Tombstone Topography in Arbuckle Group
Wichita Mountains

The cover photograph shows an outcrop of limestone beds of the McKenzie Hill Formation (Ordovician) in the middle part of the Arbuckle Group. The outcrop is north of State Highway 9, in sec. 14, T. 5 N., R. 13 W., Caddo County, Oklahoma. Limestone beds are dipping northeastward into the Anadarko basin, away from the Cambrian igneous rocks that form the core of the Wichita Mountains.

Differential weathering and erosion of alternating layers of resistant and nonresistant limestone produce the "tombstone topography" that is characteristic of parts of the Arbuckle Group in both the Wichita Mountains and the Arbuckle Mountains.

The McKenzie Hill is about 500 feet thick here, and it consists of light-gray to medium-gray calcarenites, mudstones, and intraformational conglomerates. Thin layers of chert are present in the upper part of the formation; the chert occurs as nodules and irregular masses replacing limestone. The McKenzie Hill was studied in this area by Harry E. Brookby. His master's thesis (1969), done at The University of Oklahoma, is entitled "Upper Arbuckle (Ordovician) Outcrops in the Richards Spur-Kindblade Ranch Area, Northeastern Wichita Mountains, Oklahoma."

—Kenneth S. Johnson

(Cover photograph by William E. Ham, 1968)
BIBLIOGRAPHY AND INDEX OF OKLAHOMA GEOLOGY
1974

Compiled by Elizabeth A. Ham and William D. Rose

Bibliography—pages 83-107
Index—pages 107-121

BIBLIOGRAPHY

   Al-Shaieb, Zuhair, see Kent, D.C., Al-Shaieb, Zuhair, and Silka, Lyle
   American Petroleum Institute, see American Gas Association, American Petroleum Institute, and Canadian Petroleum Association
   Annamalai, M., see Laguros, J. G., Kumar, Subodh, and Annamalai, M.
5. Asquith, G. B., 1974, Transverse braid bars in the Triassic sandstones of the Texas Panhandle [abstract]: Geological Society of America Abstracts with Programs, v. 6, p. 94-95. (Concerns Ouachita Mountains as source of sediments; reprinted in Oklahoma Geology Notes, v. 34, p. 112.)

*Includes some earlier listings.
*Oklahoma Geological Survey.


Bergman, D. L., see Bingham, R. H.; Bergman, D. L., and Thomas, W. O.

Bergström, S. M., see Sweet, W. C., and Bergström, S. M.

Bickford, M. E., see Lewis, R. D., and Bickford, M. E.


Boerngen, J. C., see Shacklette, H. T., Boerngen, J. G., and Keith, J. R.


Bower, R. R., see Kidwell, A. L., and Bower, R. R.


Brajinikov, B., see Gregory, J. T., Bacskaai, J. A., Brajinikov, B., and Munthe, K.


32. Brobst, D. A., see Pratt, W. P., and Brobst, D. A.


36. Burman, H. R., see Shelton, J. W., and Burman, H. R.

37. Burman, H. R., see also Shelton, J. W., Burman, H. R., and Noble, R. L.


41. Canadian Petroleum Association, see American Gas Association, American Petroleum Institute, and Canadian Petroleum Association.


44. Cannon, P. J., 1974, Dougherty anticline, Arbuckle Mountains: Oklahoma Geology Notes, v. 34, p. 45-46. (Cover photo and description.)

Carleton, D. A., see Kirby, J. G., Carleton, D. A., and Moore, B. M.


Christ, C. L., see Siebert, R. M., Hostetler, P. B., and Christ, C. L.

49. Church, S. B., 1974, Lower Ordovician patch reefs in western Utah: Brigham Young University Geology Studies, v. 21, pt. 3, p. 41-62, 8 figs., 3 pls. (Refers to Ordovician mounds in Oklahoma.)
Clark, D. L., see Miller, J. F., Robison, R. A., and Clark, D. L.


52. Coal Age, 1974, 1973 shipments of mining equipment, production and productivity from various methods of mining: Coal Age, v. 79, no. 2, p. 84-86, 7 tables. (Includes data on Oklahoma.)
53. Cocke, J. M., 1974, Dissepimental corals of the Upper Pennsylvanian Missourian rocks in the American Midcontinent [abstract]: Geological Society of America Abstracts with Programs, v. 6, p. 100. (Reprinted in Oklahoma Geology Notes, v. 34, p. 113.)


Collinson, Charles, see Brenkle, Paul, Lane, H. R., and Collinson, Charles

Corley, R. K., see Thomas, W. O., Jr., and Corley, R. K.


Croy, R. L., see Ham, E. A., Croy, R. L., and Rose, W. D.

