Shale Shaker

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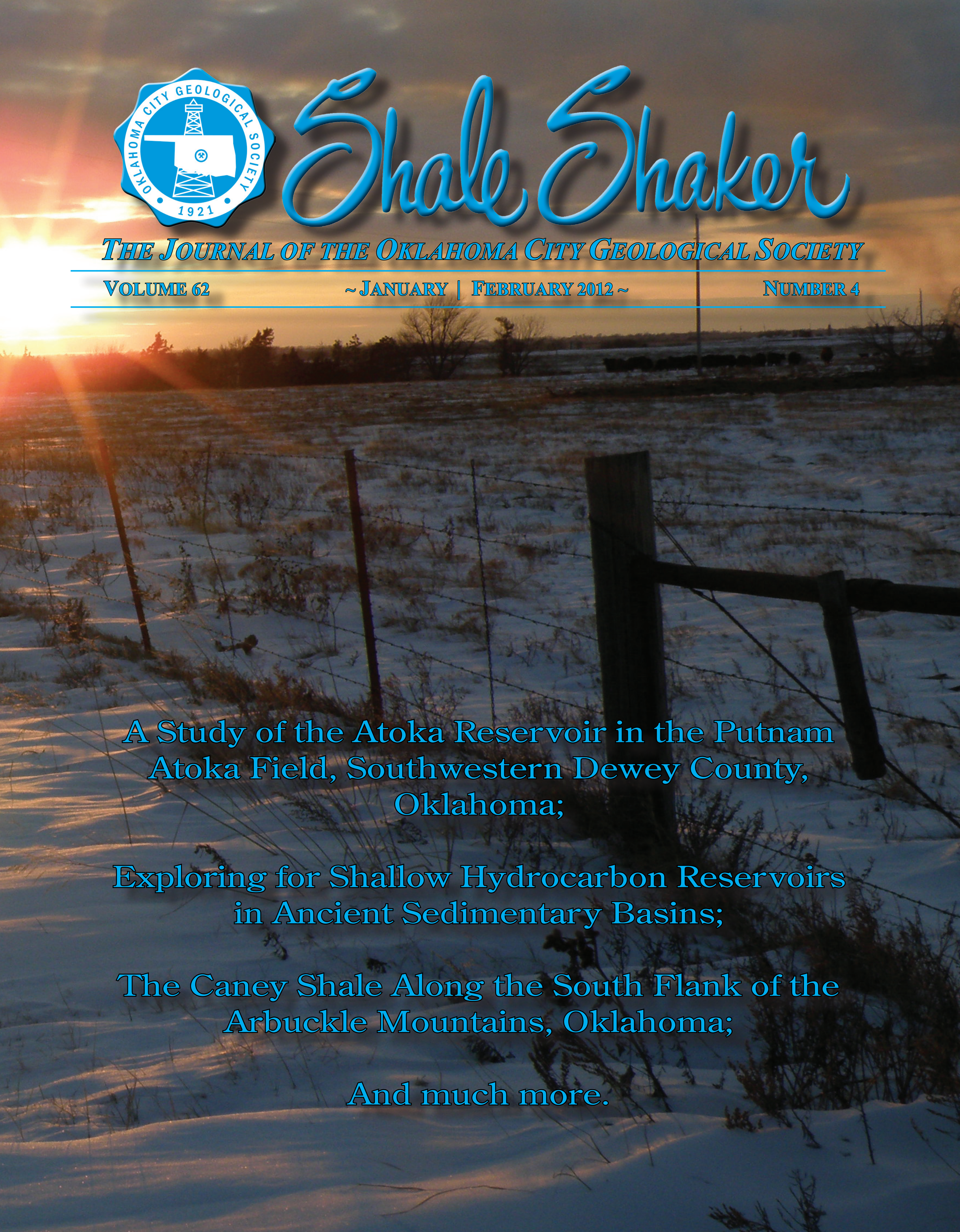
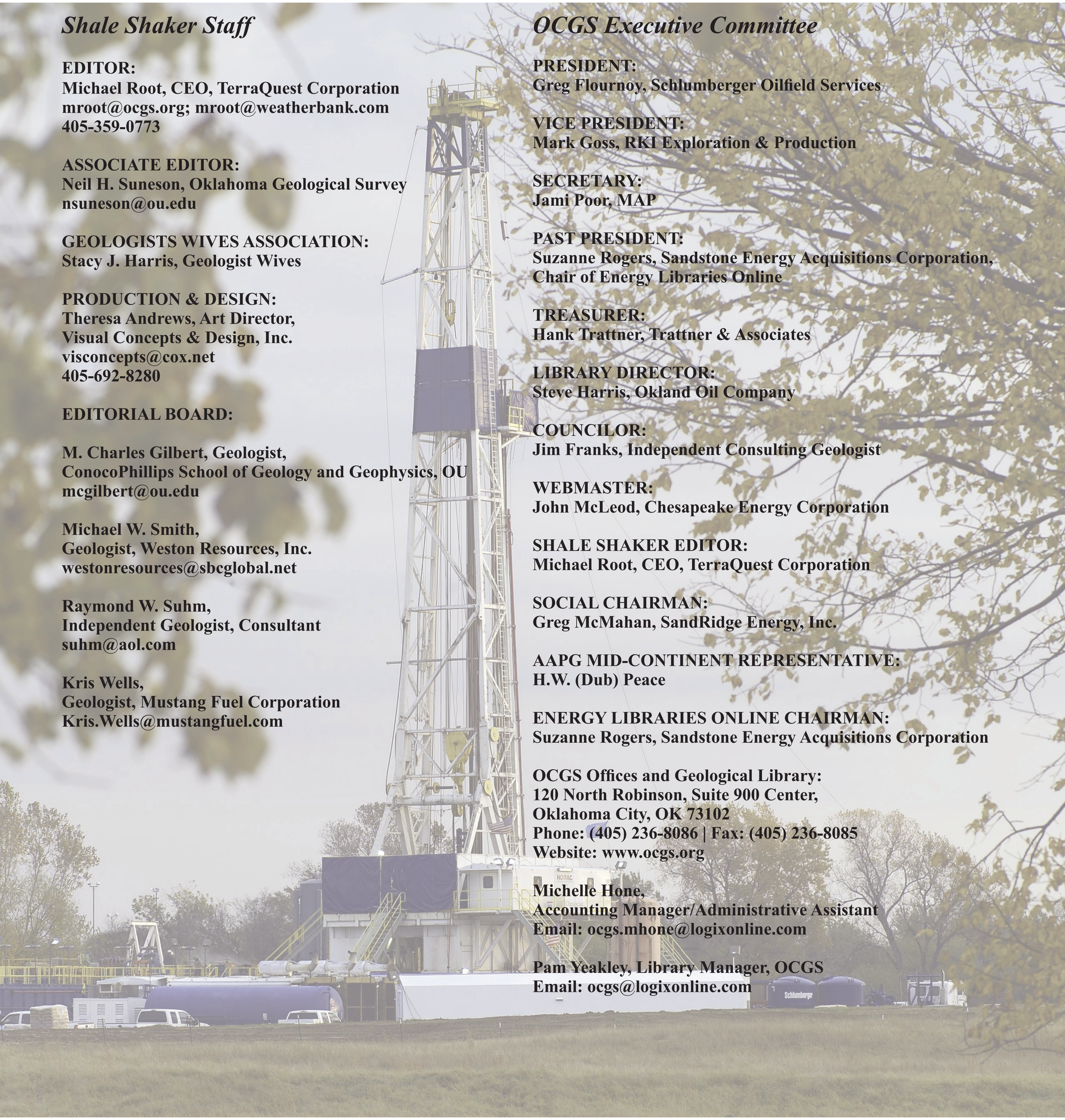


