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KANSAS GEOLOGICAL SOCIETY

# BULLETIN

Volume 88 Number 5

September—October 2013

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*KGS Clay Shoot*

### **A DIFFERENT VIEW OF GEOLOGIC TIME**

**Part 4**

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September 14  
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**Mid-Continent Section Meeting**  
**Wichita - October 12-15, 2013**

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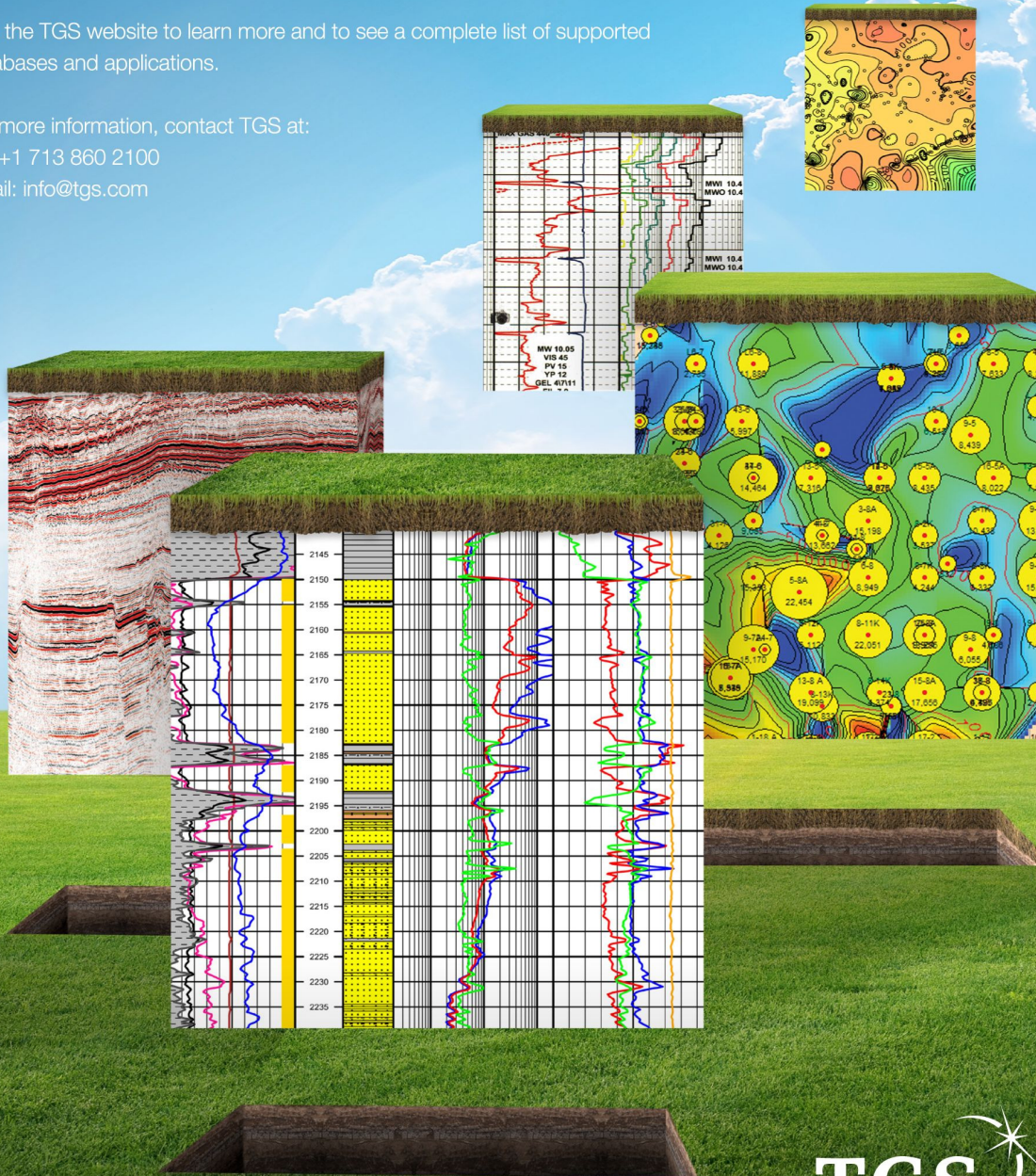
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### ON THE COVER:

The Society is hosting the 2013 AAPG Mid-Continent Section Meeting at the Doubletree Hotel at the Wichita Airport. Register by September 14th to receive a discount. Many great presentations, posters, field trips, workshops, and the Mississippian Symposium should make for a great meeting.

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### CALL FOR PAPERS

The Kansas Geological Society Bulletin, which is published bimonthly both in hard-copy and electronic format, seeks short papers dealing with any aspect of Kansas geology, including petroleum geology, studies of producing oil or gas fields, and outcrop or conceptual studies. Maximum printed length of papers is 5 pages as they appear in the Bulletin, including text, references, figures and/or tables, and figure/table captions. Inquiries regarding manuscripts should be sent to Rebecca Radford, [manager@kgslibrary.com](mailto:manager@kgslibrary.com) or mailed to 212 N. Market, Ste. 100, Wichita, KS 67202. Specific guidelines for manuscript submission appear in each issue of the Bulletin, which can also be accessed on-line at the Kansas Geological Society web site at <http://www.kgslibrary.com>

# SOCIETY Technical Meetings

Sept. 3—Dave Clothier, *“Results of the Mississippi Lime Play Horizontal VS Conventional Drilling”*

Sept. 24—Renea Elbert, Kansas Oil Museum, *“From the Ground Up: Ongoing Efforts of the Kansas Oil Museum to Preserve the Science of Oil”*

Oct. 1—to be announced

Oct. 12—15—AAPG Mid-Continent Section Meeting—Wichita Doubletree

Oct. 29—to be announced

Nov. 5—to be announced

Nov. 19—to be announced

Dec. 3—to be announced

Dec. 17—to be announced

## *Location for Technical Meetings*

*All KGS technical presentations are held at 12:30 p.m. at the **Wichita Bar Association**, located at **225 N. Market**, ground floor conference room, unless otherwise noted.*

*Note: For those geologists who need 30 points to renew their licenses, there will be a sign-in sheet at each presentation and also a certificate of attendance.*



