Frank Cornish remain our Councilors. Juan Cabasos is our outgoing Vice President. Juan is connected to about everyone in the oil/gas business in this area. He was able to schedule some outstanding speakers over the past few years. Thank you, Juan!

The annual fishing tournament was another huge success, thanks (once again) to the leadership of Leighton Devine. Nearly \$8K was raised for funds going to our scholarship accounts. A hearty THANK YOU to Leighton and everyone who assisted (or participated) in this year’s tournament.

Last year the board approved a contribution to help fund the Baffin Bay 3D Watershed Model. Our contribution (along with others) helped see this project to completion. The project was spearheaded by the Texas A&M-CC Harte Research Institute, and was unveiled at our membership kick-off (September 16th). Anyone with an interest in the earth sciences will appreciate how impressive this transportable model truly is! It is no exaggeration to state this model is useful as an educational tool for students in primary & secondary grades through undergraduate higher education.

The University of Texas Marine Science Institute (UTMSI) will host the 2026 Southern Geobiology Symposium at Port Aransas, November 5-7th. Look for details in the weeks ahead. It promises to be an exciting event, and the CCGS will sponsor some awards for best papers/presentations. Please mark your calendars accordingly.

We have an exciting 2026-2027 speaker season ahead. It started with our annual membership event on Sep 16th at Nueces Brewing Co. Our October luncheon (October 21st, Joe's Crab Shack) will feature a panel discussion on issues involving Gulf exploration. A distinguished speaker is lined up for the November 18th meeting, to talk about the Wilcox and San Marcos Arch. I hope to see you at each event!

Chuck Benson
CCGS President

STUDENTS!

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Science – Natural Sciences

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- **Networking with professionals.**
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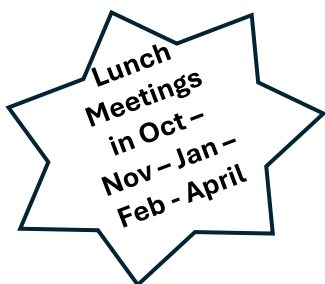
(If you've been a member, students need to re-enroll every year)

CORPUS CHRISTI GEOLOGICAL SOCIETY

Members!

Geologists – Geophysicists – Explorers
Anyone in the business, interested in geoscience,
or adjacent.

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CCGS - CBGS Bulletin Ad Space Available: Annual Rates (4 issues + directory)	
1/8 page 2.2" x 3.6" \$150	1/4 page 3.6" x 4.3" \$200
1/2 page 7.2" x 4.3" \$300	
Full page 7.2" x 8.6" \$500	Inside Front or Back Cover \$650

FOR MORE DETAILS:

EMAIL LDEVINE@SUEMAUR.COM OR CALL (361) 510-8872

The 2024-2025 season is underway, and we would like to offer very inexpensive advertising opportunities to our members and industry partners. The CCGS has four bulletins distributed to all our members each year. Ads defray the cost of producing and distributing print and PDF Bulletins.

We have lots of space available for various-sized ads, and we run business card ads at the back of each bulletin. If you have started a new business or have recently moved offices this is a great opportunity to introduce yourself. Business cards are \$30 annually. Send me a scan of your card or contact me for more information on our ad program.

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website

Port Aransas, Texas
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Areas: Gulf of Mexico, Onshore, Offshore, Mexico, and Caribbean

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- Geology and Geophysics, Field Studies, Case Studies, Look-Backs
- Source Rocks, Basin History, Geochemistry
- Structural Geology, Gulf Opening, Salt Tectonics
- Seismic Technology, Modeling, Inversion, Direct Detection
- Data Analytics, Virtual Reality, Computer Applications
- Remote Sensing Technology, Gravity Magnetics
- Environmental Studies, Near Surface Mapping, Remediation
- Gulf Coast Carbon Capture and Sequestration, Minerals, Geothermal
- Resource Assessment and Energy Economics of the GOM

DEADLINE: DECEMBER 1, 2026

Submit abstract via a Google Form at:

<https://forms.gle/KQbeDpXsX6v1FU4g9> or <https://geogulf.org>

Longer submissions (full papers or extended abstracts) after abstract acceptance are welcome.

Contact Program Chairs, Ted Godo (geodogexploration@gmail.com) and James Willis (jjwillis11@hotmail.com) for more information.





Sponsorship Opportunities

Diamond **\$20,000**

Premier recognition as a Diamond Sponsor. Opportunity to speak during the opening session. 6 complimentary conference registrations. Inside Front Cover advertisement in *Transactions* and Program (first come, first served) OR 2-pg. composite landscape advertisement, full color with bleed. Logo featured on the conference website, program, convention screens and signage, and all promotional materials.

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Copper **\$500**

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Patron **\$250**

Recognition as a Patron Sponsor. Name featured on the conference website, *Transactions*, Program, and convention screens and signage.

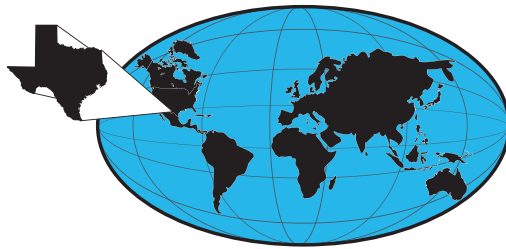
Friend **\$100**

Recognition as a Friend Sponsor. Name featured on the conference website, *Transactions*, Program, and convention screens and signage.

Note that all advertisements or logos will be published in full color for the digital version of the *Transactions* and Program. Bronze and higher-level sponsorships can be directed towards specific events dependent upon level of support.

GeoGulf 2027—76th GCAGS/GCSSEPM
Conference, 18-20 April 2027, at the
Norris Center in Houston, TX.
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Corpus Christi Geological Society

Luncheon Meeting Announcement

October 21, 2026

- Location:** Joe's Crab Shack, 444 North Shoreline Dr.,
Corpus Christi, TX 78401
- Student Sponsors:** Viper Exploration, Imagine Resources,
Advent/Aurora, Wiedmann Oil & Gas,
we thank you!
- Time:** 11:30 AM Social, Lunch follows at 11:45,
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, October
19th 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.