A Study of the Atoka Reservoir in the Putnam Atoka Field, Southwestern Dewey County, Oklahoma;

Exploring for Shallow Hydrocarbon Reservoirs in Ancient Sedimentary Basins;

The Caney Shale Along the South Flank of the Arbuckle Mountains, Oklahoma;

And much more.



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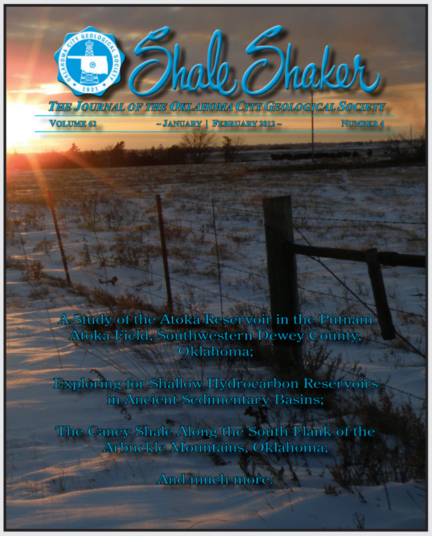

About the Cover

Michael Root creates the covers of the *Shale Shaker*. Michael's cover artwork for this Issue utilizes an image taken at Turtle Rock Farm. The Turtle Rock Farm is located within the rolling mixed grass prairie of north central Oklahoma near Billings, in Noble County. More information on Turtle Rock Farm may be found at:

www.turtlerockfarm.wordpress.com

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My Favorite Outcrop - Caney Shale Along the South Flank of the Arbuckle Mountains, Oklahoma

The Caney Shale (Upper Mississippian) gained prominence during 2005-06 as the first "focused" shale-gas resource play in Oklahoma. At that time, several vertical wells were completed, students became interested in shale-gas theses, and large energy companies brokered acreage plays in the Arkoma Basin. Production from vertical and horizontal Caney wells have subsequently been uneconomical at today's prices and disappointing in terms of capacity. The Caney play rose and fell within the course of a few years only to be replaced by a more prolific, but deeper, shale reservoir (the Woodford).

The Caney is largely composed of shale with subordinate interbedded siltstone, limestone, and sandstone. In the Arkoma Basin of southeastern Oklahoma, it is easily distinguished on well logs by its relatively "hot" gamma-ray (GR) response particularly in the upper part of the formation just below the Cromwell/ Jefferson Sandstone. The GR intensity of the formation decreases with depth where it is underlain by the Mississippian Mayes/Sycamore Limestone. Relatively thin beds of coarse-grained siltstone occur in the upper third of the formation and are characterized by density-neutron cross-plot separation which is caused by the logging matrix effect of silica (siltstone) when the logging tool is calibrated to a limestone matrix.

The Caney Shale is best exposed along the south flank of the Arbuckle Mountains adjacent to I-35 three miles north of Springer (Fig. 1). Here, it is incised by Phillips Creek exposing about 300 ft of the formation (Fig. 2). Its basal contact