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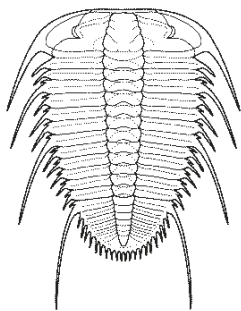
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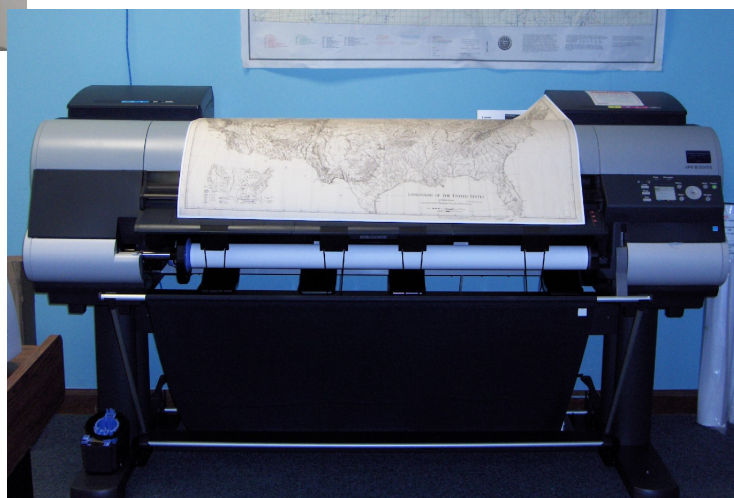


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# President's Letter

Dear Members,

As summer comes to a close, we are enjoying unusually wet and cool weather. It did not rain long enough to hold our annual picnic at Sports World on August 9th, and it was a great time. Wes and Betty Hansen, our co-chairs, and their committee did a great job. It was nice to see everyone's families, and Bingo Caller, Paul Ramondetta gave away a lot of prize money.

Brian Fisher has offered to chair the Technical Programs committee, and he's working to schedule programs for this Fall. Let Brian know if you would like to give a tech talk, or if you have any ideas for programs.

Bob Cowdery will provide Brian with guidance, and will continue to send out the emails to promote the talks.


Chairman Doug Davis and his committee are coming in to the home stretch for the AAPG Mid-continent Section Meeting in October. Registration is open, so be sure to sign up and attend. It looks to be an outstanding meeting.

Chuck Brewer and the KGS Building committee are continuing to look at real estate for the Library, and are working with KGS and KGF attorneys to prepare a capital campaign for a new building. It's not likely that the Library will move into its own building by the end of the year, but they hope to start raising money before then.

I look forward to seeing you all at the Tech Talks and the Section Meeting. Until then, hope you all find lots of oil, and the weather cooperates.

Respectfully Submitted,  
Dave Clothier—President 2013



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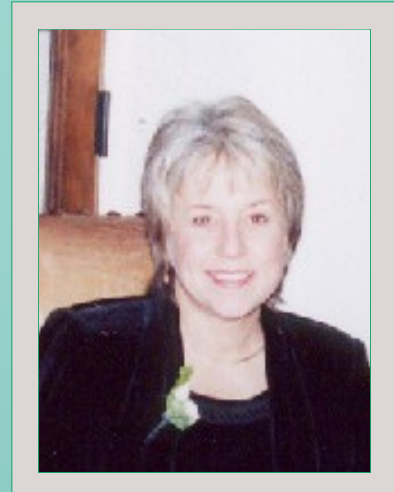


# From The Manager

Dear Members,

Hopefully you are not stuck in the mud somewhere as you read this edition of the Bulletin. What a summer, and compared to the last two summers...wow. Mother Nature never ceases to amaze me.

We are excited to be hosting the **2013 AAPG Mid-Continent Section Meeting October 12—15**. Registration is underway and if you hurry and get registered by Sept. 14th, you will receive a discount. I am hoping to see many of you from out of town and out of state. We have many great presentations planned as well as workshops, field trips and poster session. A Mississippian Symposium and the Core workshop will offer the opportunity to get the most up-to-date information on what is happening with the Mississippian Lime play. And it is always nice to be able to get together with your colleagues. Many of our members have worked very hard to put this meeting together so I hope you will take advantage and get signed up to attend.



Events for the fall are the **KGS Fishing Tournament**, which will be held at Pratt County Lake on Friday, Sept. 13th. See the insert for all the details. Also, October 4th will be the **KGS Clay shoot** at Lynbrooke Sporting Clays—see insert for that also. Take a day, or two, and enjoy the company of your colleagues and come out for these events.

Your library remains very busy and we are making some great progress on getting our **East Ranges** scanned and into the digital library. Keep checking on-line for new information and remember, you don't need to be a member of the digital library to log on and see what we have in our database.

Respectfully submitted,

*Rebecca Radford*

Manager



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## Memorial— Virginia Moreland



EL DORADO - Moreland, Virginia Ruth (Coffman), 88, passed away at the Harry Hynes Hospice Center, Wichita, Kan., on July 30, 2013. For the past two years she had been a resident at Catholic Care Center. Virginia was born in El Dorado, Kan., on September 23, 1924, to James Earl and Venita Christine (Howard) Coffman. She grew up in El Dorado and graduated from El Dorado High School in 1942. On August 7, 1943, she married Joseph Emmett Moreland Jr. at West End United Methodist Church in Nashville, Tenn. Virginia was a church pianist and organist and retired as music director of St. John's Catholic Church in El Dorado, Kan., where she served in the music ministry for forty - two years. As a 1978 breast cancer survivor she volunteered for the American Cancer Society, Make Today Count and was featured in a Mayo Clinic film. She was an avid tennis player and belonged to the Wichita International Net Set. She was also active in several Petroleum wives' organizations. She is survived by her children, Annette Lindal (Alan) of Wichita, Joseph E. Moreland III (Carol) of Topeka, Angie Schreiber (Mark) of Emporia, and Jim Moreland of El Dorado; grandchildren, Alicia Wolff, Aaron Lindal, Angela Ewing, Ben Schreiber, Gretchen Schreiber; five great-grandchildren; and a brother, Earl Coffman, of Wichita. She was preceded in death by her husband, Joe in 2010. The Mass of Christian Burial was held at 10 a.m. Saturday, August 3, at St. John's Catholic Church, 302 N. Denver, El Dorado, KS. Memorial established to Partners in Education, El Dorado.

