BULLETIN

Corpus Christi Geological Society

and

Coastal Bend Geophysical Society

November 2021
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2021-2022
www.ccgeo.org

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2021-2022

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Visit the geological web site at www.ccgeo.org

CCGS/CBGS JOINT MEETING SCHEDULE 2021-2022

September 2021

S	M	T	W	Th	F	S
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5	6	7	8	9	10	11
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31						

November 2021

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2021-22 Membership Kickoff—Nueces Brewing Co. Downtown Thursday, Sept., 9, 2021 5:30p.m.-til

Oct. 20th meeting at Crawdaddy's Downtown. Presenter: Barry J Rava- Exploration consultant to international companies. "Subtle Prospects in the 21st Century: Are They Relevant?"

Nov. 17th meeting at Crawdaddy's Downtown. Presenter: R. Scott Pollard "Magnus Opus --A Long Look Back"

December 2021

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February 2022

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27	28					

Jan. 17 meeting at Crawdaddy's Downtown. Presenter: Robert Schneider "Seismic Stratigraphy Via Attribute Analysis, Brooks County, TX."

Feb. 16 meeting at Crawdaddy's Downtown

CCGS/CBGS Joint Meeting Schedule 2021-2022

March 2022						
S	M	T	W	Th	F	S
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April 2022						
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May 2022						
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29	30	31				

April 20 meeting at Crawdaddy's Downtown

May meeting at Crawdaddy's Downtown

Calendar of Meetings and Events Meetings and Events

Calendar of Area Monthly Meetings

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, Metalllurgy & Exp..... 2nd Tues every other month in San Antonio

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From the President's Desk

Rick Paige

Seasons change

Autumn is here. We look forward to the arrival of cool fronts, changing colors, and good sleeping weather, breaking the long stretch of summer heat and humidity. The official end of hurricane season also brings a measure of relief. Fall season also means the start of monthly technical luncheon meetings. Our October luncheon meeting, the first in-person in 1.5 years, was held at our new venue, Crawdaddys Downtown. Thirty three members listened to Barry Rava speak to us on the challenges of selling subtle prospects in the current, and future, business climate. I heard many grateful comments for the chance to gather in person again. We live and work within a small geoscience community, and it has been hard to remain apart for so long. I, for one, was thrilled to be back together! As for our new venue, my sense was everyone enjoyed the top end PA system, Cajun food, and free beer!

Our next meeting is November 17. Scott Pollard will be speaking to us about recent and current supply and demand, and financing, as it relates to the shale production industry, concluding with the forecast going forward. We pause our meetings in December due to the holidays. The following meeting will be January 19th.

I'm pleased to report that the position of Vice President has been filled. We have co-VPs this year. Juan Cabasos and Charles Benson will be lining up CCGS-provided speakers for the remainder of this season. In fact, our November speaker was the first set up by Juan. Thank you both.

This fall also marks the return of college students to the classrooms of our local universities, TAMUCC, TAMUK, and Del Mar College. With that in mind, the Scholarship committee will be awarding fall scholarships at our November meeting. Come and meet the students who are among the leaders in their classes!

Recently

In September we initiated the new season with an enjoyable Kickoff event held at the Nueces Brewing Co. As it was the first Kickoff in two years, due to, what else, the pandemic, it was rewarding to see so many friends come out and reunite. Hopefully the Covid pandemic will continue to ease enough that we can put on more social events.

An update from the CCGS Fishing tournament held in July: a final accounting shows that the event generated $5000 to our college Scholarship Fund! That is an amazing accomplishment for an event that had been canceled the year before. Thank you Leighton Devine and Patrick McCollough for all your hard work. It is truly worthwhile!

Speaking of social events, if you have an interest in joining a CCGS sponsored social event, please consider volunteering. Fermin Munoz is considering reestablishing the golf tournament, while B.J. Thompson and Dawn Bissell would love to resurrect the Pub Crawl, but are very limited in time due to their job commitments. They could really use some organizer helpers. We need someone to organize

the return of Pint Night. Or perhaps you have an idea for something entirely different. Drop me a line and let's discuss.

(Trying to) Return to Normal

The economy and workplaces are trying to bounce back from the paralysis of the pandemic. However, the tenacity of the Covid Delta variant, coupled with lingering government financial support programs, is making for an inefficient return to normalcy. Some industries are suffering a shortage in the supply of materials which is choking productivity (attend this month's luncheon meeting for more on that). For others, a lack of workforce is the limiting factor. Oil and gas prices reflect that imbalance as well. While hammered during most of 2020 (remember negative $37/barrel oil for futures contracts in April, 2020?), prices have recently escalated to 7 year highs. Whether they will remain there, retreat to a healthy, stable level, or even fall back to 2020 levels, is anyone's guess. Nevertheless, now would be a good time to dust off those prospects shelved during the long, dark days of pandemic.

Looking forward to seeing you November 17.

CORPUS CHRISTI GEOLOGICAL SOCIETY
COASTAL BEND GEOPHYSICAL SOCIETY

LUNCHEON MEETING ANNOUNCEMENT

November 17, 2021

Location:	**Crawdaddy's Downtown, 317 Mesquite St. CC, TX 78401**
Student Sponsor:	**Viper Exploration, Nye Exploration, Imagine Resources. Thank you!**
Time:	**11:30 AM Bar, Lunch follows at 11:45 AM, Speaker at 12:00 PM**
Cost:	**$30.00 (additional $10.00 surcharge without reservation: NO SHOW may be billed.)**
Reservations:	**Please RSVP by 11:00 AM on Monday, November 15th before the meeting!**
	Email: arrangements@ccgeo.org

Please note that luncheon RSVPs are a commitment to Crawdaddy's Downtown 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:

arrangements@ccgeo.org

CBGS President's Letter

CBGS Board 2020-2021

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

CBGS Scholarships

The Coastal Bend Geophysical Society (CBGS) has donated $10,000 to the Department of Physics and Geosciences, Texas A&M University-Kingsville in support of the multidisciplinary Petrophysics Graduate Program that has been requested. These funds will be used as scholarships in attracting quality graduate students.

The board awarded three scholarships of $2,000 each to undergraduate geophysics majors from Texas A&M University-College Station, University of Houston and Texas A&M University-Kingsville. We will be awarding the scholarships again this year.