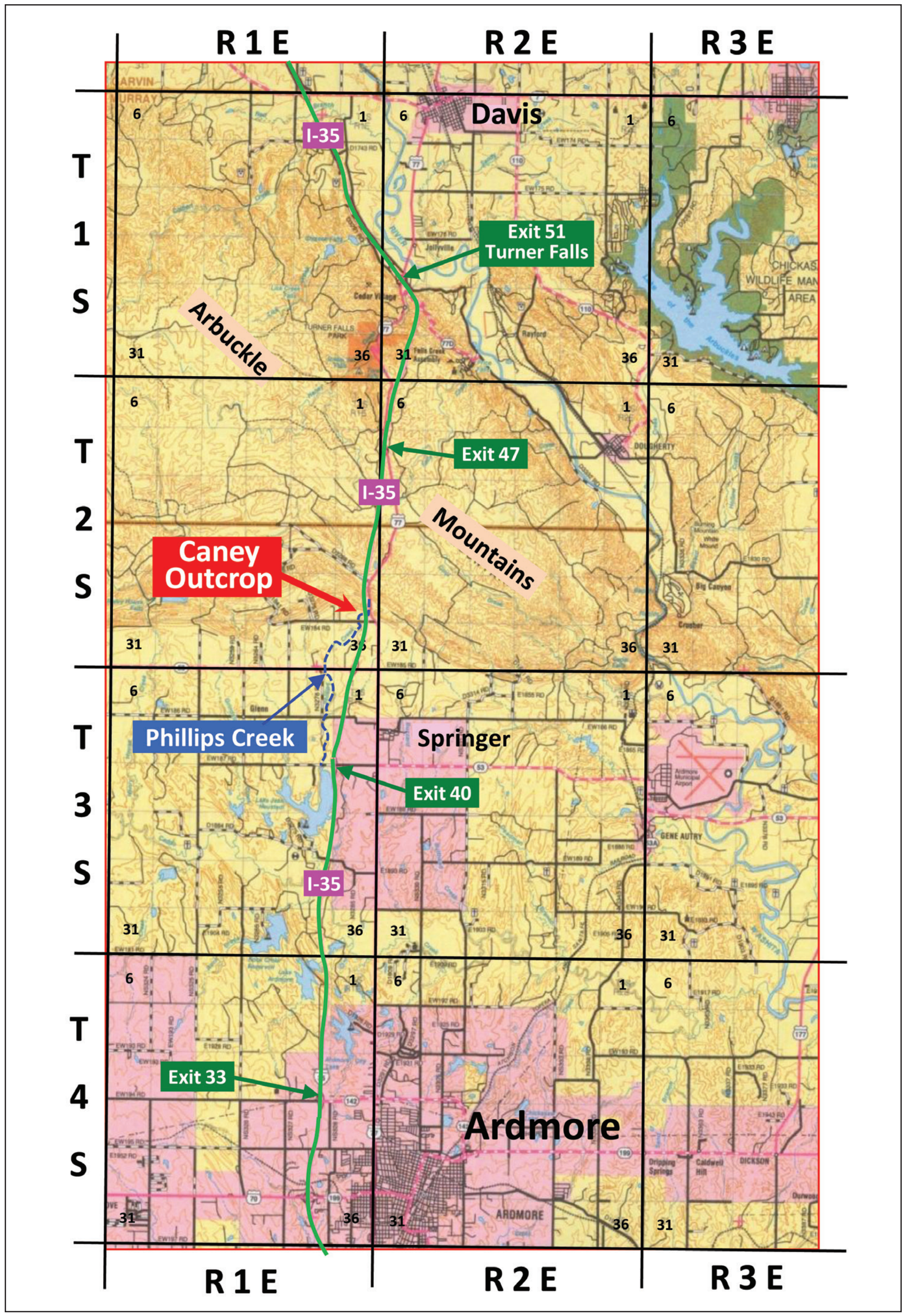

Figure 1. Generalized location map of the Arbuckle Mountains in southern Oklahoma and the location of the Caney outcrop along Phillips Creek.