### Save These Dates:

**The KGS 20th Annual  
Clay Shoot  
Friday, October 4th**

**AND**

**KGS Annual  
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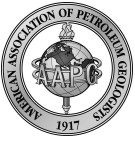
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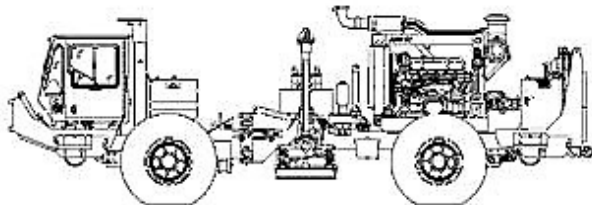
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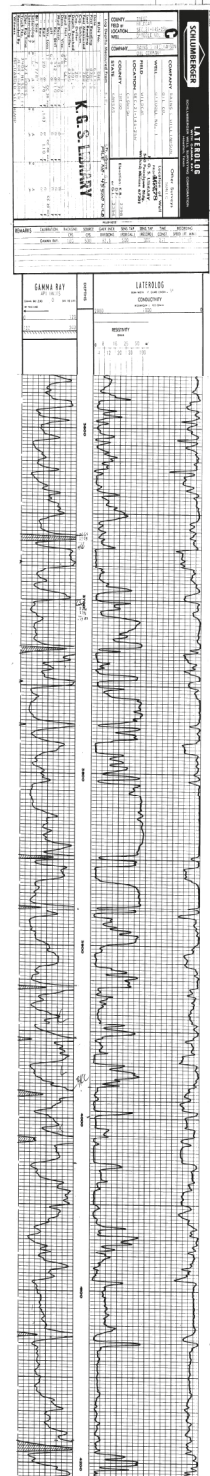
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## A DIFFERENT VIEW OF GEOLOGIC TIME

Lawrence H. Skelton, Geologist  
Wichita, Kansas

If geologic time, the 4.54 billion years since the Earth began, could be reduced to a period of just a single year, the calendar of events would be as follows: **Part IV**

**December 25 – 5:27 P.M. The Cenozoic Era! (Formerly known as the Tertiary.)** Only 66.5 million years until Christmas. The Paleogene Period is divided into three familiar epochs – Paleocene, Eocene and Oligocene (oldest to youngest). As the Paleogene Period began, the world climate was cooler and arid but warmed and became moist as time passed. Atmospheric CO<sub>2</sub> declined and kept the climate from overheating to a “greenhouse” environment as the oxygen content slowly rose. Widespread volcanism continued from the Cretaceous through the Paleogene. Rifting began in western Europe during the Eocene and in the Red Sea and Gulf of Suez in the middle Oligocene. The Red Sea rifting was followed by massive volcanic activity in present Ethiopia and South Yemen. Near the end of the Eocene, the Pyrenees Mountains underwent severe folding.

Continued northward movement of portions of the African plate affected the Alps, Carpathians and Apennine mountains during the late Eocene and again during the late Oligocene. The western European rifting was preceded by crustal thinning with subsequent graben (down-dropped blocks) faulting and scattered volcanism during the Oligocene. Devil’s Tower in Wyoming was intruded during the Eocene and Shiprock, a volcanic neck in northwestern New Mexico was intruded in Oligocene time. The Rocky Mountains continued to rise through the Paleogene into the Holocene and volcanism initiated rise of the Cascade Ranges in the Pacific Northwest as terrane blocks accreted to the continent and two adjacent oceanic plates subducted. The Kula plate sank northeastward to lift the Canadian Rockies and the Aleutian chain while the Farallon plate subducted to the east. Its northern part at a steep angle which caused it to melt and surface, forming volcanoes and its southern part at a shallow angle to farther elevate the Rocky Mountains, Colorado Plateau, etc. In Asia, the Indian plate continued its northward trek toward Eurasia and back arc volcanism caused rifting in east Eurasia, separating the future Japan from the mainland and moving it out to sea. At the end of Paleocene time, one of the greatest known sea temperature changes happened: the Paleocene-Eocene Thermal Maximum. Thought to possibly be caused by release of huge volumes of seabed methane, oceanic surface temperatures increased 5° to 8° C (9° to 14° F) and high Arctic sea temperatures increased to about 23° C (73° F) over a period of around 1,000 years. This had a severely negative affect on marine foraminifera and may have been responsible for the end of Paleocene extinction of some land creatures.

In North America, the early Eocene experienced an impact of a 3 to 5 km (1.9 to 3.1 miles) diameter asteroid that struck in the lower end of Chesapeake Bay making a crater 1.3 km (0.8 miles) deep and 137 km (85 miles) in diameter. Another one, possibly a piece of the Chesapeake bolide left its mark on the ocean floor: a 15 – 20 km (9.5 – 12 miles) crater on the ocean floor about 160 km (99 miles) east of Atlantic City, New Jersey. A third asteroid, probably part of a “swarm,” struck dry ground at present Popigai in north central Siberia hit sufficiently hard to convert gneissic graphite to diamond, leaving a 100 km (61 miles) diameter crater. Overall, the Paleogene earth was quite active!

Extinction of the saurians left the many surviving Mesozoic mammals without much competition other than themselves. Many became predecessors to modern mammals. Small and medium sized insectivores filled the forests. Multituberculates, survivors from the Mesozoic, were possibly marsupials which thrived and reached their peak of diversity during the Paleocene. Ranging in size from that of a mouse to a beaver, they survived through the Eocene and finally disappeared in the early Oligocene. Oreodonts, sheep-sized artiodactyls (even number of toes) which have been described as “generic grazers” roamed western North America in great herds during the Eocene and Oligocene. The early through middle Paleocene epoch saw the origin of the first true carnivores, small generalized weasel-like mammals. The creodonts were also carnivorous mammals which appeared during the Paleocene in the northern hemisphere and in Africa. They ranged in size from that of a domestic cat to the *Sarkastodon*, an Eocene form that weighed in at an estimated 800 kg (1760 pounds). They are divided into two families, one cat-like and the other dog-like although cats and dogs did not evolve from creodonts. Creodonts survived into Miocene time. Condylarths filled an important niche. They were likely survivors from the Cretaceous and expanded in type and numbers during the Paleocene; surviving through the Eocene and disappearing in the Oligocene. They were herbivores and are thought to be ancestral ungulates (hoofed mammals). A well-known member was *Hyracotherium*, formerly known as *Eohippus* or the “dawn horse,” a terrier-sized, forest dwelling animal ancestral to the modern horse. An ungulate unique to North America, *Uintatherium*, was a large plant browser ranging from 3 to 4.5 meters (10 to 15 feet) in length and weighing an estimated 4,500 – 5,400 kg (5 to 6 tons). Shaped rather like a modern rhinoceros, it carried three pairs of horns on its head and had two protruding saber-like upper teeth presumably used to rake up water plants. True rodents are first found in the late Paleocene and rapidly diversify through time. Several varieties of more or less modern birds evolved and by mid-Paleogene time, representatives of vultures, eagles and pelicans were extant. An unusual bird was *Diatryma*, four species of which roamed Northern America during the Paleocene and Eocene. Not capable of flight, it stood up to 2.4 meters tall (8 feet), weighed perhaps 175 kg (385 lbs) and sported a solid upper beak 23 cm (9 inches) long and 16.5 cm (6.5 inches) high. It probably was a predator or possibly a scavenger. Other animals included crocodylians, turtles, amphibians squamates (snakes and lizards) and of course, a variety of modern insects. Many types of sharks and other fish occupied Paleogene seas and primitive members of the whale family made an early appearance in Eocene North African seas. One notable whale was the *Basilosaurus*, an updated mammalian replacement for the Cretaceous mosasaur. Up to 21 meters (70 feet) long and equipped with long tooth-filled jaws, it may have been the top marine predator of its day which was over by the end of the Eocene. Grasses were beginning to take a greater hold on the land during Paleogene time but forests with trees and shrubs were dominant land plants: black walnut, magnolia, palm, chestnut, fig, cycads and grapes flourished with other angiosperms. Pines developed with other conifers and ferns and horsetail rushes filled the moist areas. Cacti made a debut in dry zones. After a 43.5 million year run, the Paleogene Era came to an end. Modern geography was shaping and modern life forms coming onto the world stage.