Scholarship Requirements

Criteria for awarding the Scholarship from Coastal Bend Geophysical Society of Corpus Christi, Texas:

1. Scholarships are open to undergraduate or graduate students.
2. Must have declared major in Geophysics, or Geology with a concentration in Geophysics or Petrophysics.
3. Preference is given to students attending Coastal Bend schools (TAMU-K, TAMU-CC and Del Mar College), then to Coastal Bend natives attending other universities.
4. Must have a GPA of at least 3.0 and be in good standing with the school.
5. Must make effort to attend a Coastal Bend Geophysical Society Meeting in Corpus Christi Texas after being awarded a scholarship to be recognized by the society.

News

- According to Baker Hughes Co, the oil and gas rig count is 533 in the week of October 8, 2021, which is the highest since April 2020. This also reflects a 98% increase compared to this time last year.
- As of October 8, the U.S. crude futures were trading at ~$79 a barrel buoyed by a global energy crunch that has helped natural gas prices to record highs and prompted China to demand increased coal production, as reported by Scott DiSavino on reuters.com.
- According to U.S. investment bank Piper Sandler, the rig count would rise to an average of 472 in 2021 and 599 in 2022 from 436 in 2020.

CBGS Business

CBGS currently has 43 active members, 4 honorary members, and 40 student members. Raised $1,450 towards student scholarships through membership revenue this past year.

CBGS workshops/talks

CBGS recently co-hosted the Ocean Discovery Lecture entitled "*Hunting the Magnetic Field through Ocean Drilling"* by Dr. Lisa Tauxe on Dec 1, 11 am-12:30 pm.

CBGS recently co-hosted a talk entitled "*Links Between Sediment Properties and Megathrust Slip Behavior – the Cascadia Example*" by Dr. Shuoshuo Han on March 1st at noon.

CBGS is looking forward to offer workshops/talks in the future. Topic/speaker suggestions are welcome. Email your suggestions to Subbarao.Yelisetti@tamuk.edu

New Degree Tracks at TAMUK and Graduate Scholarships

- Texas A&M University-Kingsville (TAMUK) started its first cohort of MS Petrophysics program in Fall 2018. If you are interested in joining this program in Spring 2022, please contact the graduate coordinator for MS in Petrophysics, Dr. Subbarao Yelisetti at Subbarao.Yelisetti@tamuk.edu.
- The Department of Physics and Geosciences at TAMUK is offering competitive scholarships for MS Petrophysics students. For additional details about the program and scholarships, please visit the website:

  https://www.tamuk.edu/artsci/departments/phge/phys/academics/gp.html
- **BS degree in Geophysics, Minor in Geophysics and Certification in Geophysics** offered at Texas A&M University-Kingsville since Fall 2017. Interested students can contact Dr. Subbarao Yelisetti (Subbarao.Yelisetti@tamuk.edu) for additional information.

Education/Events

-SEG

SEG 2022 annual meeting will be held in Dallas, TX from September 10th -16th. See https://seg.org/AM/ for additional details.

See https://seg.org/Education/Lectures/Distinguished-Lectures for information about upcoming SEG distinguished lecture in Houston and other locations.

See https://seg.org/Education/Lectures/Honorary-Lectures for SEG honorary lecture locations in Texas.

-AGU

2021 Fall AGU annual meeting will be held in New Orleans, LA from December 13-17th, 2021. https://www.agu.org/Fall-Meeting

Monthly Saying

"A century ago, petroleum - what we call oil - was just an obscure commodity; today it is almost as vital to human existence as water"- James Buchan

Monthly Summary

Texas Oil and Gas Info	Current Month	Last Month	Difference	
Texas Production	**MMBO/BCF**	**MMBO/BCF**	**MMBO/BCF**	
Oil	134.6	142.1	-7.5	June
Condensate	19.8	20.9	-1.1	June
Gas	849.2	890.1	-40.9	June
	Current Month	**Yr to date - 2021**	**Yr to date - 2020**	
Texas Drilling Permits	801	6332	6374	September
Oil wells	179	1481	1564	September
Gas wells	77	503	439	September
Oil and Gas wells	502	4083	3998	September
Other	4	65	125	September
Total Completions	1333	10300	20149	September
Oil Completions	1007	7691	15838	September
Gas Completions	326	2609	4311	September
New Field Discoveries	0	10	17	September
Other	491	3966	8121	September

Subbarao Yelisetti
President, CBGS

CCGS Luncheon Presentation – November 17, 2021
Crawdaddy's Downtown

Magnus Opus

A Long Look Back

Abstract: The paper addresses Supply and Demand in the Oil and Gas Industry focusing on the years 2017 through 2019. Mainly through the use of public data it describes the remarkable growth during the period along with the concepts and misconceptions about Shale activity. It will discuss that growths relationship with Shale Plays. How was it done and how was it financed? Where does that leave us and where do we go from here?