**SPONSORSHIP OPPORTUNITIES ARE AVAILABLE! IF YOU
WOULD LIKE TO SPONSOR, PLEASE CONTACT US AT:**

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Corpus Christi Geological Society - Luncheon Announcement

Wednesday, October 21, 2026

Gathering at 11:30 am, presentation at 12:00 pm

Joe's Crab Shack – Corpus Christi Marina

Cost: \$35/members, friends, and guests

Student lunches are sponsored (with RSVP).

Note: RSVP required – please contact Dorothy before Mon. 10/19

arrangements@ccgeo.org

Gulf of Mexico – History with a *Twist*

A presentation and facilitated discussion – Randy Bissell

Summary. To many, the Gulf of Mexico may look like a simple ocean basin—but for those who know it, the geologic history is anything but simple. This talk follows the Gulf story from the breakup of Pangea and Jurassic rifting, through deposition of the Louann Salt, development of the passive margin, massive sediment loading, salt movement, growth faulting, and gravity-driven movement of the coastal sediment wedge. These processes produced the complex structural framework that underlies the modern Gulf Coast.

The “twist” comes from recognizing that the Neogene margin did not necessarily move basinward as one uniform sheet. Adjacent sedimentary “mega-blocks” may have slid basinward at different rates, or along somewhat different trajectories, forming strike-slip zones between the blocks. These zones may be expressed by coast-perpendicular faults, terminating faults, fault bends, lineaments, structural lows, and corridors of differential subsidence. They may also have influenced where sediment was routed basinward, how depositional systems migrated through time, and, quite remarkably, where our modern rivers, bays, and estuaries became established.

Our innovative research project utilizes Geomap® regional subsurface map products to examine these suspected transform corridors systematically, looking for repeated structural alignments, fault terminations, offsets, changes in depositional fairways, and possible links between subsurface deformation and modern coastal geometry.

The petroleum implications may be equally important. Transfer systems can redirect sediment corridors, reorganize reservoir distribution, reactivate faults, deform closures, and, in some cases, contribute to trap leakage or loss. Along the Texas coast, the striking spacing and alignment of rivers and estuaries may represent one of the youngest surface expressions of a much older and still consequential structural fabric.

Randy Bissell is a Texas Licensed Professional Geoscientist with a long career in petroleum exploration, seismic interpretation, and Gulf Coast geology. His current interests are diverse, and they include Gulf of Mexico structural evolution, the impacts of orphaned wells on the ecology of Laguna Madre, and protecting the historical landforms associated with the Indigenous Peoples of South Texas. He is active in public science education through the Texas Master Naturalist program and frequently lectures on geology, natural history, and related earth-science topics across the region.

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A photograph of an oil drilling rig at night, illuminated by its own lights. The rig is positioned in the lower right quadrant of the frame. The background is a large, stylized American flag, with the stars and stripes clearly visible. The sky is dark, and the horizon shows some distant lights and structures.

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Corpus Christi Geological Society

Luncheon Meeting Announcement

November 18th, 2026

- Location:** Joe's Crab Shack, 444 North Shoreline Dr.,
Corpus Christi, TX 78401
- Student Sponsors:** Viper Exploration, Imagine Resources,
Advent/Aurora, Wiedmann Oil & Gas,
we thank you!
- Time:** 11:30 AM Social, Lunch follows at 11:45,
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, November
16th 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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arrangements@ccgeo.org

Corpus Christi Geological Society - Luncheon Announcement

Wednesday, November 18, 2026

Gathering at 11:30 am, presentation at 12:00 pm

Joe's Crab Shack – Corpus Christi Marina

Cost: \$35/members, friends, and guests

Student lunches are sponsored (with RSVP).

Note: RSVP required – please contact Dorothy before Mon. 11/16

arrangements@ccgeo.org

LARAMIDE DEFORMATION IN CENTRAL AND SOUTHWEST TEXAS: BALCONES FAULTING, WILCOX UNCONFORMITIES AND THE SAN MARCOS ARCH (A PRELIMINARY REPORT)

Presented by Thomas E. Ewing, Frontera Exploration Consultants, San Antonio TX

Pacific-side convergence and compression associated with the Laramide system affected much of North America from 80 to 40 Ma; however, its effects in Texas have generally been regarded as limited. Recent studies substantially expand the interpreted area and scope of Laramide-related events in the state.

Recent U-Pb dating of vein calcite from several locations in the Balcones fault system indicates that these normal faults formed at 55–60 Ma, with later reactivation during the Eocene and Oligocene. These results challenge earlier models of Miocene faulting that were based on the sedimentary record to the southeast. The Miocene was a time of regional uplift and erosion, but not necessarily of Balcones extensional faulting. The Paleocene age of major fault formation places it within the Laramide orogenic phase. How might the two be related?

Ongoing subsurface correlation studies, integrated with sparse surface observations, reveal a series of major unconformities affecting the Midway, Wilcox, and Queen City formations (Paleocene–Eocene) in southwest Texas west of San Antonio. Cumulative uplift of more than 1,000 ft is likely in the preserved outcrop area. The center of observed uplift lies in Zavala and adjoining counties, although uplift probably continued farther northwest beyond the preserved Paleogene sedimentary record. This uplift overlaps

with, but is distinct from, the San Marcos Arch, which was active in the Late Cretaceous and possibly also during the Paleogene. No Laramide faulting has been documented in southwest Texas but folding of the Chittim anticline and other structures of the Del Rio fold belt displaced strata as young as the lower Queen City Formation.