**December 28 - 6:53 P.M. The Neogene Period!** A new world! Or is it? Many things look familiar but there are a lot of museum quality animals roaming about. If we omit the Quaternary Period from the Neogene (as some scientists do) the Miocene or lower Neogene constitutes 86.5 % of Neogene time ... from 23 million to 5.3 million years ago. Coastal marshes as far north as modern Maryland harbored crocodilians while the giant *Carcharodon megalodon* – a far greater white shark than those of the present – ruled the sea. It was joined by its cousins which included most types of presently living sharks. Primitive deer, antelope, horses, seals, walruses, various members of the dog family including the “bear dog,” a bear-sized canine are present during the Miocene and bears proper split off from the canid group during this time. Likewise, varieties of the elephant family, edentates (armadillos, anteaters, glyptodonts, etc.) and ground sloths roamed the earth. The perissodactyl group included a variety of horses, tapirs and rhinoceroses including the 5.2 meter (18 feet) (at the shoulder) tall *Balu-chitherium* that found a home in Asia during the early Miocene. A fourth of known Miocene vertebrates died off near the end of that epoch or during the early Pliocene but 75% of the families have modern-day representatives. By late Miocene, the fauna of Eurasia and probably Africa were homogeneous: abundant families of bovines, dogs, cats (including saber-tooth varieties), mustilids (weasels, ferrets, etc), primitive bears and hyenas filled the land. Most of the modern bird families were airborne by the end of the Miocene and one non-flying “terror bird,” *Titanis*, lasted until near the end of the Pliocene. It was a 2.5 meter (8 feet plus) predator that stalked the North American Gulf Coast.

World climate during the Miocene was warm and humid. Palm trees grew in present northern Siberia and Wyoming. The climate cooled as time passed and by the end of the Miocene, it became more arid and an icecap began to spread in Antarctica. During this time and during early Pliocene, many varieties of plants shifted to more amenable climes and were replaced by grasslands. In turn, grazing animals and their predators increased. Ancestral species of bison, possibly originating in India, migrated into Europe and North America (via a Bering Strait land bridge) during the late Pliocene and evolved into more modern types of the genus during the following Pleistocene. During the mid-Pliocene, movement of the Nazca Plate raised the Isthmus of Panama and for the first time, North and South America became connected, allowing faunal movement between the two. The first appearance of primitive hominids occurred in the lower Pliocene of Africa with the presence of *Ardopithicus* which was followed about two million years later by Australopithecines in the upper Miocene.

The Neogene world continued to be tectonically active. The Red Sea opened during the Pliocene and pushed the Arabian plate into the central Iranian microplate to create the Zagros Mountains. India continued its northward push into the Asian Plate, resulting in compressing some of Asia eastward and increasing elevation of the Himalayas and Tibetan Plateau. On the western end of the Alpine-Himalayan orogeny, the floor of the Alboran Sea in the western Mediterranean rose and compressed land on its north and south sides to cause folding and stacked thrust faulting to both sides creating the Rif Mountains in modern Morocco and the Betic Ranges on the Spanish side. During the Late Miocene about six million years ago, collision of the African Plate and the Iberian portion of the European Plate resulted in closure of the Strait of Gibraltar with consequent isolation of the Mediterranean. The sea dried and evaporite deposits up to two km. (1.25 mi.) thick accumulated in some areas. The Nile and Rhone rivers cut deep canyons and formed great alluvial fans on the arid Mediterranean floor and some African fauna migrated to former islands which became accessible on foot. About 700,000 years later rising sea levels, caused by a bit of global warming and ice melting in Antarctica, combined with renewed tectonic activity allowed reintroduction of ocean water across the Gibraltar barrier. A trickle over the 200 km. (150 mi.) barrier soon became a deluge and the Mediterranean basin was refilled in a little more than two years, resulting in an approximate drop of 10 cm (3.9 in.) in world sea level. Elsewhere in the world, Miocene and Pliocene volcanic activity thought to be caused by a mantle plume spilled some 184,000 km<sup>2</sup> (113,000 mi<sup>2</sup>) of basalt lava in the Pacific Northwest and adjacent British Columbia. Some of the deposits are up to 1,850 m. (6,000 ft.) thick. Along the Pacific-North American coast, the Farallon Plate nearly completed subduction beneath the North American plate which continued its western trek over the Pacific plate. As it over rode the East Pacific Rise (where the Pacific plate had struck the western edge of the Farallon), two transform margin faults were created: the San Andreas and the Queen Charlotte faults. The Pacific Plate was to move northward along the San Andreas and subduct to the north at the Queen Charlotte; both actions causing a history of devastating earthquakes. The Farallon Plate having been over ridden by the westward moving North American Plate was not finished. It seems to have leveled out its descent toward the mantle and broke apart in some areas. Some parts sank while others adhered to the bottom of the crust. These Late Miocene-Early Pliocene actions along with increased heat from the mantle stretched the overlying crust causing it to rupture and allow large blocks (grabens) to fall, forming the Basin and Range Physiographic Province. Upper mantle upwelling of uncertain causes (but possibly related to the Farallon Plate) occurred from Late Cretaceous time and accelerated during Miocene and Pliocene to lift the Colorado plateau from sea level to the current average elevation of 1,800 m (6,000 ft). A final but not yet completed effect of the Farallon Plate may have been the opening of the Rio Grande Rift, a potential continent-splitting opening that extends from north central Colorado to Chihuahua, Mexico and the Big Bend of Texas. Opening during Oligocene time and continuing through the Miocene and Pliocene, it is responsible for volcanic fields along its route. Rifting at present has slowed to 2mm per year

To the south, the Pacific Plate continued subducting beneath the Andes ranges, pushing them ever higher and creating a string of volcanoes. In the southwestern Pacific Ocean, the Australian plate, now independent of Antarctic, continued a northward path where during the Late Miocene, collision with the Asian plate caused the eventual uplift of the New Guinea Highlands to elevations ranging from 4,038 m (13,248 ft) on the east end of the island to 4,509 m (14,793 ft) on the west end. Tectonic activity elsewhere in the world continued through the Neogene but its description remains beyond scope of this story. Increasingly high mountain ranges, raising of the Central American isthmus and the isolation of Antarctica all contributed to changes in ocean and air currents and brought down world temperature by the end of the Pliocene. Antarctica became ice covered and ice was forming in the Arctic and some areas farther south. Many Neogene species of the dog, cat and horse families became extinct along with the giant megalodon shark and European crocodilians to name a few.