Cuffey, R. J., see Bifano, F. V., Guber, A. L., and Cuffey, R. J.


Deiter, L. E., see Calkins, J. A., and Deiter, L. E.
Diez, Maria del Carmen R., see Cramer, F. H., and Diez, Maria del Carmen R.
Donaldson, E. C., see Lorenz, P. B., Donaldson, E. C., and Thomas, R. D.

76. Ekebaf, S. B., 1973, Stratigraphic analysis of the interval from the Hogshooter Limestone to the Checkerboard Limestone, a subsurface study in north-central Oklahoma: University of Tulsa unpublished M.S. thesis. (Abstract printed in Oklahoma Geology Notes, v. 35, p. 34.)


Fanelli, L. L., see Harper, W. B., and Fanelli, L. L.

Fanelli, L. L., see also Wood, S. O., Jr., and Fanelli, L. L.


80. Fay, R. O., 1974, Origin of petroleum II, a summary review: Oklahoma Geology Notes, v. 34, p. 149-152.


82. Feenstra, R. E., 1974, Minor fold in the Blaylock Sandstone (Silurian), Ouachita Mountains, Oklahoma: Oklahoma Geology Notes, v. 34, p. 97-98. (Cover photo and description.)

Friedman, Irving, see Donovan, T. J., Friedman, Irving, and Gleason, J. D.

83. Friedman, S. A., 1974, Coal resources of eastern Oklahoma [abstract]: American Chemical Society Meeting, Oklahoma Section Paper, March 1974. (Reprinted in Oklahoma Geology Notes, v. 34, p. 129.)


88. Gentile, R. J., 1974, A new species of Dentalium from the Pennsylvanian of eastern Kansas: Journal of Paleontology, v. 48, p. 1213-1216, 1 fig. (Refers to species from Wewoka Formation.)

Gleason, J. D., see Donovan, T. J., Friedman, Irving, and Gleason, J. D.

89. Gonzales, Serge, 1974, Relationship between petroleum accumulations and stratiform ore deposits within Paleozoic carbonate se-


Cuber, A. L., see Bifano, F. V., Guber, A. L., and Cuffey, R. J.

Hagni, R. D., see Gann, D. E., and Hagni, R. D.


Ham, W. E., see Waddell, D. E., Sanderson, G. A., and Ham, W. E.

Honor, J. S., see Baria, L. R., and Honor, J. S.


ogy Notes, v. 34, p. 35, and in Petroleum Abstracts, v. 14, p. 395-396.)

102. Heckel, P. H., 1974, Carbonate buildups in the geologic record: a review, in Laporte, L. F. (editor), Reefs in time and space, selected examples from the recent and ancient: Society of Economic Paleontologists and Mineralogists Special Publication No. 18, p. 90-154, 9 figs. (Includes Oklahoma Ordovician reefs.)


Heine, R. R., see Al-Shaieb, Zuhair, and Heine, R. R.


108. Hoover, W. B., 1974, New tectonic theory has origin in convection cells: World Oil, v. 178, no. 6, p. 104, 105-106, 2 figs. (Includes Arbuckle area and Ouachita front.)


Horn, M. K., see Shelton, J. W., Horn, M. K., and Lassley, R. H.

Hostetler, P. B., see Siebert, R. M., Hostetler, P. B., and Christ, C. L.

110. Howell, B. F., Jr., 1974, Seismic regionalization in North America based on average regional seismic hazard index: Seismological Society of America Bulletin, v. 64, p. 1509-1528, 6 figs., 3 tables. (Includes data on plains states and figure on Guthrie earthquake of 1952.)


112. Hunt, H. B., 1974, Study looks at exploration model and gas prices: Oil and Gas Journal, v. 72, no. 16, p. 148-149, 4 figs. (Anadarko basin model.)


115. Ireland, J. L. 1973, Geology for land-use planning of western Rogers County and southern Washington County, Oklahoma: Oklahoma State University unpublished B.S. thesis. (Abstract printed in Oklahoma Geology Notes, v. 35, p. 27.)

Jackson, K. C., see Lines, W. B., and Jackson, K. C.


117. Johnson, K. S., 1974, Maps and description of disturbed and reclaimed surface-mined coal lands in eastern Oklahoma: Oklahoma Geological Survey Map GM-17, 3 maps, scale 1:125,000; text to accompany maps, 12 p., 9 figs., 2 tables. (Prepared in cooperation with Oklahoma Department of Mines.)


Johnson, K. S., see Southard, L. G., Johnson, K. S., and Roberts, J. F. Jones, R. M., see Stoever, E. C., Jr., and Jones, R. M.


Keller, G. R., see also Cebull, S. E., Keller, G. R., Shurbe, D. H., and Russell, L. R.