An initial hypothesis relates the Zavala uplift to the Carta Valley fault zone and related structures in West Texas. Left-lateral movement on the Carta Valley fault zone created compression to the east-southeast. Uplift of the Zavala area, as well as the broader San Marcos Arch to the north, may in turn have allowed the Ouachita fold-and-thrust belt wedge to slide southeastward off the uplift toward the deep Gulf of Mexico. Less than 1 km of sliding would have been sufficient to generate the extensional faults of the Balcones system. Distal Laramide stress may also have generated the outcrop arch of the Sabine uplift and the Preston anticline in east and north Texas.

Regional fracture systems of Laramide age have been reported in southwest Texas; regional fracturing and stylolite development are also likely to be significant in the southern West Texas Basin.

Dr. Thomas E. Ewing is a geoscientist with over 45 years of experience in hydrocarbon exploration and research. He is a Registered Professional Geoscientist in the State of Texas (#1320), an AAPG/DPA Certified Petroleum Geologist (#4538), and holds certification #1610 from SIPES.

He received a B.A. in Geology from the Colorado College (1975), an M.S. in Geochemistry from New Mexico Institute of Mining and Technology (1977), and a Ph.D. in Geological Sciences from the University of British Columbia (1981).

Dr. Ewing was a research geologist for four years at the Texas Bureau of Economic Geology in Austin, where he served as a co-author of the Atlas of Texas Oil Reservoirs, and compiled the Tectonic Map of Texas. Since 1985 he has been an owner of Frontera Exploration Consultants, Inc., a San Antonio-based geoscience consulting company. He worked with Venus Oil and Venus Exploration from 1985 to 2005 as staff consultant and Senior Explorationist,

playing a main role in its successful exploration in the Yegua Trend of the Gulf Coast Basin and elsewhere in Texas.

Dr. Ewing has served in many offices in AAPG and its Divisions, He served as Vice-President for Sections of AAPG (2012-14). He received Honorary Membership in the South Texas Geological Society in 2009, Honorary Membership in the GCAGS in 2010, AAPG Distinguished Service Award, and BEG Alumnus of the Year in 2011. More recently he has completed service as President of the GCAGS (2016-2017). In 2018 he was awarded the "Don Boyd Medal for Excellence in Gulf Coast Geology" from the GCAGS (Gulf Coast Association of Geological Societies), their highest award. In 2021 he received Honorary Membership in AAPG, and in 2023 the Berg Research Award from AAPG. In 2023 he also received the Monroe Cheney Science Award from the Southwest Section of AAPG. The 2024 GeoGulf Transactions was dedicated to him. And in August, 2026 he received the Sidney Powers Award, the top honor at AAPG.

Tom has spoken extensively at local, regional, and national geological meetings and published over 100 papers and abstracts. Among other awards, he has received the AAPG Levorsen Award three times, twice in Gulf Coast Section and once in Southwest Section. He has written articles on Gulf Coast geology and hydrocarbons, the geology and tectonics of Texas, and history and urban geology of the San Antonio area. He wrote the popular guidebook "Landscapes, Water and Man: Geology and Man in the San Antonio Area" published by the South Texas Geological Society in 2008. In 2016, Dr. Ewing completed Texas Through Time, an illustrated book and website on the geologic history and earth resources of Texas published by the Bureau of Economic Geology. Subsequently, he has authored chapters on the tectonic evolution of the Permian Basin (Ruppel volume; BEG) and on the geological development of the Gulf of Mexico Basin (Miall volume, with W.E. Galloway; Elsevier).

In his spare time, he directs a 30-voice German men's chorus, the San Antonio Liederkrantz, and a 20-voice women's chorus, the Beethoven Damenchor.

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SINCE 1905

Corpus Christi Geological Society Remembering Walter Vernon Kramer



As your membership chairman, I must share with you that I really do have some favorite members... Vern was typically the first to sign up each year and brought scores of students into the Society. Great CCGS member, colleague, true leader, and friend...Randy

Dear CCGS Members and friends,

One of my favorite people on this planet has passed into the geological record – Walter Vernon Kramer. Known by many names, Walter, Vern, Kramer, beloved by those who called him teacher, Mr. Kramer, mentor, friend, colleague...

When I got invited to teach Historical Geology at TAMUCC, the first thing I did was reach out to Vern and sit in on his Del Mar historical class. His patient style, deep knowledge, thoroughness, and engagement set a high bar, but he convinced me (excitedly) that geology is properly taught outside – with little patience for those less field capable than himself. He had low regard for any pseudo-geologist who dismissed the importance of traditional field methods. Field was sacred---mastery of the subject required---conquest of the outcrop expected...a proving ground for sincerity.

We share that. What good is a geologist that can't/won't look at rocks?

I am confident that other heaven-bound geologists will be led through the exquisite geology of the Hereafter, guided by Walter Vernon Kramer, wearing our green vests and hardhats. The chariots of heaven will be whizzing by too fast and too closely, but we'll be out there.

No doubt that he's already started the field planning details...because that is how Kramer rolls

RIP my friend. Thank you for making the CCGS better.

See you in the field.

<https://www.gracegardensfh.com/obituaries/walter-kramer>

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Jonathan N. Halepeska, CPL, REALTOR® and ROW Agent



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jnhalepeska@gmail.com**

Geophysical Interpretation of Shell Middens: Karankawa Occupation Sites within the Welder Wildlife Refuge, San Patricio Co., Texas

By Jarrett Kernen¹ and Randy Bissell²

¹Student & Research Assistant – 2025/2026; ²Adjunct Professor, Texas A&M University - Corpus Christi