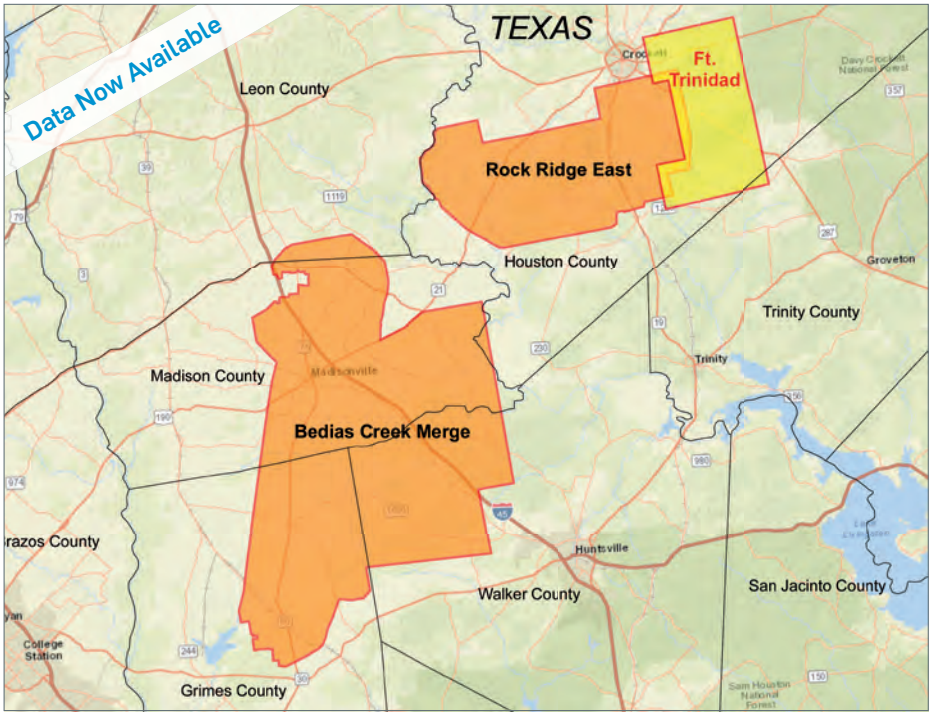
R. Scott Pollard

Bio

Scott Pollard graduated with a B.B.A. in Petroleum Land Management in 1979 and B.Sc. in Geology in 1981 both from the University of Oklahoma. He worked as a Petroleum Geologist in Oklahoma City, Oklahoma for a small Independent until 1991. In 1991 he moved to San Antonio, Texas to work for Clayton Williams as an Oilfield Scout and then Geologist until 1994. Since 1994 Scott Pollard has worked as a Contract Oilfield Scout focused on horizontal activity across the Gulf Coast and Permian Basin. Mr. Pollard has consulted for such companies as Clayton Williams, ExxonMobil, Marathon, Anadarko, EOG (Tyler), Kerr-McGee and many others.

YOU'VE ARRIVED

New Ft. Trinidad 3D Survey
Houston and Trinity Counties, TX



CGG continues to expand its East Texas footprint with high-quality 3D projects while illuminating the stacked pay formations.

Data is already available from our Bedias Creek Merge and Rock Ridge East projects. Orthorhombic PSTM from our newest project Ft. Trinidad is also now available.

The right data, in the right place, at the right time

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CGG
Passion for Geoscience

Lillie Maxine Shelton Neth

It is with deep sadness to report that Lillie “Maxine” Shelton Neth passed away on September 23, 2021. Everyone in the geologic community that met Maxine could not help but think she was extraordinay. She was always gracious and helpful. She will be truly missed. If there is a geological library in heaven, she is surely the manager of it. God bless you, and may you rest in peace Maxine.

Some of the content in the following paper "Mountaineering in the Sierra Nevada" contain materials that may be considered prejudiced, stereotyped, or offensive. It should be remembered that this account is the author's opinion at the time of its writing in 1870. These opinions do not represent the opinions of the Corpus Christi Geological Society, its officers, or members.

Mountaineering in the Sierra Nevada
by Clarence King
XII
SHASTA FLANKS
1870

There are certain women, I am informed, who place men under their spell without leaving them the melancholy satisfaction of understanding how the thing was done. They may have absolutely repulsive features, and a pretty permanent absence of mind; without that charm of cheerful grace before which we are said to succumb. Yet they manage to assume command of certain. It is thus with mules. I have heard them called awkward and personally plain, nor is it denied that their disposition, though rich in individuality, lacks some measure of qualities which should endear them to humanity. Despite all this, and even more, they have a way of tenderly getting the better of us, and, in the long run, absolutely enthroning themselves in our affections. Mystery as it is, I confess to its potent sway, long ago owning it beyond solution.

Live on the intimate terms of brother-explorer with your mule, be thoughtful for his welfare, and you by-and-by take an emotional start toward him which will surprise you. You look into that reserved face, the embodiment of self-contained drollery, and begin to detect soft thought and tender feeling; and sometimes, as you cinch your saddle a little severely, the calm, reproachful visage will swing round and melt you with a single look. Nothing is left but to rub the velvet nose and loosen up the girth. When the mere brightness and gayety of mountain life carries one away with their hilarious current, there is something in the meek and humble air of a lot of pack animals altogether chastening in its prompt effect.

My "'69" was one of these insidious beings who within a week of our first meeting asserted supremacy over my life, and formed a silent partnership with my conscience. She was a chubby, black mule, so sleek and rotund as distantly to suggest a pig on stilts. Upon the eye which still remained, a cataract had begun to spread its dimming film. Her make-up was also defective in a weak pair of hind legs, which gave way suddenly in going up steep places. She was clumsy, and in rugged pathways would squander much time in the selection of her foothold. At these moments, when she deliberated, as I fancied, needlessly long, I have very gently suggested with Spanish spur that it might be as well to start; the serious face then turned upon me, its mild eye looking into mine one long, earnest gaze, as much as to say, "I love and would spare you; remember Balaam!" I yielded.

These animals are always of the opposition party; they reverse your wishes, and from one year's end to another defy your best judgment. Yet I love them, and only in extreme moments "go for" them with a fence-rail or theodolite-tripod. Nothing can be pleasanter than to ride them through forest roads, chatting in a bright company, and catching glimpses of far, quiet scenery framed by the long, furry ears.

So we thought on that sunny morning when we left Sisson's, starting ahead of wagons and pack animals, and riding out into the woodland on our trip round Shasta; a march of a hundred miles, with many proposed side-excursions into the mountain.

The California haze had again enveloped Shasta, this time nearly obscuring it. In forest along the southeast base, we came upon the stream flowing from McCloud Glacier, its cold waters milky white with fine, sandy sediment. Such dense, impenetrable fields of chaparral cover the south foothills that we were only able to fight our way through limited parts, getting, however, a clear idea of lava flows and topography. Farther east, the plains rise to seven thousand feet, and fine wood ridges sweep down from Shasta, inviting approach.

While Munger and Watkins camped to make studies and negatives of the peak, Fred Clark and I packed one mule with a week's provisions, and, mounting our saddle-animals, struck off into dark, silent forest.