Kent, D. C., see DeVries, R. N., and Kent, D. C.
Kent, D. C., see also Naney, J. W., and Kent, D. C.


Kumar, Subodh, see Laguros, J. G., Kumar, Subodh, and Annamalai, M.


Landis, G. P., see Heyl, A. V., Landis, G. P., and Zartman, R. E.


Lane, H. R., see Brenkle, Paul, Lane, H. R., and Collinson, Charles


Lassley, R. H., see Shelton, J. W., Horn, M. K., and Lassley, R. H.


147. Lewis, R. D., and Bickford, M. E., 1974, U-Pb ages of the Spavinaw and Tishomingo Granites [abstract]: Geological Society of America Abstracts with Programs, v. 6, p. 844-845. (Reprinted in Oklahoma Geology Notes, v. 34, p. 216.)


LoPiccolo, R. D., see Lowe, D. R., and LoPiccolo, R. D.
156. Lutz-Garihan, A. B., The brachiopod genus Composita from the Wreford Megacyclothem (Lower Permian) in Nebraska, Kansas, and Oklahoma [abstract]: Geological Society of America Abstracts with Programs, v. 6, p. 527. (Reprinted in Oklahoma Geology Notes, v. 34, p. 126-127.)
160. McCaslin, J. C., 1974, Oklahoma’s Springer sand trend surges: Oil and Gas Journal, v. 72, no. 28, p. 99, 1 fig.
McCowan, F. P., see Collins, R. J., McCowan, F. P., Stonis, L. P., and Petzel, G.


167. McNabb, Dan, 1974, Gas prices stir risky new Oklahoma play: Oil and Gas Journal, v. 72, no. 9, p. 24-25, 1 fig.


Meyer, R., see McFarland, W., and Meyer, R.


179. Miotke, Franz-Dieter, 1969 [1974], Gipskarst östlich Shamarock/Nordtexas, in Morphologie des Karstes: v. 1 of 5. Inter-

Moore, B. M., see Kirby, J. G., Carleton, D. A., and Moore, B. M.
Moore, C. B., see Lange, D. E., Moore, C. B., and Rhoton, Kendall


Morrisey, N. S., see Rummersfield, B. F., and Morrisey, N. S.


Munthe, K., see Gregory, J. T., Bacskai, J. A., Brajnikov, B., and Munthe, K.

Mutis-Duplat, Emilio, see Kehle, R. O., Mutis-Duplat, Emilio, and Schonfeldt, H. A.


Naney, J. W., see Yost, Coyd, Jr., and Naney, J. W.

Nassicuk, W. W., see Strimple, H. L., and Nassichuk, W. W.

National Stripper Well Association, see Interstate Oil Compact Commission and National Stripper Well Association


Niem, A. R., see Picha, Frantisek, and Niem, A. R.

Noble, R. L., see Shelton, J. W., Burman, H. R., and Noble, R. L.

Noble, R. L., see also Shelton, J. W., and Noble, R. L.

Nondorf, J. L., see Davis, H. G., and Nondorf, J. L.


186. Oklahoma Baptist University Speleology Class, 1974, Caves of Seminole County, Oklahoma: Oklahoma Underground, v. 6, p. 53-64, 7 figs.


Parrish, D. R., see Craig, F. F., Jr., and Parrish, D. R.
Peoples, J. A., see Jarjur, S. Z., and Peoples, J. A.


Petersen, L. E., see Lundin, R. F., and Petersen, L. E.


Pohl, E. R., see Browne, R. G., and Pohl, E. R.


Potter, P. E., see Pettijohn, F. J., Potter, P. E., and Siever, Raymond


Pray, L. C., see Choquette, P. W., and Pray, L. C. Quinn, J. H., see Manger, W. L., Saunders, W. B., and Quinn, J. H. Ramananantoandro, R., see Manghnani, M. H., and Ramananantoandro, R.


Renfro, A. R., see Shockey, P. N., Renfro, A. R., and Peterson, R. J. Rhoton, Kendall, see Lange, D. E., Moore, C. B., and Rhoton, Kendall
Roberts, J. F., see Southard, L. G., Johnson, K. S., and Roberts, J. F.
Robison, R. A., see Miller, J. F., Robison, R. A., and Clark, D. L.
Rose, W. D., see Ham, E. A., Croy, R. L., and Rose, W. D.
220. Rowland, T. L., 1974, Lone Star 1 Rogers Unit captures world depth record: Oklahoma Geology Notes, v. 34, p. 185, 1 fig., 2 tables.
221. Rowland, T. L., 1974, World’s largest land-based drilling rig used for record well: Oklahoma Geology Notes, v. 34, p. 1-2. (Cover photo and description.)
Rowland, T. L., see Shelton, J. W., and Rowland, T. L.
223. Rummersfield, B. F., and Morrisey, N. S., 1974, Justify exploration costs by finding needed reserves: Oil and Gas Journal, v. 72, no. 44, p. 121-125, 5 figs., 3 tables. (Includes southern Oklahoma.)
224. Runnegar, Bruce, 1974, Evolutionary history of the bivalve subclass Anomalodesmata: Journal of Paleontology, v. 48, p. 904-939, 10 figs., 5 pls. (Includes Oklahoma specimens.)
Russell, L. R., see Cebull, S. E., Keller, G. R., Shurbet, D. H., and Russell, L. R.
Ryland, S. L., see Leeds, D. J., and Ryland, S. L.