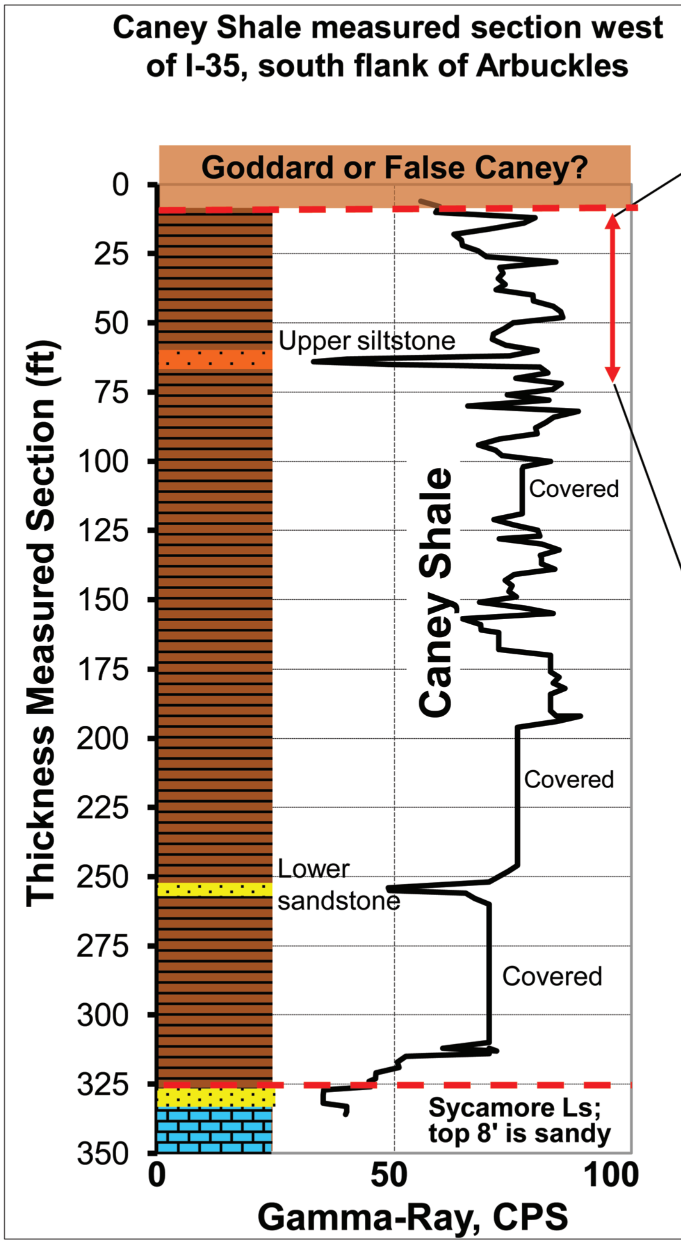

Figure 2. Much of the Caney Shale can be examined just west of I-35 along Phillips Creek (above). Here, the formation is about 300 ft thick (measured section to left with GR recordings) and contains a notable siltstone bed that locally occurs in the upper part of the formation. The siltstone is lenticular in areal extent and has faint horizontal and low-angle cross bedding (Fig. 4). In the absence of other recognizable sedimentary structures, its depositional origin is unclear. The overlying Goddard Shale? (dark gray) occupies the covered area in the upper left of photo.

with sandstone in the upper part of the Sycamore is evident in the adjacent hill to the north. The contact with the overlying Goddard Shale is presumed to be where the outcrops are covered because it is much less resistant to weathering compared to the upper Caney.

The composition of the Caney can be approximated by walking across the strata when it is wet - the lower part is particularly clay-rich, muddy, and clings to your boots. It appears black, earthy, soft, and thinly bedded. Strata up-section becomes increasingly more siliceous, fissile, brittle, and iron-stained (altered pyrite). Here, the shale remains competent and does not become sticky when wet. Phosphatic nodules ~ 1 inch diameter are locally found in this upper part of the section (Fig. 3). Also within the upper part of the formation a thin, resistant bed of siltstone? crops out prominently along the creek and is intermittently exposed along the hill to the north for a great distance (Fig. 2). This peculiar bed has sharp upper and lower contacts with shale, is very-well cemented, effervesces weakly with dilute HCL, and varies in thickness from only several inches to more than a foot. Faint horizontal and cross-bedding is apparent (Fig. 4). Shale above the siltstone bed has conspicuous iron/hematitic staining from

Figure 3. Shale in the upper part of the Caney is siliceous, fissile, and locally contains phosphatic nodules (to the right of the knife). In this part of the formation the shale weathers into very sharp chips.