It was a steep climb of eight or ten miles up tree-covered ridges and among outcrops of gray trachyte, nearly every foot showing more or less evidence of glacial action; long trains of morainal rocks upon which large forest-trees seemed satisfied to grow; great, rough regions of terminal rubbish, with enclosed patches of level earth commonly grass-grown and picturesque. It was sunset before we came upon water, and then it flowed a thousand feet below us in the bottom of a sharp, narrow cañon, cut abruptly down in what seemed glacial *débris*. I thought it unwise to take our mules down its steep wall if there were any camp-spot high up in the opener head of the cañon, and went off on foot to climb the wooded moraines still farther, hoping to come upon a bit of alpine sward with icy pool, or even upon a spring. When up between two and three hundred feet the trees became less and less frequent, rugged trains of stone and glacier-scored rock in places covering the spurs. I could now overlook the snow amphitheatre, which opened vast and shadowy above. Not a sign of vegetation enlivened its stony bed. The icy brook flowed between slopes of *débris*. At my feet a trachyte ridge narrowed the stream with a tortuous bed, and led it to the edge of a five-hundred-feet cliff, over which poured a graceful cascade. Finding no camp-spot there, I turned northward and made a detour through deep woods, by-and-by coming back to Clark. We faced the necessity, and by dark were snugly camped in the wild cañon bottom. It was one of the loneliest bivouacs of my life: shut in by high, dark walls, a few clustered trees growing here and there, others which floods had undermined lying prostrate, rough bowlders thrown about, an icy stream hurrying by, and chilly winds coming down from the height, against which our blankets only half defended us.

Our excursion next day was south and west, across high, scantily wooded moraines, till we came to the deep cañon of the McCloud Glacier.

I describe this gorge, as it is one of several similar, all peculiar to Shasta. We had climbed to a point about ten thousand feet above the sea, and were upon the eastern edge of a cañon of eleven or twelve hundred feet depth. From the very crest of the Shasta, with here and there a few patches of snow, a long and remarkably even *débris* slope swept down. It seemed as if these small pieces of trachyte formed a great part of the region, for to the very bottom our cañon walls were worked out of it. A half mile below us the left bank was curiously eroded by side streams, resulting in a family of pillars from one to seven hundred feet high, each capped with some hard lava bowlder which had protected the soft *débris* beneath from weathering. From its lofty *névé* the McCloud Glacier descended over rugged slopes in one long cascade to a little above our station, where it impinged against a great rock buttress and turned sharply from the south wall toward us, rounding over in a great, solid ice-dome eight or nine hundred feet high. For a mile farther a huge accumulation looking like a river of *débris* cumbered the bottom. Here and there, on close scrutiny, we found it to be pierced with caverns whose ice-walls showed that the glacier underlay all this vast amount of stone. Bowlders rattled continually from the upper glacier and down both cañon walls, increasing the already great burden. Along both sides were evidences of motion in the lateral moraine embankments, and a very perceptible rounding up of terminal ramparts, from which in white torrent poured the sub-glacial brook.

It is instructive to consider what an amount of freighting labor this shrunken ice-stream has to perform besides dragging its own vast weight along. In descending Shasta we had found glacial ice which evidently for a mile or more deeply underlaid a mass of rock similar to this. It is one of the curiosities of Mount Shasta that such a great bulk of ice should be buried, and in large part preserved, by loads of rock fragments. fine contrasts of color were afforded high up among the *sérac* by a combination of blue ice and red lavas. We hammered and surveyed here for half the day, then descended to our mules, who bore us eagerly back to their home, our weird little cañon camp.

A pleasant day's march, altogether in woods and over glacial ridges, during which not a half hour passed without opening views of the cone, brought us high on the northern slope, at the upper forest limit, in a region

SPONSORS

of barren avalanche tracks and immense moraines.

Between those great, straight ridges which jut almost parallel from the volcano's base are wide, shelving valleys, the pathways of extinct glaciers; and here the forest, although it must once have obtained foothold, has been uprooted and swept away before powerful avalanches, crushed and up-piled trunks in sad wreck marking spots where the snow-rush stopped.

Two brooks, separated by a wide, gently rounding zone of drift, flowed down through the glacier valley which opened directly in front of our camp.

Early next morning Clark and I made up a bag of lunch, shouldered our instruments, and set out for a day on the glacier. Our slow, laborious ascent of the valley was not altogether uninteresting. Constant views obtained of moraines on either side gave us much pleasure and study. It was instructive to observe that the bases of their structure were solid floors of lave, upon which, in rude though secure masonry, were piled embankments not less than half a mile wide and four hundred feet high. Among the huge rocks which formed the upper structure the tree-forms were peculiar. Apparently every tree had made an effort to fill some gap and round out the smooth general surface. No matter how deeply twisted between high bowlders, the branches spread themselves out in a continuous, dense mat, stretching from stone to stone. It was only rarely, and in the less elevated parts of the moraine, that we could see a trunk. The whole effect was of a causeway of rock overgrown by some dense, green vine.

Similar patches of stunted trees grew here and there over the bottom of our broad amphitheatre. Oftentimes we threaded our way among dense thickets of pines, never over six or eight feet in height, having trunks often two and three feet in diameter, and more than once we walked over their tops, our feet sinking but two or three inches into the dense mat of foliage. Here and there, half buried in the drift, we came across the tall, noble trunks of avalanche-killed trees. In comparing their straight, symmetrical growth with the singularly matted condition of the living-dwarfed trees, I find the indication of a great climatic change. Not only are the present avalanches too great to permit their growth, but the violent cold winds which drift over this region bend down the young trees to such an extent that there are no longer tall, normal specimens. Around the upper limits of aborescent vegetation we passed some most enchanting spots; groves, not over eight feet in height, of large trees whose white trunks and interwoven boughs formed a colonnade, over which stretched thick, living thatch. Under these strange galleries we walked upon soft, velvety turf and an elastic cushion of pine-needles; nor could we resist the temptation of lying down here to rest beneath the dense roof. As we looked back, charming little vistas opened between the old and dwarfed stems. In one direction we could see the moraine with its long, graded slope and variegated green and brown surface; in another, the open pathway of the old glacier worn deeper and deeper between lofty, forest-clad spurs; and up to the great snow mass above us, with its slender peak in the heavens looking down upon magnificent sweep of *névé.*

Only the strong desire for glaciers led us away from these delightful groves. A short tramp over sand and bowlders brought us to the foot of a broad, irregular, terminal moraine. Two or three milky cascades poured out from under the great bowlder region and united to form two important streams. We followed one of these in our climb up the moraine, and after an hour's hard work found ourselves upon an immense pile of lava blocks, from which we could overlook the whole.

In irregular curve it continues not less than three miles around the end of the glacier, and in no place that I saw was less than a half mile in width. Where we had attacked it the width cannot be less than a mile, and the portion over which we had climbed must reach a thickness of five or six hundred feet.