Schonfeldt, H. A., see Kehle, R. O., Mutis-Duplat, Emilio, and Schonfeldt, H. A.


249. Siever, Raymond, see Pettijohn, F. J., Potter, P. E., and Siever, Raymond

Silka, Lyle, see Kent, D. C., Al-Shaieb, Zuhair, and Silka, Lyle

Simmons, R. W., see Work, P. L., Stevens, O. D., and Simmons, R. W.

250. Simpson, H. M., 1974, Palynology and the vertical profile of sedimentation of lower Missourian strata, Tulsa County, Oklahoma [abstract]: Geological Society of America Abstracts with Programs, v. 6, p. 122. (Reprinted in Oklahoma Geology Notes, v. 34, p. 120.)


252. Smith, S. G., see Shaver, R. H., and Smith, S. G.
Soto, Carlos, see Dickey, P. A., and Soto, Carlos
Spinosa, Claude, see Saunders, W. B., and Spinosa, Claude
Stevens, O. D., see Work, P. L., Stevens, O. D., and Simmons, R. W.
Stonis, L. P., see Collins, R. J., McCowan, F. P., Stonis, L. P., and Petzel, G.
Straka, J. J., II, see Lane, H. R., and Straka, J. J., II
259. Strimple, H. L., and Nassichuk, W. W., 1974, Pennsylvanian crinoids from Ellsmere Island, Arctic Canada: Journal of Paleontology, v. 48, p. 1149-1155, 1 fig., 1 pl. (Refers to Oklahoma species.)
Strimple, H. L., see Pabian, R. K., and Strimple, H. L.
261. Sutherland, P. K., 1974, Significance of the stratigraphic distribution of colonial rugose corals in the Pennsylvanian System of North America [abstract]: Geological Society of America Abstracts with Programs, v. 6, p. 124. (Reprinted in Oklahoma Geology Notes, v. 34, p. 120.)
265. Tanner, W. F., 1974, Bed-load transport in a chain of river segments:
Shale Shaker, v. 24, p. 128-134, 5 figs. (Study of Arkansas River from Tulsa to river's mouth; abstract printed in Petroleum Abstracts, v. 14, p. 641.)


Taylor, M. E., see Yochelson, E. L., and Taylor, M. E.


Thomas, R. D., see Lorenz, P. B., Donaldson, E. C., and Thomas, R. D. Thomas, W. O., see Bingham, R. H., Bergman, D. L., and Thomas, W. O.


Thompson, J. C., see Barrett, N. D., and Thompson, J. C.


276. U.S. Board on Geographic Names, 1974, Decisions on geographic
names in the United States, April through June 1974, Decision List no. 7402: U.S. Department of the Interior, 27 p. (Names and defines Seneca Creek.)


Veinus, Julia, see Brower, J. C., and Veinus, Julia


Walters, J., see Lago, O. K., and Walters, J.


286. West, Jim, 1974, Explorers flock back to the Palo Duro: Oil and Gas Journal, v. 72, no. 43, p. 38-39, 1 fig.


288. Westphal, K. W., 1974, New fossils from the Middle Ordovician Platteville Formation of southwest Wisconsin: Journal of Paleontology, v. 48, p. 78-83, 4 figs., 1 pl. (Refers to Oklahoma cystoid.)


Willis, D. G., see Hubbert, M. K., and Willis, D. G.

289. Wilson, L. R., 1974, Observations on the morphology and stratigraphic distribution of Hamiapollenites [abstract]: Geological Society of America Abstracts with Programs, v. 6, p. 130. (Reprinted in Oklahoma Geology Notes, v. 34, p. 121.)

290. Wood, S. O., Jr., and Fanelli, L. L., 1974, Natural gas liquids, in


296. Yost, Coyd, Jr., and Naney, J. W., 1974, Water quality effects of seepage from earthen dams: Journal of Hydrology, v. 21, p. 15-26, 3 figs., 2 tables. (Concerns dams on Washita River tributaries.)

Zartman, R. E., see Heyl, A. V., Landis, G. P., and Zartman, R. E.