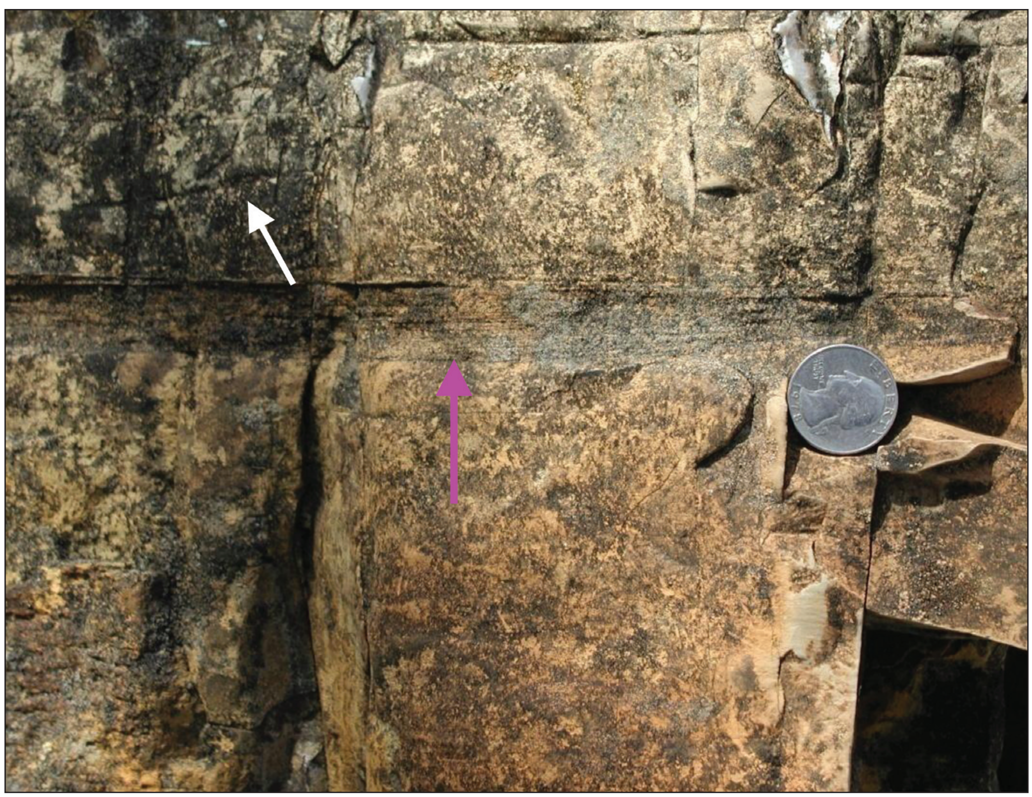

Figure 4. The siltstone is very dense and reacts slightly with dilute HCl. In a cross-section view, horizontal bedding is evident within the faint laminations (pink arrow). Above to the left, low-angle cross bedding is also evident (white arrow).

the alteration of pyrite which occurs as minute crystals within the shale. Fracturing is vertical and locally is curvilinear (Fig. 5). Although limestone is not found at this outcrop, it is identified from well logs in nearby wells. Typically, the shale itself does not effervesce noticeably at outcrop.

Figure 5. Fracturing in the Caney Shale is abundant in the upper part of the formation. In most places it is nearly perpendicular to bedding, but locally it is curvilinear and dies-out along bedding planes. See penny for scale.

Richard (Rick) D. Andrews

Biographical Sketch

Richard (Rick) D. Andrews

Rick Andrews is a petroleum geologist for the Oklahoma Geological Survey. He was the lead geologist for the DOE Class I (oil reservoir) FDD project and is the principal author of several hydrocarbon plays including the Springer, Morrow, Cromwell, Hartshorne, Bartlesville, Red Fork, Skinner, and Prue plays. His responsibilities include regional subsurface mapping and analysis of oil and gas reservoirs ("plays") in Oklahoma, detailed reservoir field studies, formation evaluation using wire line logs, presentation of "play" workshops, and field trip leader. Rick was employed 15 years with a major oil company and received additional training in formation evaluation, well log interpretations, reservoir engineering, reservoir testing, depositional environments, sequence stratigraphy, core and outcrop interpretations, subsurface mapping techniques, and surface to subsurface log correlations. He is proficient in many computer applications and in managing large-scale projects. His ties with the energy industry have been very beneficial to the success of all his workshops and field trips.

Since 2008, Rick was a principal instructor for the ConocoPhillips School of Geology & Geophysics newly established class "Subsurface Methods, 4233". His responsibilities include core, sample, and well log interpretations, and formation evaluation. Rick also assists other OU geology and engineering classes as a guest lecturer and field trip leader. Currently, Rick is serving on two thesis committees (Reed Stevens and Justin Newman). He continuously provides technical assistance for many other MS and PhD candidates regarding their research. Rick has earned several degrees, including a BS and MS in Geological Sciences, from University of Wisconsin-Milwaukee and a MS in Hydrology from Western Michigan University. Prior to joining the Oklahoma Geological Survey, he worked for Union Energy Mining Division, Union Oil Company of California (UNOCAL), Geo Information Systems (GIS).

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