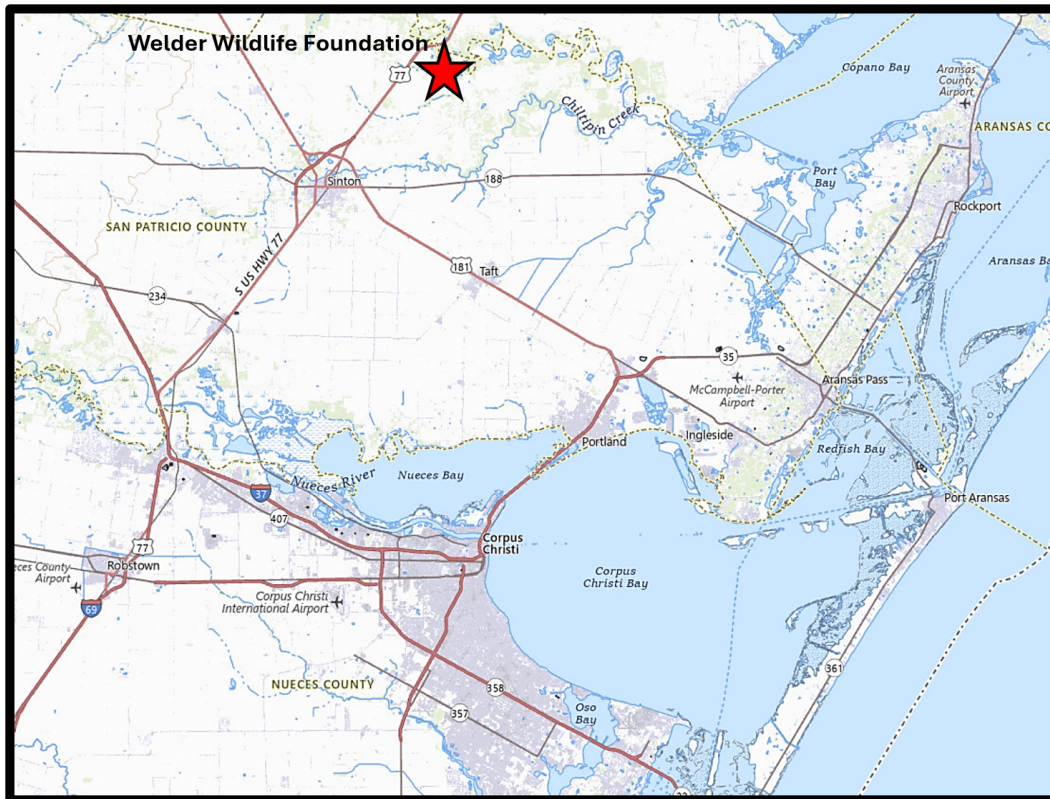


Figure 1. The Welder Foundation Parcel is north of Sinton, Texas, along the Aransas River from US77 to Copano Bay.

Introduction

Summary

Shell middens—accumulations of discarded mollusk shells and other material left by Indigenous Peoples—are widespread across the Welder Wildlife Refuge (WWR), and some remain undocumented or only superficially described. Among the most culturally significant markers of Karankawa Indians (in this region, Copano or Coapite Bands) occupation, these subtle geomorphic features provide insight into seasonal mobility, subsistence, and habitation decision-making. A previously unrecognized midden along the Hackberry Trail was identified by Randy Bissell in 2019 due to *Rangia cuneata* shells weathering from upland terrace soils, more than eleven miles (24 miles by river course) inland from

their natural brackish-water habitat. Because this midden was not excavated during earlier archaeological surveys, its composition and subsurface dimensions are unknown. In the context of renewed sensitivity to Karankawa heritage and an emphasis on non-destructive research practices, this study sought to determine whether geophysical methods could delineate the subsurface extent of the midden without disturbance.

Guided by regional geomorphology of the Aransas River valley—characterized by Pleistocene Lissie and Beaumont Formations, Holocene alluvium, and terraced floodplain surfaces—Ground Penetrating Radar (GPR) was selected as the first technique for its optimal vertical resolution (1 m) and depth of investigation (2–3 m). Fieldwork, completed in November 2025, employed a GSSI SIR-4000 system and drone-supported reconnaissance to design transects across the midden-bearing terrace. Preliminary processing suggests that GPR can identify subsurface heterogeneities consistent with cultural deposits, despite vegetation-related noise on select transects. In February 2026, another geophysical technique, an inverted resistivity survey, was attempted with likewise encouraging results.

Beyond addressing the technical questions of mapping midden geometry, this project provides a model for respectful, non-invasive geophysical archaeology. It affirms the potential for simple geophysical methods to enhance understanding of Indigenous land use, particularly the Karankawa strategy of occupying elevated terraces safe from Aransas River flooding. As geophysical imaging advances, such approaches may offer a vital alternative to more invasive excavations, supporting both scientific inquiry and the cultural sovereignty of descendant communities.

Reasoning for this Study

Shell middens, or relict refuse piles of shells from consumed clams of Indigenous Peoples, have been observed and documented on the private lands of the Welder Wildlife Refuge for decades. Ricklis (1996) published his findings regarding Welder middens in the aptly titled book, *Karankawa Indians of Texas: An ecological study of cultural tradition and change*, which has become the seminal text for understanding the placement and content of middens in the South Texas region.

In 2019, a “new” midden location was identified along an existing educational nature path, referred to as the Hackberry Trail, which runs along the Aransas River. This site was recognized by the occurrence of

bay-clam shells weathering from the soil. Later determined to be *Rangia cuneata* clams, this accumulation is eleven miles inland (24 miles by river) from the present habitat or natural occurrence of these brackish-water clams and thus it is interpreted to be a shell midden. Consultations with a Texas Parks and Wildlife archaeologist confirmed the midden interpretation. Visiting other documented Karankawa midden sites at Welder, *Rangia* clams are the most obvious identifier of a midden site, owing to the necessity of human transport far from their natural occurrence at Copano Bay.



Figure 2. The subject “Hackberry Midden” at Welder Wildlife Refuge. *Rangia cuneata* shells are brackish water clams found at a location eleven miles inland from their occurrence.