About a half mile above us, though but little lifted from our level, undulating hillocks of ice marked the division between glacier and moraine; above that, it stretched in uninterrupted white fields. The moraine in every direction extended in singularly abrupt hills, separated by deep, irregular pits and basins of a hundred

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and more feet deep.

As we climbed on, the footing became more and more insecure, piles of rock giving way under our weight. Before long we came to a region of circular, funnel-shaped craters, where evidently the underlying glacier had melted out and a whole freight of bowlders fallen in with a rush. Around the edges of these horrible traps we threaded our way with extreme caution; now and then a bowlder, dislodging under our feet, rolled down into these pits, and many tons would settle out of sight. Altogether it was the most dangerous kind of climbing I have ever seen. You were never sure of your foothold. More than once, when crossing a comparatively smooth, level bowlder-field, the rocks began to sink under us, and we sprang on from stone to stone while the great mass caved and sank slowly behind us. At times, while making our way over solid-seeming stretches, the sound of a deep, sub-glacial stream flowing far beneath us came up faint and muffled through the chinks of the rock. This sort of music is not encouraging to the nerves. To the siren babble of mountain brook is added all the tragic nearness of death.

We looked far and wide in hope of some solid region which should lead us up to the ice, but it was all alike, and we hurried, on the rocks settling and sinking beneath our tread, until we made our way to the edge, and climbed with relief upon the hard, white surface. After we had gained the height of a hundred feet, climbing up a comparatively smooth slope between brooks which flowed over it, a look back gave a more correct idea of the general billowy character of our moraine; and here and there in its deeper indentations we could detect the underlying ice.

It is, then, here as upon the McCloud Glacier. For at least a mile's width the whole lower zone is buried under accumulation of morainal matter. Instead of ending like most Swiss glaciers, this ice wastes chiefly in contact with the ground, and when considerable caverns are formed the overlying moraine crushes its way through the rotten roof, making the funnels we had seen.

Thankful that we had not assisted at one of these engulfments, we scrambled on up the smooth, rooflike slope, steadying our ascent by the tripod legs used as alpine stock. When we had climbed perhaps a thousand feet the surface angle became somewhat gentler, and we were able to overlook before us the whole broad incline up to the very peak. For a mile or a mile and a half the sharp, blue edges of crevasses were apparent here and there, yawning widely for the length of a thousand feet, and at other places intersecting each other confusedly, resulting in piled-up masses of shattered ice.

We were charmed to enter this wild region, and hurried to the edge of an immense chasm. It could hardly have been less than a thousand or twelve hundred feet in length. The solid, white wall of the opposite side—sixty feet over—fell smooth and vertical for a hundred feet or more, where rough wedged blocks and bridges of clear blue ice stretched from wall to wall. From these and from numerous overhanging shelves hung the long, crystal threads of icicles, and beyond, dark and impenetrable, opened ice-caverns of unknown limit. We cautiously walked along this brink, examining with deep interest all the lines of stratification and veining, and the strange succession of views down into the fractured regions below.

I had the greatest desire to be let down with a line and make my way among these pillars and bridges of ice, but our little twenty feet of slender rope forbade the attempt. Farther up, the crevasses walled us about more and more. At last we got into a region where they cut into one another, breaking the whole glacier body into a confused pile of ice blocks. Here we had great difficulty in seeing our way for more than a very few feet, and were constantly obliged to climb to the top of some dangerous block to get an outlook, and before long, instead of a plain with here and there a crevasse, we were in a mass of crevasses separated only by thin and dangerous blades of ice.

We still pushed on, tied together with our short line, jumping over pits and chasms, holding our breath over slender snow-ridges, and beginning to think the work serious. We climbed an ice-crag together; all around

rose strange, sharp forms; below, in every direction, yawned narrow cuts, caves trimmed with long stalactites of ice, walls ornamented with crystal pilasters, and dark-blue grottoes opening down into deeper and more gloomy chambers, as silent and cold as graves.

Far above, the summit rose white and symmetrical, its sky line sweeping down sharp against the blue. Below, over ice-wreck and frozen waves, opened the deep valley of our camp, leading our vision down to distant forest slopes.

We were in the middle of a vast, convex glacier surface which embraced the curve of Shasta for four miles around, and at least five on the slope line, ice stretching in every direction and actuallybounding the view on all sides except where we looked down.

The idea of a mountain glacier formed from Swiss or Indian views is always of a stream of ice walled in by more or less lofty ridges. Here a great, curved cover of ice flows down the conical surface of a volcano without lateral walls, a few lava pinnacles and inconspicuous piles of *débris* separating it from the next glacier, but they were unseen from our point. Sharp, white profiles met the sky. It became evident we could go no farther in the old direction, and we at once set about retracing our steps, but in the labyrinth soon lost the barely discernible tracks and never refound them. Whichever way we turned, impassable gulfs opened before us, but just a little way to the right or left it seemed safe and traversable.

At last I got provoked at the ill-luck, and suggested to Clark that we might with advantage take a brief intermission for lunch, feeling that a lately quieted stomach is the best defence for nerves. So when we got into a pleasant, open spot, where the glacier became for a little way smooth and level, we sat down, leisurely enjoying our repast. We saw a possible way out of our difficulty, and sat some time chatting pleasantly. When there was no more lunch we started again, and only three steps away came upon a narrow crack edged by sharp ice-jaws. There was something noticeable in the hollow, bottomless darkness seen through it which arrested us, and when we had jumped across to the other side, both knelt and looked into its depths. We saw a large, domed grotto walled in with shattered ice and arched over by a roof of frozen snow so thin that the light came through quite easily. The middle of this dome overhung a terrible abyss. A block of ice thrown in fell from ledge to ledge, echoing back its stroke fainter and fainter. We had unconsciously sat for twenty minutes lunching and laughing on the thin roof, with only a few inches of frozen snow to hold us up over that still, deep grave; a noonday sun rapidly melting its surface, the warmth of our persons slowly thawing it, and both of us playfully drumming the frail crest with our tripod legs. We looked at one another, and agreed that we had lost confidence in glaciers.