INDEX

ANADARKO BASIN:
abnormal subsurface pressure zones, 9
computerized exploration model, 112
connate waters, 222
crude-oil studies, 26
deep wells, 73, 126, 157, 161, 219, 220, 221, 237
Endicott sand, 35, 36
ERTS-1 imagery exploration, 54
exploration, general, 134, 157, 219, 255
gas-bearing deltaic sandstones, 36
genetic increment strata, 35
Hunton oil and gas fields, analysis, 266
Morrowan reservoirs, 36, 222
Morrow-Clay Spring gas trend, 63, 64
Mountain View fault zone, 220
Mustang field, 129
North Dibble field, 144
Paleozoic orogeny, 28
Red Fork sand, 35
seismic studies, 9
Springer gas discoveries, 167
statistics, production, exploration, and reserves, 255

107
subsurface waters, 67, 222
Tonkawa sand, 35, 36
well stimulation, 14
annual reports: Oklahoma Department of Mines, 200; Oklahoma Geological Survey, 170; Oklahoma Water Resources Research Institute, 195

ARBUCKLE MOUNTAINS:
Arbuckle Group, dolomite studies, 229
Buckhorn Limestone, 282
caves, 20, 187
Criner Hills, 58
Dougherty anticline, 40
Elgin Sandstone, source of 267, 268
Ordovician conodont, 163
Overbrook anticline, 58
radar imagery, 42
Simpson Group, Bryozoa, 78
Spavinaw and Tishomingo Granites, dating, 147
stratigraphy, 45, 58
tectonics and structure, 28, 40, 58, 108
Vanoss Formation, mineralogy, 269

Ardmore basin: biostratigraphy, 237; Dornick Hills Group, 58; exploration, 134;
Paleozoic orogeny, 28

ARKOMA BASIN:
Atoka Shale, 36
Booch deltaic sandstone, 35, 36, 204, 209
coal beds, 62, 84, 85, 117, 139
coalification, 62
exploration, 133, 158, 293
geneic sequence, 35
geothermal gradient values, 242
isocarbs, 139
McAlester Formation, 35, 36, 204, 209
stratigraphy, 45
asphaltic deposits, 282

BIBLIOGRAPHIES:
crinoids, 284
fossil vertebrates, 93
fusulinids, 228
Oklahoma geology, 1974, 96
theses in geology, 1967-1970, 283
biometrics, Ordovician-Silurian brachiopods, 4

BIOSTRATIGRAPHY:
Atokan Series, ostracodes, 237
Chester Series, ammonoids, 232
Cochrane Formation, 4
Keel-Edgewood strata, 4
Morrowan; algal facies, 135; brachiopod zones, 104, 105; ostracodes, 131, 237
Pennsylvanian: coral zones, 53, 261; palynomorph marker, 176
Permian index palynomorph, 289
Pierson Formation, conodonts, 140
Sylvan Shale, 4
Tremadocian, conodont and trilobite faunas, 177
Upper Cambrian Matthevia fauna, 295

Cambrian: Arbuckle Group, 212; Lamotte-Reagan Sandstones, 212; Upper Cambrian
Matthevia fauna, 295
Canadian River, 239, 265
carbonates: classification, 47; Ordovician reefs, 49, 102; Pennsylvanian deposition,
244; Permian deposition, 51
Caves:
  Arbuckle Mountains, 187
  Cold Springs Cave, 186
  Cromwell Cave, 186
  Dinosaur's Bathtub, 186
  Gar Creek Cave, 186
  Horseshoe Cave, 185
  Little Crystal Cave, 187
  Murray County, 187
  *Oklahoma Underground*, index for 1968-1974, 20
  Outlaw Cave, 187
  Seminole County, 186
  Wagon Wheel Cave, 187
  Whiskey Cave, 186
  Woodward County, 185

Cimarron River, 241, 243

Coal:
  Arkoma basin, 62, 84, 85, 117, 139
  coalification, 62
  coke, 84, 245
  eometamorphism, 139
  gasification, 84
  general, 84, 85, 178, 189, 277, 287
  Hartshorne beds, 148
  history, 84
  land reclamation, 84, 117, 170, 188
  producers, 178, 190, 200, 255
  quality, 83, 84, 85, 190
  regulations, 84, 117, 188, 255
  resources, 83, 84, 85, 117, 170, 255, 287
  statistics: consumption, 83, 84, 188, 192; economics, 84, 178, 188; exports, 83, 84;
  production, 84, 85, 117, 178, 188, 190, 200, 254, 255; projections, 84; resources, 83, 84, 85, 178, 189, 190, 287; technology, 82, 287
  surface-mined lands, 84, 117, 188
  technology, 52, 84, 117, 178, 200, 287
  terminology, 84