The Hackberry Midden was not documented by Ricklis; thus, it was not subjected to the routine methods of archaeological analysis and census of contents. The only knowledge of the Hackberry Midden contents comes from the scores of *Rangia* shells and few deer teeth that have weathered out of the soil along the trail. What is also unknown, without excavation, is the subsurface extent of the midden. Sensitivities towards cultural sites have changed since Ricklis, owing mostly to the reclaiming of Karankawa heritage by living descendants. Given the thoroughness of past investigations, it no longer seems fitting to excavate new middens in the name of understanding and to remove contents for “analysis.” Unrealized by Ricklis, the Karankawa are not an extinct group without a say in the

disarticulation of their sacred places. A modern, sensitive approach leaves such a site undisturbed as a cultural landmark in pristine condition.

The key questions asked in this study were **“How might we investigate the extent of the subsurface midden?”** and **“How might it be done with no impact on the site?”** Other research at Texas A & M University – Corpus Christi has employed Ground Penetrating Radar, Resistivity Surveys, and Acoustic Seismic as geophysical techniques conducted above ground surface with no destructive footprint of acquisition. Based upon the depth of investigation, to about 2-3 meters, and the controlled horizontal resolution, about one meter, Ground Penetrating Radar (GPR) was determined to be the most suitable method, and easiest, to try with available experienced personnel and equipment. Later, another technique called inverted resistivity was utilized.

This project represents the attempt to answer those two key questions within the context of the geological understanding of the area – and referencing a cultural understanding of the Karankawa People. An outgrowth of this effort is to better understand the geomorphological preferences of the Indigenous People as they inhabited the fertile Aransas River valley. This short river, placid much of the time, is prone to rapid and ferocious flooding. Midden locations at Welder reflect the Karankawa understanding of the hazards of being too low, too close to the river, preferring the upland terraces of the river and creek for habitation. Settlement by Anglo-Texans in the 1800s reflects the location of their homesteads on and near midden sites in these locations, close to water but safely upland.

Natural And Cultural History

Welder Wildlife Refuge (WWR) is approximately 7,800 acres of conserved land located in San Patricio County, in South Texas, USA, located on Figure 1. Here, the South Texas inner coastal plain sits upon the early Pleistocene Lissie Formation (Deussen, 1914), and the loamy soil covers the refuge’s greater area. Inclusions of Holocene alluvium are present in the Eastern section of the refuge on the Aransas River flood plain, with the Beeville sheet (fluvial terraces sometimes referred to as Deweyville) including from the North over the study area. The Pleistocene Beeville sheet does not change lithology from the Lissie, except with the addition of gravel and caliche in deposits along valley walls. (USGS, Pocket Texas Geology). Above the Lissie formation sits the Beaumont Formation, the late Pleistocene

outer coastal plain with clayey soils. The Fleming and Goliad sit below the Lissie, formed during the Miocene to Pliocene, primarily composed of fluvial deposits, the Goliad being the sandiest facies with often calcified (caliche) coarse, braided stream, deposits.

Generalized Stratigraphy – Welder Wildlife Refuge	
Holocene Deposits	Modern alluvium - <i>undifferentiated sands/muds</i>
Late Pleistocene	Beeville/Deweyville - <i>fluvial gravels and caliche</i>
Late Pleistocene	Beaumont Formation - <i>clay soils (agricultural)</i>
Early Pleistocene	Lissie Formation - <i>sandy clay soils (pastoral)</i>
Pliocene-Miocene	Goliad Formation – <i>friable sandstone</i> Fleming Formation – <i>sand, clay, caliche, petrified wood</i>

Table 1. Age, Stratigraphy, and Lithology

Welder Wildlife Refuge, and the newly studied Hackberry Midden, are characteristically an Aransas River fluvial terrain located well inland from the nearest estuarine and marine wetlands, the closest being Copano Bay, twelve miles to the east. The Aransas River forms a small bayhead delta in the southern reach of Copano Bay. Considering the normally brackish conditions of the delta, this location would have been an important food source for Karankawa because of the abundant *Rangia* clams, oysters, fishing, small game, and shorebirds, all of which contributed to their high-protein diet. East of Copano Bay, the Rockport sand ridge is part of the late Pleistocene Eemian barrier island Trend, which stretches from Flour Bluff, and across the Lamar Peninsula to Port Lavaca. This low sand ridge separates inland bays from the lagoonal bays behind the modern barrier islands. Flood plains on rivers, small and large, are an integral part of the dynamic geomorphology of the coast. LiDAR Digital Elevation Models (DEMs) readily indicate ancient and more modern floodplains and natural levees across the Refuge occurring between elevations of 4 m above sea level with high terraces reaching 6-8 m (Figure 3). The large scale sea-level changes in Copano Bay have occurred before 4.0 ka, with the largest Holocene flooding events occurring prior to 5000 yr. BP (Anderson et al., Fig. 55). Smaller scale climate events and cycles effected the region during the time of local Native American habitation (1200s-1800s).