Splendid rifts now opened to north of us, with slant sunshine lighting up one side in vivid contrast with the cold, shadowed wall. We greatly enjoyed a tall precipice with a gaping crevasse at its base, and found real pleasure in the north edge of the great ice-field, whither we now turned. A low moraine, with here and there a mass of rock which might be solid, flanked the glacier, but was separated from it by a deeply melted crevasse, opening irregular caverns along the wall down under the very glacier body. We were some time searching a point where this gulf might be safely crossed. A thin tongue of ice, sharpened by melting to a mere blade, jutted from the solid glacier over to the moraine, offering us a passage of some danger and much interest. We edged our way along astride its crest, until a good spring carried us over a final crevasse and up upon the moraine, which we found to be dangerously built up of honeycombed ice and bowlders. The same perilous sinks and holes surrounded us, and alternated with hollow archways over subterranean streams. It was a relief, after an hour’s labor, to find ourselves on solid lava, although the ridge, which proved to be a chain of old craters, was one of the most dreary reaches I have ever seen.

In the evidence of glacier motion there had seemed a form of life, but here among silent, rigid crater rims and stark fields of volcanic sand we walked upon ground lifeless and lonely beyond description: a frozen desert at nine thousand feet altitude. Among the huge, rude forms of lava we tramped along, happy when the tracks of

mountain sheep suggested former explorers, and pleased if a snow-bank under rock shadow gave birth to spring or pool. But the severe impression of arctic dreariness passed off when, reaching a rim, we looked over and down upon the volcano's north foot, a superb sweep of forest country waved with ridgy flow of lava and gracefully curved moraines.

Afar off, the wide, sunny Shasta Valley, dotted with miniature volcanoes, and checked with the yellow and green of grain and garden, spread pleasantly away to the north, bounded by Clamath hills and horizoned by the blue rank of Siskiyou Mountains. To our left the cone slope stretched away to Sisson's, the sharp form of the Black Cone rising in the gap between Shasta and Scott Mountain.

Here again the tremendous contrast between lava and ice about us and that lovely expanse of ranches and verdure impressed anew its peculiar force.

We tramped on along the glacier edge, over rough ridges and slopes of old moraine, rounding at last the ice terminus, and crossing the valley to camp, where our three mules welcomed us with friendly discord.

A day's march over forest-covered moraines and through open glades brought us to the main camp at Sheep Rock, uniting us with our friends. The heavier air of this lower level soothed us into a pleasant laziness which lasted over Sunday, resting our strained muscles and opening the heart anew to human and sacred influence. If we are sometimes at pain when realizing within what narrow range of latitude mankind reaches finer development, how short a step it is from tropical absence of spiritual life to dull, boreal stupidity, it is added humiliation to experience our marked limitation in altitude. At fourteen thousand feet little is left me but bodily appetite and impression of sense. The habit of scientific observation, which in time becomes one of the involuntary processes, goes on as do heart-beat and breathing; a certain general awe overshadows the mind; but on descending again to lowlands one after another the whole riches of the human organization come back with delicious freshness. Something of this must account for my delight in finding the family of Preuxtemps (a half-Cherokee mountaineer known hereabouts as Pro-tem) camped near us. Pro-tem was a barbarian by choice, and united all the wilder instincts with a domestic passion worthy his Caucasian ancestor, and quite charming in its childlike manifestation.

Protem *mère*, an obese Digger squaw, so evidently avoided us that I respected her feelings and never once visited their bivouac, although the flutter of gaudy rags and that picturesque squalor of which she and the camp-fire were centre and soul, sorely tempted me.

The old man and his four little barefoot girls, if not actually familiar, were more than sociable, and spent much time with us. The elder three, ranging from eight to twleve, were shy and timid as little quails, dodging about and scampering off to some hiding-place when I strove to introduce myself through the medium of such massive sweet-cakes as our William produced. Not so the little six-year-old Clarissa, who in all frankness met my advances and repaid me for the cookies she silently devoured by gentlest and most fascinating smiles.

A stained and earth-hued flour-sack rudely gathered into a band was her skirt, and confined the little, long-sleeved, pink calico sack. From out a voluminous sun-bonnet with long cape shone the chubby face of my little friend. For all she was so young and charming small, Clarissa was woman rather than child. She took entire care of herself, and prowled about in a self-contained way, making studies and observations with ludicrous gravity. Early mornings she came with slow, matronly gait down to the horse-trough, and, rolling up her sleeves, laid aside the huge sun-bonnet, washed her face and hands wiping them on her petticoat, and arranged her jetty Indian hair with the quiet unconsciousness of fifty years.

Her good-morning nod, with the reserved yet affectionate smile, put me in happiness for the day, and when as I strolled about she overtook me and placed her little hand in mine, looking up with fearless, quiet confidence, I measured step with her, and we held sweet chats about squirrels and field-mice. But I thought her most

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charming when she brought her father down to our camp-fire after supper, and, alternately on his knee or mine, listened to our stories and wound a soft little arm about our necks. The twilight passed agreeably thus, Clarissa gradually paying less and less attention to our yarns, till she pulled the skirts of my cavalry coat over her, and curling up on my lap laid her dear little head on my breast, smiled, gaped, rubbed with plump knuckles the blinking eyes, dozed, and at last sank into a deep sleep.

I can even now see old Protem draw an explanatory map on the ground his moccasin had smoothed, and go on with his story of bear fight or wolf trap, illustrating by singularly apt gesture every trait and motion of the animal he described, while firelight warmed the brown skin and ruddy cheek of my little charge and flickered on her soft, black hair.

The last bear story of an evening being ended, Protem took from me Clarissa, whose single yawn and pretty bewilderment subsided in a second, leaving her sound asleep on the buckskin shoulder of her father.

About half way between Sheep Rock and the snow-line extensive eruptions of basalt have occurred, deluging the lower slopes, and flowing in gently inclined fields and streams down through Shasta Valley for many miles. The surface of this basalt country is singularly diversified. Rising above its general level are numerous domes, some of them smoothly arched over with rock, others perforated at the top, and more broken in circular parapets. The origin of these singular blisters is probably simple. Overflowing former trachyte fields, the basalt swept down, covering a series of pools and brooks. The water converted into steam blew up the viscous rock in such forms as we find. Here and there the basalt surface opens in circular orifces, into which you may look a hundred feet or more.

In 1863, in company with Professor Brewer, I visited this very region, and we were then shown an interesting tubular cavern lying directly under the surface of a lava plain.