computer data systems, 37, 175

copper shales, 1, 68, 87, 118, 119, 125, 136, 150, 214, 251

Counties:
  all counties: mineral industries, 200, 255; oil and gas exploration, 6, 7, 255; oil
  and gas production, 8, 255; well data, 8
  Atoka: coal, 84, 117; ostracodes, 237
  Beaver: "Haskell" limestone, 36; subsurface waters, 67; Tonkawa sand, 35, 36
  Beckham: deep wells, 73, 157, 219, 221; exploration, 134, 157, 219, 221; karst
  topography, 179
  Blaine: exploration and development, 293; Morrow-Springer trend, 63; pressure
  data, 172
  Caddo: exploration, 160, 167, 293
  Canadian: Morrow-Springer trend, 63; Mustang field, 129, 151
  Carter: Berwyn Conglomerate, 79; biostratigraphy, 232; exploration, 134;
  Springer-Goddard shales, 138
  Cimarron: Seneca Creek, name decision, 276; subsurface waters, 67
  Coal: coal, 84, 117; crinoid, 258; ostracodes, 237
  Comanche: fossil amphibian, 23
  Craig: coal, 84, 117, 287; soil survey, 184
  Creek: coal, 84, Elgin Sandstone, 267; environmental geology, 122, 162
  Dewey: exploration and development, 293; Oswego Limestone, 217
Ellis: Ivanhoe Creek, name decision, 275; Pennsylvanian sandstones, 36
Garfield: Enid flood, 19, 279
Garvin: exploration, 134
Grady: exploration and development, 134, 160, 167, 206, 293
Greer: copper shales, 119; grooved granites, 98
Harmon: karst topography, 179
Harper: Endicott sandstone, 35; exploration, 286; stratigraphic traps, 171
Haskell: coal, 84, 85, 117, 287
Hughes: Hawkins pool, 35
Jackson: Creta copper deposit, 68, 119; exploration, 286
Latimer: coal, 84, 117; Potato Hills structure, 208
Le Flore: coal, 84, 85, 117, 287; Stanley Shale, 138
McClain: exploration and development, 293; North Dibble field, 144
McCurtain: Blaylock Formation, folding, 81, 82
McIntosh: coal, 84, 117; Senora Shale, 138
Mayes: Chattanooga Shale, 138; coal, 84, 117
Murray: caves, 187
Muskogee: coal, 84, 117, 287; Morrowan bioherms, 25
Noble: copper mineralization, 1; Oswego Limestone, 35; Red Fork Sandstone, 35; South Ceres pool, 35
Nowata: coal, 84, 117, 287
Okfuskee: coal, 84
Oklahoma: Mustang field, 151
Okmulgee: coal, 84, 117; Oologah Limestone, flysch, 17
Osage: Cherokee Group, petroleum source rocks, 12; Elgin Sandstone, 267; land-use planning, 162
Pawnee: copper mineralization, 1; Elgin Sandstone, 267; land-use planning, 162
Payne: copper mineralization, 1
Pittsburg: coal, 84, 117, 287
Pontotoc: biostratigraphy, 292
Pushmataha: Potato Hills structure, 208
Roger Mills: exploration, 134, 157
Rogers: coal, 84, 117, 287; land-use planning, 115; Oologah Limestone, 15
Seminole: caves, 186; "Wilcox" sand, 217
Sequoyah: coal, 84, 85, 117
Stephens: Claypool Shale, 138; exploration and development, 293; Sholom Alechem field, 215
Texas: connate waters, 222; subsurface waters, 67
Tulsa: coal, 84, 117; land-use planning, 162; Oologah Limestone, 15, 17, 218, 271; palynology, 249
Wagoner: coal 84, 117
Washington: coal, 84; land-use planning, 115
Washita: deep wells, 73, 220, 293; exploration, 134, 157, 220
Woods: stratigraphic traps, 171
Woodward: caves, 185; Pennsylvanian sandstones, 36; pressure data, 172
Cretaceous: Purgatoire Formation, benthic communities, 235; Washita shales, 138
Criner Hills: source of Dornick Hills Group sediments, 58
Delaware basin, well stimulation, 14
DEVONIAN:
Arkansas Novaculite, 208
Bois d'Arc Formation, 151
brachiopods, 4
Haragan Formation: brachiopods, 4; crinoids, 258; petrology, 4; stratigraphy, 4
Henryhouse Formation, correlation with Rockhouse Formation, Tennessee, 155
Hunton Group: data, 159; exploration and development, 293; Mustang field, 129, 151; North Dibble field, 144
dictionary, exploration geophysics, 246