**December 30 – 10:15 A.M. The Quaternary Period.** It is 2.6 million years ago and the beginning of the **Pleistocene Epoch**, the latest “Ice Age.” The most recent 10,000 years of the Quaternary is the **Holocene Epoch** which also is occasionally labeled the Anthropocene because of human-made changes to the earth (and, in the author’s opinion, the vanity of the human race). The Quaternary is in many ways a rerun of the past: shifting continents, bolide impacts, volcanic catastrophes, extinctions and new families of biota. Pummeling of the earth from outer space continued when near or at the Pliocene-Pleistocene time boundary, a bolide struck in present southern Tajikistan and excavated the 52 km (31 mi) diameter Karakul Crater. Early in the Pleistocene, around 900,000 years ago, the 13 km (8 mi) diameter Zhamanshin Crater was

made in Kazakhstan; the Bosumti Crater, a 10.5 km (8 mi) feature in Ghana, Africa was made 1.07 million years ago; the 1.18 km (1.9 mi) diameter Barringer Crater in Arizona is 49,000 years old; an ocean impact around the year 1443 on the New Zealand shelf is recorded by the Mahuika Crater which measures around 20 km (12 mi) in diameter and is 153 m (502 ft) deep. It produced devastating tsunamis, leaving beach sand at an elevation of 220 m (722 ft) above sea level on Stewart Island, New Zealand. More recently in June, 1908, an object estimated by NASA to have weighed 220 million pounds (99,790 mt) exploded at an altitude of around 28,000 ft (8,534 m) above Tunguska, Siberia laying waste to a vast area below.

Volcanoes are associated with plate tectonics or hot-spots and have affected the earth's topography and climate since its beginning. Major volcanic eruptions during the Quaternary have also made their mark, covering huge areas with ash, darkening worldwide atmosphere and creating sharp, though temporary climatic changes. According to the Smithsonian Institute, between 1,300 and 1,500 volcanoes have erupted on the earth's surface during the past 10,000 years (Holocene time). The first of 183 historically documented Holocene eruptions was in central Turkey about 6,200 B.C. There are perhaps a million young volcanoes on oceanic floors. Estimates of active volcanoes during the entire Quaternary are not readily available but the number must be great. Some of the significantly climate-affecting volcanoes are: the Yellowstone Caldera in Wyoming erupted in the Early Pleistocene, about 2.1 million years ago. It spewed approximately 2,450 km<sup>3</sup> (588 mi<sup>3</sup>) of ash into the atmosphere and left a caldera 100 x 50 km (62 x 31 mi) leaving ash deposits which can be found in the subsurface strata of the Mississippi Delta and which blanketed much of middle America. The Valles Caldera located in the Rio Grande Rift zone of New Mexico blew out an estimated 600 km<sup>3</sup> (145 mi<sup>3</sup>) about 1.15 million years past during Middle Pleistocene time. The Long Valley Caldera in California covered much of western North America with 600 km<sup>3</sup> (145 mi<sup>3</sup>) of ash when it violently erupted 759,000 years ago. Its "crater" a 17 x 32 km (10.5 x 18.5 mi) feature offers signs of renewed activity. The Atitlan Caldera in the Guatemalan Highlands erupted 84,000 years ago, ejected 270 km<sup>3</sup> (65 mi<sup>3</sup>) of tephra (ash, etc) and blanketed Guatemala with tephra deposits 200 m (656 ft) thick in some areas. An estimated 700 kilotons of elemental bromine was released into the atmosphere with the eruption. At present, the caldera contains three active volcanoes. The greatest known surface volcanic event during Holocene time may be the Toba eruption which occurred on the island of Sumatra approximately 74,000 years ago. Its 2,800 km<sup>3</sup> (670 mi<sup>3</sup>) of ash covered Southeast Asia, India and the Indian Ocean as far as Africa. The ash was accompanied by an estimated six billion tons of sulfur dioxide (SO<sub>2</sub>).

The input of huge volumes of sulfates, carbon dioxide and various gases from erupting volcanoes caused a cooling effect in the earth's atmosphere and subsequently on its surface. This would be a cause, most likely a minor one, of the most severe and lasting phenomenon of the Holocene: the Pleistocene glaciation or "Ice Age". Volcanic eruptions, however, would have a short term effect on climate – a few years. The Pleistocene ice age lasted about a million years; so primary causes were long term events. World climate was cooling somewhat during Late Pliocene time and the cooling continued into the Pleistocene. Orbital and axial variations (Milankovich effects), the connection of North and South America by the Isthmus, earlier closing of the Tethys Sea and continued tectonic plate movements were adequate to alter ocean currents and together with continuing tectonic movement raising mountain ranges ever higher (Alpine-Himalaya, Andes, etc) all combined with fluctuating output of solar energy to cause worldwide temperature changes of a few degrees. There were at least four major advances and retreats of ice sheets in North America and six or seven in Eurasia. In South America, the Antarctic ice cap expanded over the southern Andes and Patagonia. In mountainous areas (Southern Alps in New Zealand, Rockies, Himalayas, Alps, etc) mountain glaciers advanced and coalesced on foothill zones and adjacent prairies. At some periods, up to 30% of the earth's surface was covered by ice that in certain areas exceeded 3,900 m (13,000 ft) thickness. The great static weight of ice caused the crust beneath it to buckle and squeezed the underlying asthenosphere downward and outward hundreds of meters. Following retreat of the ice caps, the land surface slowly "rebounded" – an effect still continuing in Scandinavia, Canada and other previously ice-buried areas of the world. The evaporative loss of water making all the ice resulted in lowered world sea level of around 140 m (459 ft) causing much wider coastal plains or steep escarpments to sea level in non-frozen areas.