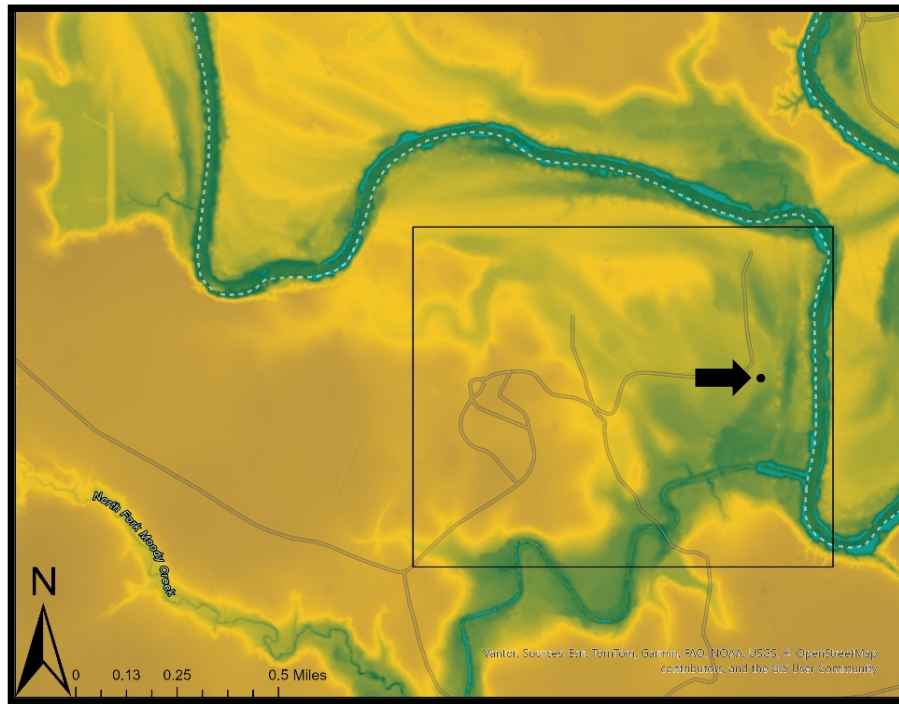


Figure 3: Shows the study area at the black dot, within a multi lane floodplain, with branches approximately 200-300 m North of the study area (DEM Credit: HARTE Research Center open source, TCRMP)

The Karankawa

A common misconception is that Karankawa is one people, or a “tribe,” with a singular defined culture, traditions, and central leadership. This is only partly true as Robert Ricklis points out in his book, *The Karankawa Indians of Texas, An Ecological Study of Cultural Tradition and Change*, there were five distinct family-language groups of Karankawa Indians; “Carancaguases, Cocos, Cujanes, Guapites, and Copanes.” (Ricklis 1996) Within the study area, the accurate band assignment would be Copanes or Coapites, those inhabiting the Aransas River valley, which empties into Copano Bay. Ricklis also mentions natural ecological boundaries between “Karankawa and non-Karankawa in the 1760s” (Ricklis 1996). Such a boundary is the Brazos River, marked as the northernmost in Figure 4, created a physiographic barrier between the Karankawa (Coco) and other groups such as the Akokisa and Atakapa. It appears through other sources related to native American peoples that Baffin Bay, marked as

the southernmost “Karankawa Country” bay and approximately 50 km South of Nueces Bay, bounded the coastal Unpunclegut or Coahuiltecan peoples occupying present day Cameron and Willacy Counties (Campbell 2023).

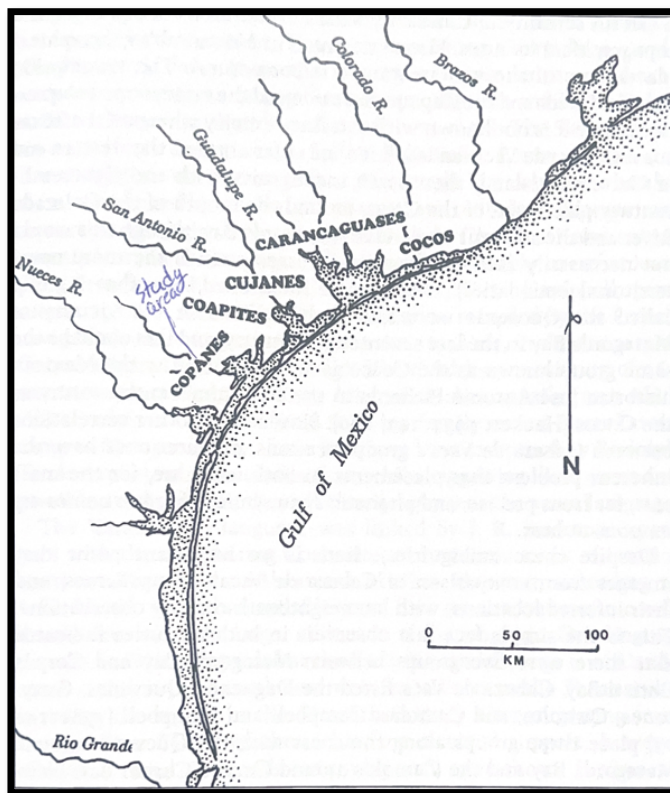


Figure 4: Map of the Coastal bend area, with the addition of the different river systems which empty into the five bays that make up a majority of the coast; Nueces Bay, Copano Bay, Hynes Bay, Lavaca Bay, and Matagorda Bay when moving South to North (Ricklis 1996).

As understood, the Copanes and Coapites are the bands of Karankawa in and around the Nueces River, Aransas River, and Copano Bay areas. Through Robert Ricklis’s extensive work in the Coastal Bend, he found and examined sites believed to be Karankawa habitations as indicated by the presence of middens. One such site is a large shoreline fishing camp, located on his maps where the modern “Camp Aranzazu” is presently in Rockport Texas, at the northern edge of the Live Oak peninsula. A smaller hunting camp is adjacent to Swan Lake inland. Moving up the Aransas River, at the second break from the rivers meandering flow path is a dense collection of “Prairie-Riverine hunting camps” (Ricklis

1996). Within this area is the Hackberry Trail Midden, which is this project specific study area, denoted in Figure 3.

In their centuries of inhabitation, the Karankawa relied on a variety of plants and animals to meet their caloric needs, with the Coastal Bend containing a vast and varied selection of seasonal foods such as clams, fish, large mammals, small mammals, and plants (berries, greens, nuts, and roots). Often mistakenly referred to as nomadic or semi-sedentary, the Karankawa were experts at seasonal migrations for reliable food sources. Movement amongst the rivers, bays, and islands required a regard for seasons, conditions, and passage via water and land.

The Karankawa would move inland as temperatures warmed for deer and bison, while less intensive activities such as bow fishing and harvesting *Rangia* could be done in the fall and winter. (Ricklis 1996) Large animals were abundant on the prairies, and food was plentiful – the good hunting grounds in the warmer months. The island was important, also, but rather than stay at the coast the entire year, food sources motivated movement. The migratory history reflects a deep understanding of weather patterns. Higher winds would help with keeping insects away while fishing. Due to the size and number of the middens found at the Welder Wildlife Refuge, there seems validity to Ricklis' assertion that these sites were significant habitations and trade with other groups was conducted in this inland region.