110
earth-science education, 256, 257
Enid: record flood, 19, 279

**Environmental Geology:**
- air-quality control, 189, 255
- brine evaporation, 194
- brine pollution of aquifers, 92
- coal-land reclamation, 84, 117, 170, 188
- Craig County, 184
- energy conservation, 189
- flooding: Enid, 19, 279; Oklahoma streams, 231, 270; urban areas, 230
- Keystone Reservoir pollution, 91, 122
- land-use planning: Craig County, 184; Creek, Osage, Pawnee, and Tulsa Counties, 162; Rogers and Washington Counties, 115
- Mannford area, 122
- mineral pollution, in reservoir sediments, 207
- mining regulations, 84, 117, 186, 200, 255
- nuclear energy: regulation control, 189, 190
- oil and gas regulations, 188, 190, 234
- oil pollution, Lake Keystone, 91
- soils: mineral concentration, 236
- strip-mined lands inventory, 117
- waste management: underground fluid injection, 111
- water quality: Ardmore-Sherman quadrangles, 100; Arkansas River, 59; brine-storage reservoirs, 194; control, 189, 190; Elgin sands, 268; Keystone Lake, 91, 122; Lake Thunderbird, 107; Red River, 59, Washita River alluvial ground water, 123; Washita River basin, 296

**General Information Processing System (GIPSY), 37, 175**

**Geochemistry:**
- aragonite from dolomite dissolution, 248
- Arbuckle Group, isotopic studies, 229
- barite-lead-zinc mineralization, Tri-State, 143
- carbon isotopes of methane, 227
- central-plains Pleistocene deposits, 22
- copper mineralization, 1, 68, 87, 118, 119, 125, 136, 150, 214, 251
- crude oils: spectrographic analyses, 26; geochemical studies, 80
- hydrocarbon alteration, 69, 70, 71
- interstitial waters, Paleozoic shales, 11
- isotopic studies, 106, 229
- organic, Cherokee Group, 12
- rare-earth elements, Permian, 60
- Simpson sands, 204
- subsurface connate waters, Anadarko basin, 222
- Tri-State area, galena, 106
- Washita River alluvium and ground water, 123

**Geographic names decisions: Ivanhoe Creek, 275; Seneca Creek, 276**

**Geomorphology (including Physiography and Topography):**
- Ardmore-Sherman quadrangles, 100
- karst topography, Beckham and Harmon Counties, 179
- Mill Creek area, 39
- northwest Oklahoma, 36
- south-central Oklahoma, 38, 41
- southwest Oklahoma, 179

**Geophysics:**
- dictionary, 246
- digitized well logs, 292
- exploration statistics, 252
- gravity anomalies, Wichita-Amarillo zone, 213
gravity profiles, Permian basin, 109
magneto-electroradiometric exploration, 206
neutron-activation analysis, Permian rare-earths, 60
reflection seismograph, 120
seismic studies: Anadarko basin, 9; computerized data, 223; earthquake data, 202; Guthrie earthquake, 110; Midcontinent region, 146, 213; Rayleigh waves, 116
tectonophysics: Permian basin, 109; stress gradients, 121
wave velocities, 169
gypsum and anhydrite: Blaine and Dog Creek Formations, 51; statistics, 200, 211, 255

Hydrogeology, Hydrology:
Ardmore-Sherman quadrangles, 100
resources, 170, 190, 195
subsurface waters: alluvial ground water, Washita River, 123; Anadarko basin, water chemistry, 67; Ardmore-Sherman quadrangles, 100; brine pollution, 92; Elgin Sandstone wells, 268; Ogallala aquifer, 48, 66, 195; Panhandle, 181; Permian basin, salt solution, 264; Rogers and Washington Counties, 115; Washita River basin, 123, 183, 296
surface waters: Ardmore-Sherman quadrangles, 100; Arkansas River, bed-load transport, 265; brine-storage reservoirs, 59, 194; Canadian River, bed-load transport, 265; floods, 19, 195, 230, 231, 270, 279; Keystone Lake, Keystone Reservoir, 19, 91, 122; Lake Thunderbird, water quality, 107, mineral pollution, 207; Permian basin, salt discharge, 264; Rogers County, 115; South Canadian River deposits, 124, 259; south-central Oklahoma, stream evolution, 41; Washington County, 115; Washita River: bank stability, 90; dam seepage, 296
water quality: Ardmore-Sherman quadrangles, 100; Arkansas River, 59; brine-storage reservoirs, 194; control, 189, 190; effects of dam seepage, 296; Elgin sands, 268; general, 195; Keystone Lake, 91, 122; Lake Thunderbird, 107; Red River, 59; Washita River alluvial ground water, 123; Washita River basin, 296