Mr. Palmer and I revisited the spot, and, having tied our mules, descended through a circular hole to the cavern's mouth. And archway of black lava sixty feet wide by eighty high, with a floor of lava sand and rough bowlders, led under the basalt in a notherly direction, preserving an incline not more than the gentle slope of the country. Our roof overhead could hardly have been more than twenty or thirty feet thick. We followed the cavern, which was a comparatively regular tube, for half or three-quarters of a mile. Now and then the roof would open up in larger chambers, and the floor be cumbered with huge piles of lava, over which we scrambled, sometimes nearly reaching the ceiling. Fresh lava-froth and smooth blister-holes lined the sides. Innumerable bats and owls on silent wing floated by our candles, fanning an air singularly still and dense.

After a cautious scramble over a long pile of immense basalt blocks, we came to the end of the cave, and sat down upon piles of *débris*. We then repeated an experiment, formerly made by Brewer and myself, of blowing out our candle to observe the intense darkness, then firing a pistol that we might hear its dull, muffled explosion.

The formation of this cave, as explained in Professor Whitney's Geological Report, is this: "A basalt stream, flowing down from Shasta, cooled and hardened upon the surface, while within the mass remained molten and fluid. From simple pressure the lava burst out at the lower end, and, flowing forth, left an empty tube. Wonderfully fresh and recent the whole confused rock-walls appeared, and we felt, as we walked and climbed back to the opening and to daylight, as if we had been allowed to travel back into the volcano age."

One more view of Shasta, obtained a few days later from Well's ranch on the Yreka road, seems worthy of mention. From here the cone and side crater are in line, making a single symmetrical form with broad, broken summit singularly like Cotopaxi.

You look over green meadows and cultivated fields; beyond is a chain of little volcanoes girdling Shasta's foot, for the most part bare and yellow, but clouded in places with dark forest, which a little farther up mantles the broad, grand cone, and sweeps up over ridge and cañon to alpine heights of rock and ice.

Strange and splendid is the evening effect from here, when shadow over base and light upon summit divide the vast pile into two zones of blue-purple and red-gold. We watched the colors fade and the peak recede farther and dimmer among darkness and stars.

Mountaineering in the Sierra Nevada by Clarence King

First Director of US Geological Survey

Summary (Library of Congress)

Clarence King (1842-1901) of Rhode Island was a Yale-educated geologist and mining engineer who rode horseback across the continent in 1863. In California, he worked as a volunteer on Whitney's geological survey of the state, and he went on to a distinguished professional career. *Mountaineering in the Sierra Nevada* (originally published 1872) begins with a summary of the geological history of the Sierras and then recounts King's experiences in the range, both as a member of the Whitney expedition and as a mountain climber, 1864-1870. Highlights include his ascents of Mount Tyndall, Mount Shasta, and Mount Whitney; survey of Yosemite Valley; and field trips in the Merced Valley. King provides anecdotes of the mountains' people and natural history along the way.

Brewer Party of 1864:
James T. Gardiner, Richard Co er,
William H. Brewer, and Clarence King

Contents

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Clarence King (1842 - 1901), *Mountaineering in the Sierra Nevada* (New York: C. Scribner's sons, 1902). xi p., 1 l., 378 pages. 20 cm. Library of Congress Call Number F868.S5 K52. The text for *Mountaineering in the*

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Mountaineering in the Sierra Nevada first appeared, in part, in *The Atlantic Monthly*, starting with the May 1871 issue (vol. 27, issue 163), and ending with the Dec. 1871 issue (chapters 1, 2, 3, 4, 6, 5, and 9, respectively). *The Atlantic Monthly* issues are available as page images from University of Michigan's *Making of America* (MOA) digital library. *Mountaineering in the Sierra Nevada* first appeared in book form in 1872, published by James Osgood & Co. of Boston (292 pages). This edition came in 2 forms, octavo in green or maroon cloth with gilt lettering and edge, and large paper copies. Sampson Low, Marston, Low, & Searle in London also printed the same edition in 1872 (with reset type).

A "fourth edition" appeared in 1874 with v + 308 pages. This edition has additional information about the Mount Whitney (namely, that Mr. King climbed the wrong Peak, and his climb, of 1873, of the real Mt. Whitney.) Note that at the 1994 Yosemite Association reprinting of *Mountaineering* (and perhaps others) omits this additional material and doesn't even inform the reader that Mr. King described climbing the wrong peak. The 1874 edition also added maps of California and Southern Sierra Nevada. Reprints of this edition were called the fifth through ninth edition, with no changes.

A genuinely new 1902 edition has xi+378 pages. It has minor corrections. The 1902 edition is used here.

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Type Logs of South Texas Fields, Vol. I, Frio Trend. Compiled by Don Kling. Includes 134 fields. 158 p., 1972. Ring binder.
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Structure and Mesozoic Stratigraphy of Northeast Mexico, prepared by numerous authors, variously paginated. 76 p., 38 p., 1984.
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Southwest Speaks Deep

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Hostetter
Hostetter, North

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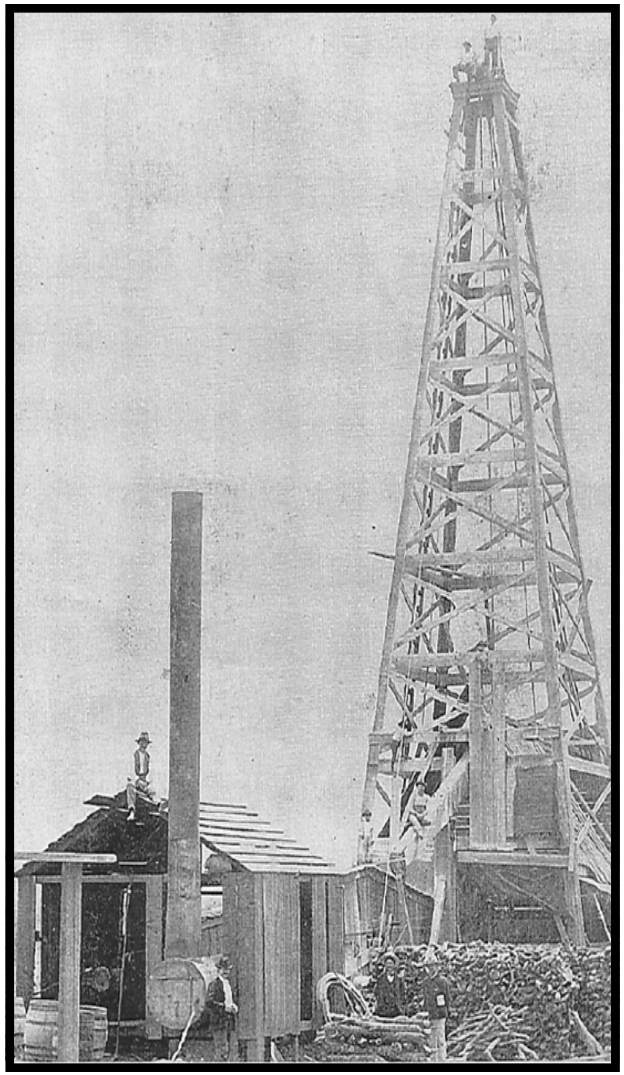