In the mid-18th century, Spanish colonization and missionization reached the Karankawa, evidenced by missions such as Nuestra Señora del Espíritu Santo de Zúñiga in Goliad and Nuestra Señora del Refugio. By the 19th century, the coastal region of “Texas” was encroached and pressured from multiple directions - Mexicans/Texicans from the south; Stephen F. Austin's “Empresarios” and the homesteading American Anglo-Texans from the north; and other Indigenous groups, like the Apache and Comanche from the west. Missions and land claims separated the territory, disrupting the patterns essential to sustaining the Karankawa lifestyle. Spanish colonial attempts to “civilize,” assimilate, and convert the Karankawa at missions encouraged dependency and led to near enslavement. Alternations in self-sustenance resulted in vulnerability. Texas settlers regarded the “primitive and lazy” Karankawa as a nuisance and impediment to their ranching and farming aims (Anderson 2005). Bands of settlers, sanctioned and unsanctioned, hunted Karankawa for sport and bounty. By the mid-1800s, the Karankawa were considered “conquered.” Displaced, with the remnant of mostly women, they were

forced to the Rio Grande Valley. The culture was obliterated, the language and tradition lost – only in the times of the 21st Century would the remnant regroup to reclaim their name and place. That is a history still being written.

Geophysical Methods

Study Area Description

Hackberry Midden is located at a latitude of 28.114310°N and 97.407462°W - WGS 84 (GoogleEarth). The site rests on an Aransas River high terrace, upland of the flood plain to the east. Floodplain information was collected from open-sourced DEM from HARTE Research Institute, and analyzed using ArcGIS Pro. This site was chosen for our investigation due to its compact size. It is uniquely unexcavated and previously undocumented.

November 2025 GPR Survey

Meetings with Welder Wildlife staff were held before any field activities began in the refuge. After reconnaissance of the Hackberry Midden site, two primary tools were used for scouting and data collection during the first survey: a DJI Mavic Mini quadcopter drone and a GSSI SIR 4000 Ground Penetrating Radar system.



Figure 5: Shows an aerial view of the Hackberry Mott Trail and midden survey site to the far right. The road is the Hackberry Trail, moving down elevation into the floodplain.

The drone was useful for aerial scouting of the site and determination of possible transect tracts. We recorded footage for the project proposal using the lightweight recreational drone to preplan the GPR transect. Figure 5 shows the area in which the scouting of the transect and the subsequent surveying took place along the road. Surveying was completed on November 2, 2025, under clear skies with a temperature of 25.5-27°C (77.9-80.6°F). The site was damp due to light rain the night prior, with minimal vegetation cover on the x-axis transects, while y-axis across the midden contained heavier brush, requiring filtering from GPR data.



Figure 6: Jarrett and the GSSI SIR 4000 in November 2025.

The profile revealed significant interruptions in shallow reflectivity. Surface inspection revealed midden shells in the soil at places scattered along the trail. More detailed site work might align shell artifact occurrence along the trail with the GPR interpretation suggestion of extent.

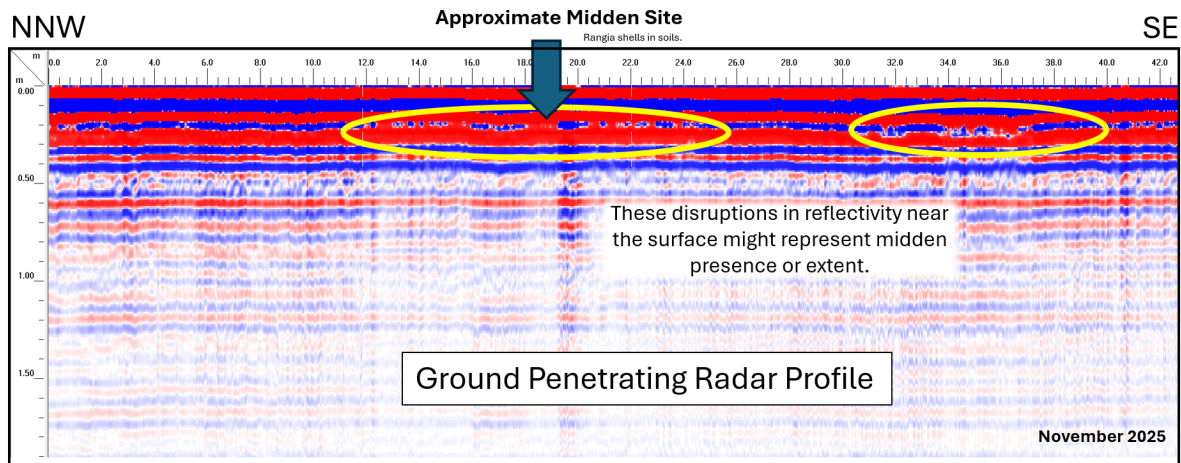


Figure 7. The GPR profile with suspicious disruption in the uppermost soil reflections.

February 2026 Resistivity Survey

In February 2026, another opportunity to acquire geophysical data over the midden site arose, using a different technique, inverted resistivity. Inverted resistivity surveys offer a deeper non-invasive means to examine the extent of shell middens, revealing variations in soil composition caused by dense shell deposits and altered midden soils.

TAMUCC graduate researcher, Muhamed Elshalkany, conducted the survey and described the process details, “Data were acquired using an Advanced Geosciences Inc. (AGI) SuperSting R8 Resistivity/IP system, with up to fifty-six electrodes deployed in dipole–dipole and strong gradient configurations. Electrode spacing was set at 1 m to achieve high near-surface resolution. The collected data were processed and numerically inverted using EarthImager 2D to generate a two-dimensional geo-electric cross-section along the transect.”