During summers, melt-water flowed from the leading edges and from beneath ice caps carrying huge amounts of crushed bedrock (called rock flour) into drainage streams. Winter brought arid conditions; and winds blowing off high atmospheric pressure cells above the ice caps mobilized the previous summer's dust and moved it in the prevailing wind direction. As it blew over low areas such as basins and valleys, the wind velocity slowed and the dust dropped out. Settling, the dust formed non-stratified layers which are termed loess. Loess deposits which occur downwind from the world's formerly glaciated areas range in thickness from a few inches to typically less than one hundred feet. The Illinois Geological Survey has noted that about 30% of North America has loess deposits atop bedrock. In north central China, the Loess Plateau however is typically 300 m (1,000 ft) thick and blankets around 380,000 km<sup>2</sup> (147,000 mi<sup>2</sup>). All that loess is not glacial in origin however. Lower parts are pre-Pleistocene and were caused by aridity induced by the rising Himalaya Range that cut off rainfall from the south and replenishment of large lakes to the west. The loess creates huge dust storms in modern China and loads the Yellow River with silt.

As the ice caps formed and moved southward (in the Northern Hemisphere) the biotic zones were forced southward. As the climate cooled, crocodilians died off in Europe and moved south in North America. The giant megalodon sharks died out as did many horse and cat species. "Fuzzy" mammals arrived and remained during the Pleistocene: woolly mammoths, woolly rhinos, musk ox and yaks. Giant deer, cave bears (AKA short-face bears), saber-tooth cats, hippos, and others populated non-glaciated areas. Excepting the yak in the high Himalayas, musk oxen in Ellesmere Island and elsewhere in the far Arctic and pygmy mammoths on Wrangel Island off the Chukchi Peninsula, all would become extinct by the end of the Pleistocene. Extinctions in North and South America include the mammoth, mastodon, camel, horse, ground sloth, giant beaver, glyptodon, giant bison, saber tooth cats, dire wolf, American lion and short-face bear. The pygmy mammoths of Wrangle Island survived into historical time, the last survivors dying around 1650 B.C. Other similar mammoth fossils, dated at around 3690 B.C were found on St. Paul's Island in the Alaskan Pribilof.

Several types of primitive bipedal humanoids appeared in Africa during the Late Pliocene and Early Pleistocene. By Middle Pleistocene, some 1.8 million years ago (37 minutes on the time scale of this paper), *Homo erectus*, generally considered to be the ancestor of modern humans, Heidelberg Man, Neanderthals and Denisovans (a 2010 discovery in Denisova Cave in the Altai Mountains of south central Siberia) was on the scene. All the preceding are members of the genus *Homo*, with Heidelberg man preceded by *Homo*



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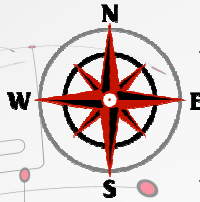
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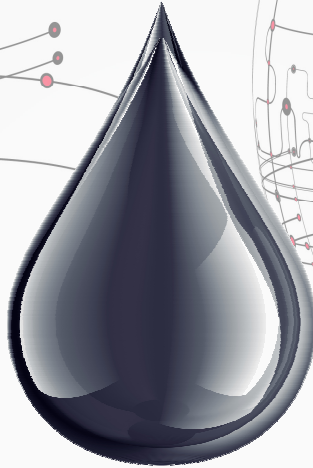




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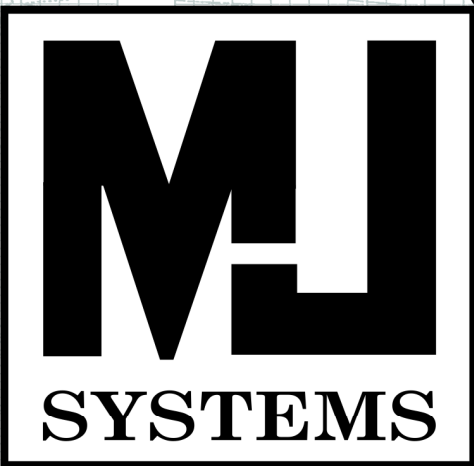
*erectus* and followed in time respectively by Neanderthal and Denisova man and in the Late Pleistocene by modern man or *Homo sapiens sapiens*. Another Late Pleistocene representative of the *Homo* genus is *Homo floresiensis*, a pygmy or dwarf hominid discovered on the Indonesian Flores Island in sedimentary deposits ranging from 95,000 to 17,000 years. Ongoing debate concerns whether floresiensis is a *Homo erectus* descendent made small by “island dwarfism” (such as the Wrangel and St. Paul’s Island mammoths) or descends from some other hominid branch such as the *Australopithecus* group. The Flores man is known to have made and used stone tools and to have hunted and eaten pygmy elephants that also were resident on the island.

**December 30 – 3:44 P.M.** The **Holocene Epoch** or last 10,000 years of earth history has experienced an ongoing general warming period which may represent another interglacial period or the final departure from the last round of continental glaciation to be followed by return to a warm, ice-free planet such as that of the early Paleogene. Tectonic plates continue to move and will again reshape Earth’s geography given sufficient time. Volcanoes continue to create chaos ... the Smithsonian Global Volcanism Program reports 5,337 historical eruptions and the Arabian and Indian Plates continue to push northward causing violent earthquakes from China to Turkey. And lurking in space are asteroids and comets with known orbits that mathematically intersect the Earth’s orbit. It probably is only a matter of time until another Chicxalub or Shiva incident happens and causes still another mass extinction. Which politicians or scientific groups will be blamed for that? It’s nearly New Year’s Eve! There are only a few more hours to decide before the year ends – 99.9% of time has passed. The answer to such a trivial question must wait until next year.

This essay covers only part of the significant events that have shaped the modern earth. The time periods and their durations named in this essay are taken from the *International Stratigraphic Chart* published in 2006 by the International Commission on Stratigraphy and the Precambrian portion of the periods and duration from a chart published in 2009 by the Geological Society of America.

There are between 500 and 700 references used for information contained herein. I have chosen not to list them because of their quantity. The references used are taken from internet sites hosted by the U. S. Geological Survey, the British Geological Survey, the Canadian Geological Survey, the Illinois Geological Survey, the Geological Society of America, The Geological Society (London), Smithsonian Institute, the National Geographic Society, the American Museum of Natural History, the Norfolk Museum (England), Journal of Geophysical Research, Quaternary Research, the Paleontological Research Institute, many North American and British universities. Textbooks include: *Vertebrate Paleontology*, 3<sup>rd</sup> ed.. By A.S Romer, *Microfossils* by M.D. Brasier, *Glacial and Pleistocene Geology* by R.F. Flint, *Basin and Range* by John McPhee, *Frozen Earth: Explaining the Ice Ages* by R.V. Fodor, *Roadside Geology of New Mexico* by H. Chronic and *Introduction to Historical Geology* by R.C. Moore. No non-documented or “esoteric” internet sites were used. Interested readers are advised to consult an internet search engine such as “Google” or “Ask” by entering the names of subjects or terms used in this essay.