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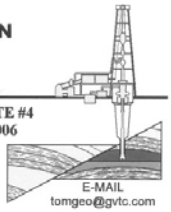

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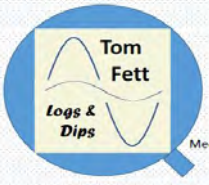

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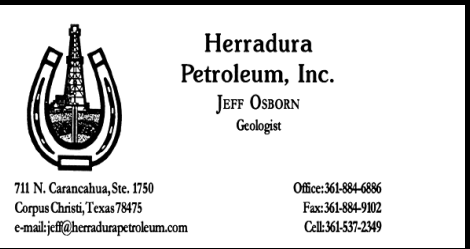

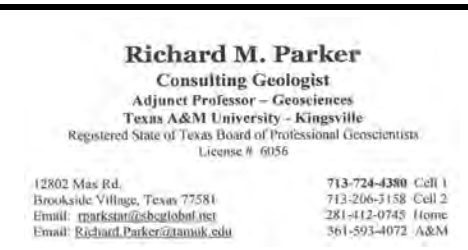

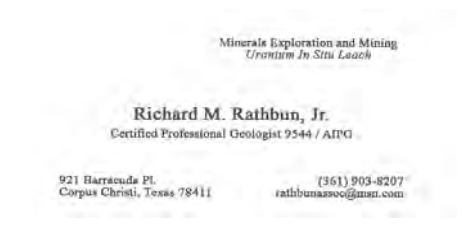

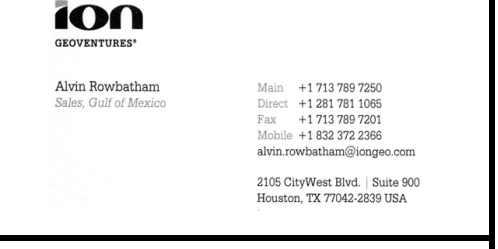

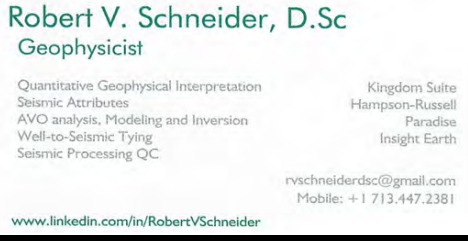

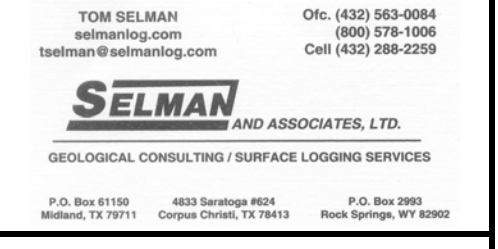

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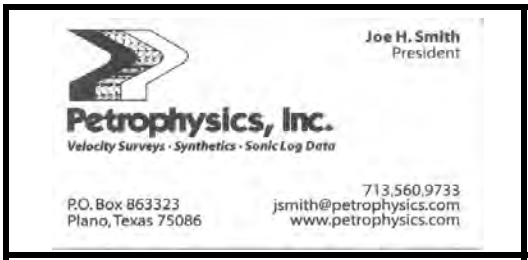

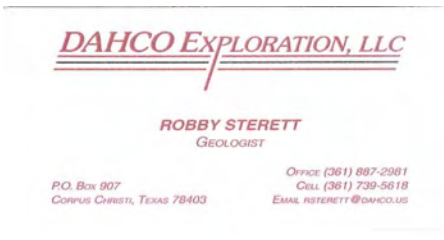

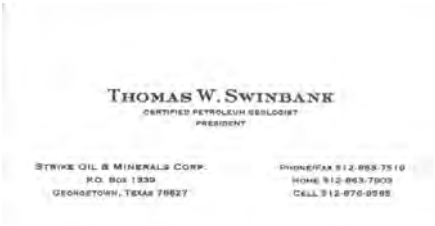

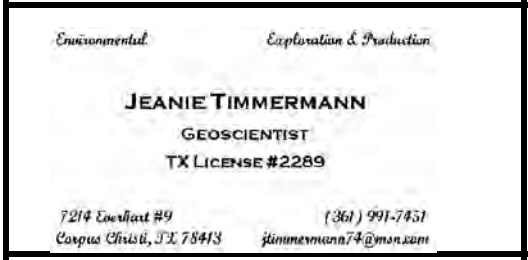

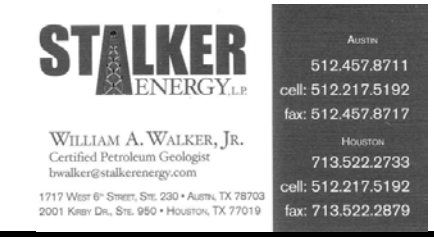

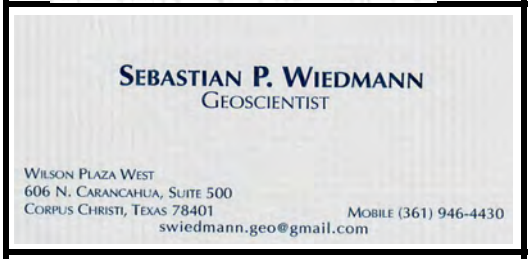

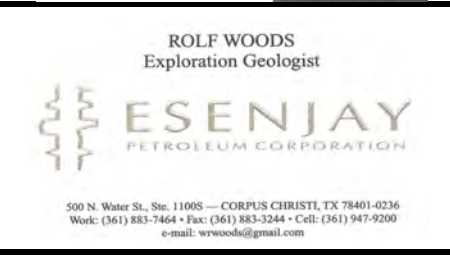

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