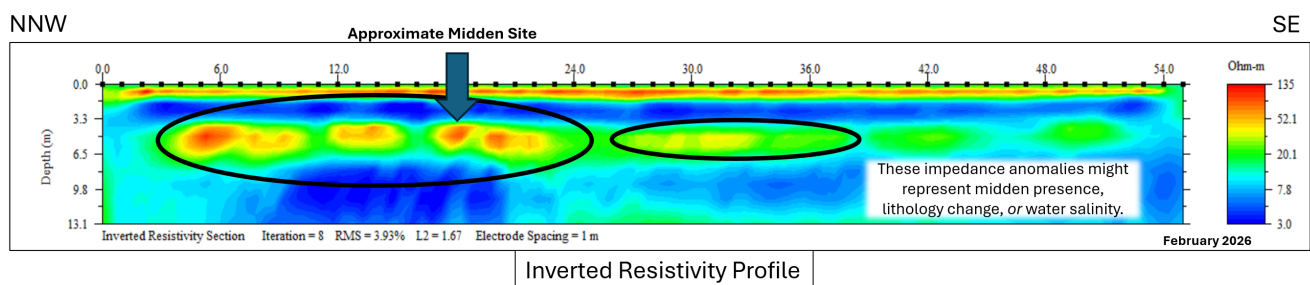


Figure 8. The resistivity profile with anomalies in proximity to the GPR disruptions.

Complementing the earlier GPR, the resistivity profile result suggests variations significantly deeper in the 2-4 m depth range. The deposits or variations in the strata that are causing these anomalies could be shell middens, gravels, or variations in aquitard salinity.

Preliminary Conclusions

Notwithstanding the results of additional processing the GPR and the resistivity profiles and with further interpretations of imaging, we feel that this project was successful in meeting the stated objectives of the TAMUCC Directed Independent Studies for Fall 2025 and Spring 2026.

Research Objectives

- Conduct thorough literary research on the native peoples of the Texas coast, their culture, behavior, and movement. (Accomplished in research readings).
- Interact with other professionals and organizations involved in the preservation and investigation of Texas archaeological sites and artifacts. (Accomplished through contact with Dr. Moore, Dr. Montoya, Welder staff, NDP staff, and others).
- Utilize GIS software, such as ArcGIS and QGIS, to compare LiDAR and downloadable satellite data and imagery to identify and verify midden sites within the Welder Wildlife Refuge. (Accomplished in review using QGIS).
- Conduct field reconnaissance of midden sites at Welder. (Accomplished in the field).
- Utilize Ground-Penetrating-Radar (GPR) to “map” the extent of subsurface disturbances correlated to midden sites. (Accomplished Nov. 5). Additionally, the resistivity profile was added in February 2026.
- Prepare a short report and presentation, poster or oral, for an upcoming student or public forum. (Presented at the University of Texas Marine Science Institute’s Texas Bays & Estuaries Meeting in April 2026).

Of greatest success was the employment of non-destructive geophysical technologies to analyze a bona fide and important archeological site without disrupting the site itself. Prior work by Ricklis and others was vital to understanding the contents of the Welder-Aransas middens. In this project,

we accomplished a “respectful” approach to geo-archeology using TAMUCC technologies. We are excited to try these and other non-invasive techniques to measure and characterize South Texas shell middens.

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[CCGS 112G](#) \$12.00

GEO LINK POST

<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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<http://antwrp.gsfc.nasa.gov/apod/asropix.html> Astronomy picture of the day--awesome. I click this page everyday.

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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
Lutties
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

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LAVACA COUNTY

Hallettsville

Hope

Southwest Speaks

Southwest Speaks Deep

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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

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Hodges

Mathis, East

McC Campbell 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.

Cabazon

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Tenerias

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ZAPATA COUNTY

Benavides

Davis, South

Jennings/Jennings, West

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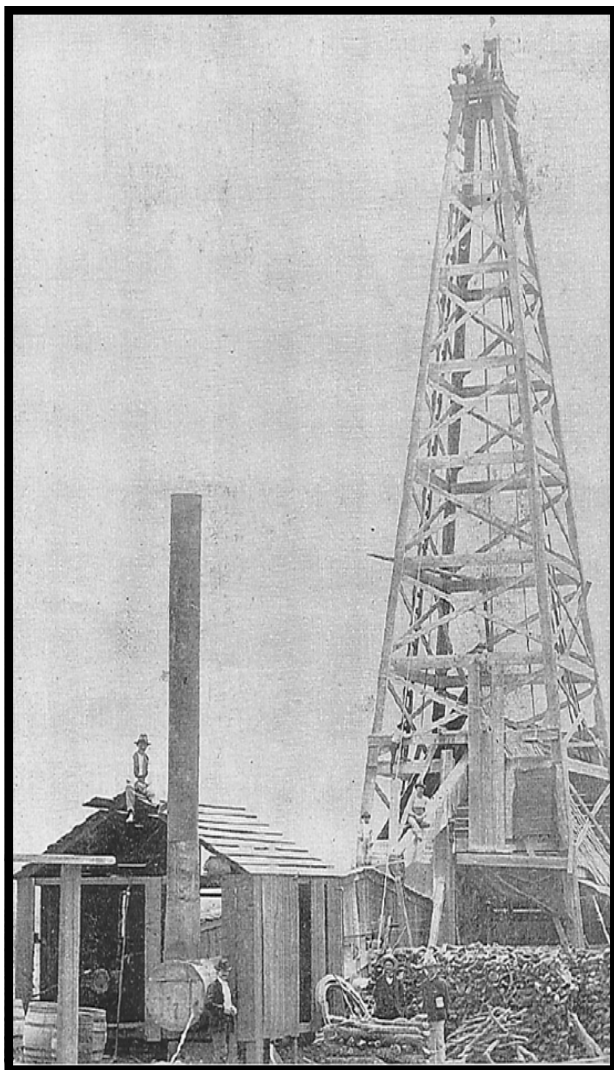
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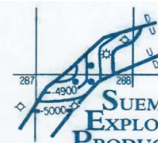
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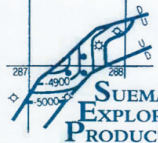


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