L. H. Skelton  
Wichita, Kansas  
October, 2011



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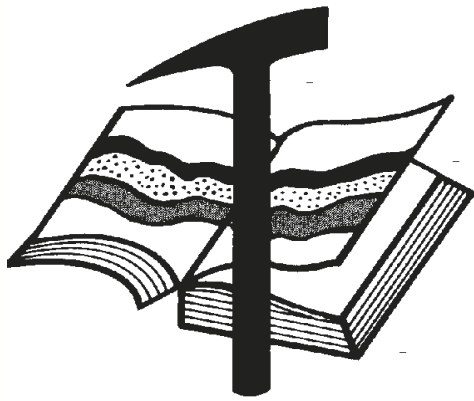
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The Kansas Geological Foundation was founded in March, 1989 as a not-for-profit corporation under the guidelines of section 501(c)(3) of the tax code to provide individuals and corporations the opportunity to further the science of geology. It is dedicated to providing charitable, scientific, literary and educational opportunities in the field of geology for the professional geologist as well as the general public.

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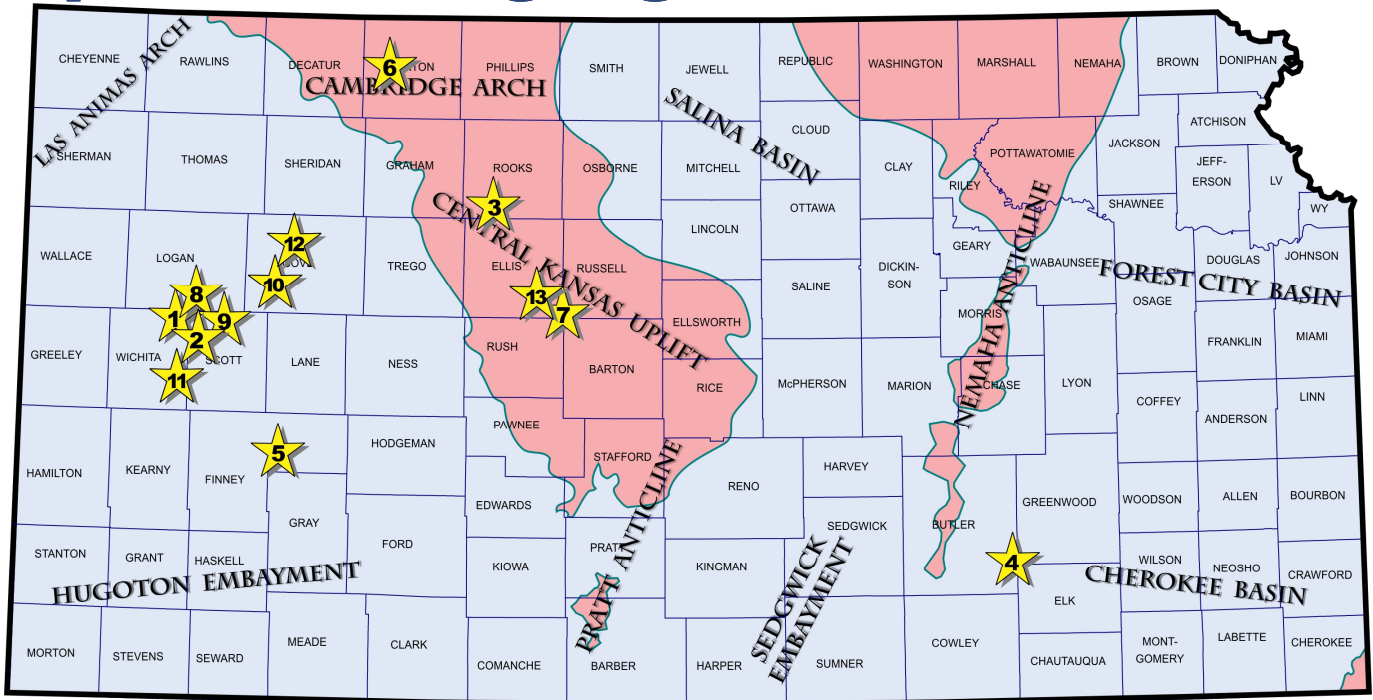
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# Exploration Highlights

By John H. Morrison, III



(1) **Shakespeare Oil Company, Inc**, Salem (IL), is producing an unknown amount of crude oil from the Marmaton and Cherokee formations at their 1-9 Tucker (API 15-171-20947), spotted in the SE SE SE of section 9- T16s- R34W, in northwestern Scott County. The well was drilled to a total depth of 4864 ft nearly three-quarters mile northeast of Shakespeare's discovery well in the Janzen Field, 1-16 Janzen OWWO (API 15-171-20790), completed in the first quarter of 2011 in section 16. It also produced oil from the same horizons. The Tucker well will be an infield wildcat and extension of the field which lies about twelve miles north of Modoc, Kansas.

(2) **Landmark Resources, Inc**, Houston (TX), has discovered new Marmaton oil reserves at its 1-11 Sands wildcat well (API 15-171-20948) in Scott County. The 4900 ft-deep well found oil deposits in the Marmaton (Altamont) formation over one and quarter miles north of the recently established Capstone Field (Cherokee oil) in section 2, which Landmark also opened in late 2012. Their latest find was drilled in the NE NE SW of section 11- T17s- R34W, four miles northeast of Modoc, Kansas.

(3) **Anderson Energy, Inc.**, Wichita (KS), reports the discovery of Lansing-Kansas City oil deposits at the 2 Pelton A, located in the NE SE SW in section 23- T10s- R19W, **Rooks** County. The 3,738-ft deep well found the new isolated reserves in the heavily drilled township about three-quarters mile south of the Nutsch (L-KC) oil field and nearly four and one-half miles southeast of the town of Zurich, Kansas.

(4) **Range Oil Company, Inc.**, Wichita (KS), has discovered new Mississippian oil reserves in **Butler** County about four miles northeast of Latham, Kansas. The 1 Breedlove 'A', spotted 1340 ft from the south line and 4500 ft from the east line of irregular section 30- T28s- R8E, the wildcat well lies over one mile from Mississippian and Arbuckle oil production within the Flies Field. Production zone at the Breedlove site is Mississippian. Summit Drilling tools drilled the well to a total depth of 3225 ft.

(5) **SandRidge Exploration & Production LLC**, Oklahoma City (OK), has completed two new oil discoveries in **Finney** County, southwest Kansas. Both wells are producing crude from the Mississippian formation after successful re-entry of two 'show holes' that were plugged and abandoned as dry holes 6 to 10 years ago. The 1-2 Renee 2230 was washed down in March to 4668 ft and deepened to 5595 ft in the SE NE SW in section 2- T22s- R30W. In the same month, the 1-34-RE Pamela 2330 was also cleaned out to a depth of 4850 and was deepened to 5420 ft in the SE NE NW of section 34- T23s- R30W. Completion details remain confidential. The new unnamed oil fields lie over three miles from nearest production in the county.

(6) **BlueRidge Petroleum Corp.**, Enid (OK), is producing oil from the Lansing-Kansas City zones at their 1-5 Maddy-Heaton Unit in **Norton** County, north-central Kansas. The wildcat well was drilled to a total depth of 3750 ft by L. D. Drilling rig. Discovery site is situated over one mile north of the Spring Draw (L-KC) oil field and is eight miles west of Norton, Kansas.

(7) **Samuel Gary Jr & Associates**, Denver (CO), has established a new unnamed oil field in **Ellis** County with the completion of the 1-24 Layher Etal. The wildcat well found oil deposits in the Arbuckle formation over two miles northeast of the Beeching Field where the Lansing-Kansas City zones have produced oil since 1943. Nearest Arbuckle production nearby lies over two miles away. New field area is located three and one-half miles northeast of Pfeifer, Kansas.

(8) **Russell Oil, Inc**, Edmond (OK), has established a new unnamed oil field in **Logan** county with the completion of the 1-32 Edwards Trust 'B', located in the NE NW SW of section 32- T15s- R34W. The wildcat test is producing an undisclosed amount of crude from the Marmaton (Altamont 'C') and Cherokee (Johnson Zone) limestones. Site lies nearly two miles from Marmaton and Cherokee



producers in the McDaniel Field (est. 1982) and is about fourteen miles south and two miles east of Russell Springs, Kansas. Operator used H2 Drilling tools to drill the well to a rotary total depth of 4725 ft.

**(9) Shakespeare Oil Company, Inc**, Salem (IL), is producing commingled Cherokee (Johnson Zone) and Morrow oil at a wildcat well spotted nearly three miles from Marmaton oil production in the Frick Field (est. 1982) in **Scott** County. The firm's 1-22 Rudolph discovered the new reserves at site located in the SE NW SE of section 22- T17s- R33W, or about five miles north and 2 miles west of Scott City, Kansas. The well was bottomed at a total depth in Mississippian at 4940 ft. The new field has not been named.

**(10) O'Brien Resources LLC**, Shreveport (LA), has discovered new Cherokee (Johnson Zone) oil reserves at the 1 Prather Farms 22 in southwestern **Gove** County. The 4650 ft deep wildcat well was drilled at site located in the NE SW SE of section 22- T14s- R30W, about nine miles south and seven miles west of Gove, Kansas. Nearest existing production can be found nearly one and one-quarter miles to the north in the Rudzik Field (est. 2010, Mississippian oil). Similar Johnson Zone production is situated almost two miles away from O'Brien's new field which remains unnamed at this time.

**(11) Lario Oil & Gas Company**, Wichita (KS), has a new Marmaton (Pawnee limestone) oil find in **Wichita County**, western Kansas. New oil reserves were discovered at the 1-33 Martin Trust which is located in the NW SE NW of section 33- T19s- R35W. The remote wildcat was drilled to a total depth of 5200 ft by Duke Drilling's rig. Site is located over two miles northeast of established Marmaton production in the Holstein Northeast Field which was opened by Raymond Oil Company in January 2012. The Holstein Northeast Field has given up nearly 9,000 barrels of oil to date. Lario's new oil field has not been named. Field area lies about eight miles south of Marienthal, Kansas.

**(12) Ritchie Exploration, Inc**, Wichita (KS), has discovered Marmaton (Pawnee limestone) oil deposits at an outlying wildcat site located over four miles southeast of the Carl Field (est. 1977, Mississippian oil) and over seven miles from any other Marmaton production in **Gove** County. Discovery was made at the firm's 1 Beougher 8-B, spotted in the NE SW NW of section 8- T12s- R29W, about four miles north and east of the city of Gove. WW Drilling tools bottomed the well at a total depth of 4620 ft. The new field awaits a name.

**(13) Downing-Nelson Oil Company, Inc**, Hays (KS), reports the discovery of new Lansing-Kansas City oil reserves at their 1-12 Ball, SW NW SE in section 12- T15s- R16W, in **Ellis** County. Operator found oil deposits nearly two miles southeast of multipay oil production in the Wagner Field (est. 1956) where the Shawnee, LKC and Arbuckle formations have given up crude. Discovery Drilling tools were used to drill the hole to a total depth of 3550 ft. The new unnamed field lies about 3 miles north and six miles east of Pfeifer, Kansas.

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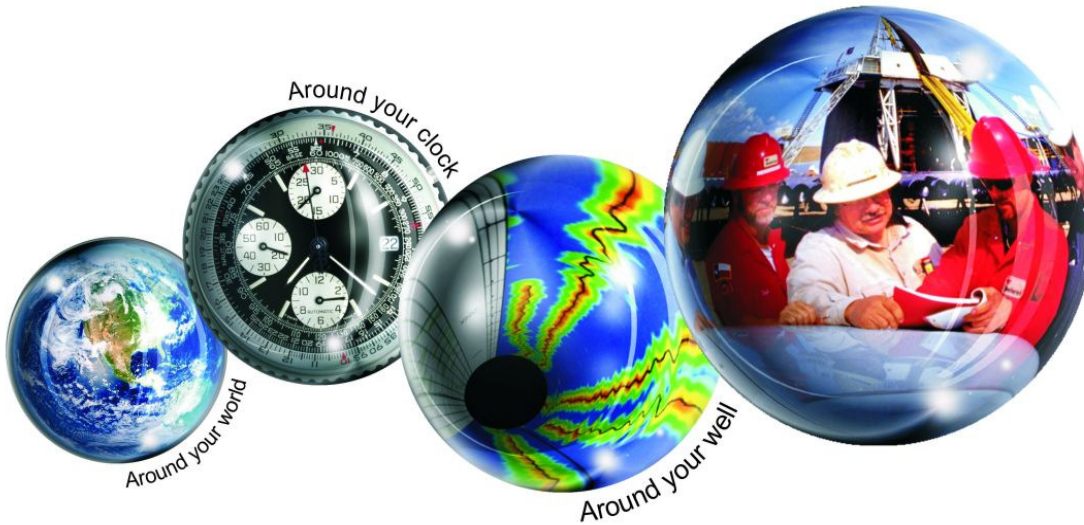
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**October 2013**

Sun	Mon	Tue	Wed	Thu	Fri	Sat
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6	7	8	9	10	11	12 Mid-Con. Mtg.
13 AAPG Mid-Continent Section Meeting	14	15	16	17	18	19
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27	28	29 Tech Talk	30	31		