Indexes:
crinoids, 284
Oklahoma geology 1973, 96
Oklahoma Geology Notes, 193
Oklahoma Underground 1968-1974, 20
theses in geology 1967-1970, 283
Keyes, meteorite, 142
Keystone Lake, Keystone Reservoir, 19, 91, 122
Lake Chickasha, flood-dam seepage, 296
Lake Thunderbird, water quality, 107
McAlester basin: Cherokee petroleum source rocks, 12; sandstone, 204
maps: Ardmore-Sherman quadrangles, 100; Panhandle, 181; surface-mined coal lands, 117; topographic maps, survey of Oklahoma coverage, 95
memorials: Willard L. Miller, 61; Bing Yee, 166
meteorites, Keyes meteorite, 142

Mineral Industries:
mixed-land reclamation, 84, 117, 200
producers, 200, 255
resources: barite-lead-zinc, Tri-State, 143; cement, 33; copper, 1, 68, 87, 118, 119, 125, 136; copper-silver, 247; general, see Statistics; lead-zinc, relation of ores to petroleum deposits, 89; salt, 165
statistics: bentonite, 200; carbon black, 297; cement, 33; clay, 3, 200; coke, 245; columbium and tantalum processing, 262; copper, 200; crushed stone, 74; general, 180, 200, 210, 254, 255, 277, 278; germanium, 10; granite, 74, 200; gypsum, 200, 211; helium production, 132; lead, 226; limestone and dolo-
mite, 74, 200; nitrogen, 31; producers, 200, 255; pumice, 173; salt, 165; sand and gravel, 200, 201; shale, 3,200; silver, 285; sulfur, 174; thorium processing, 253; tripoli, 50, 200; uranium processing, 291; vermiculite processing, 88; volcanic ash, 200

technology: ammonia plant, Enid, 31; coke, 245; columbium and tantalum processing, 262; germanium processing, 10; mining, 180; thorium processing, 253; uranium processing, 291

MINERALOGY:

aragonite from dolomite, 248
Creeker Group underclays, 272
clay minerals, 138, 294
copper mineralization, 1, 68, 87, 118, 119, 125, 136, 150, 214, 251
Flowerpot Shale sulfides, 125
Tri-State area, barite-lead-zinc mineralization, 143
Vanoss Formation, dispersal patterns, 269

MISSISSIPPIAN:

Arkansas Novaculite, 208
Caney Shale, 45, 151, 215, 232
Chattanooga Shale, 138
Chester Series: ammonoids, 232; exploration, 160, 171
codonts, 50, 141
Fayetteville Formation, crinoids and foraminifers, 34
Jackfork Group, 45, 208
Johns Valley Shale, 45
"Mayes" lime, 151
Menamiean Series, 171
"Meramec-Osage" fracture traps, 99
Moorefield Formation, conodonts, 30
Morrow sands, gas production, 63
paleoclimatology, northwest Oklahoma, 36
Pierson Formation, biostratigraphy, 140
Stanley Group, 45, 138, 205, 208
Sycamore Formation, 215
Northeastern Oklahoma shelf, coal beds, 84, 85
nuclear energy, 189, 190
Oklahoma Energy Advisory Council 170, 188, 189, 190, 192 234
Oklahoma Geological Survey: annual report, 170; publications, 170

ORDOVICIAN:

Arbuckle Group, 212, 229, 263
Big Fork Chert: conodonts, 29; structure, 208
brachiopods, 4
Bromide sand, 144
Burgen Sandstone, grain study, 240
carbonate reefs, 49, 102
Cochrane Formation, 4
cystoid, 287
Gasconade Formation, 27
Hart sand, 144
Joints Formation, conodonts, 163
Keel Formation, 4
McLish Formation, pore filling, 47
Mazarn-Womble shales, 208
Oil Creek Sandstone, 103, 144
Osborne sand, 144
Polk Creek Shale, 208
Simpson Group: Bryozoa, 78; correlation with Everton Formation, Arkansas, 260; trilobites, 238
Simpson sands, chemical composition, 204
Sylvan Shale, 151
Tremadocian conodonts and trilobites, 177
West Spring Creek Formation, conodonts, 163
“Wilcox” sandstone, 217

OUACHITA MOUNTAINS, OUACHITA FOLD-BELT, OUACHITA GEOSYNCLINE:
  Albion anticline, 208
  Appalachians, junction with, 65
  barite deposits, 13
  benthonic trace fossils, DSDP cores, 46
  Black Knob Ridge, conodonts, 29
  Cedar Creek fault, 208
  Choctaw fault, 45
  Council House syncline, 208
  Elgin sands, source of, 267, 268
  flysch sequences, 45, 153, 205
  geologic history, 101
  gravity tectonics, 65
  Hartshorne Sandstone, deposition, 148
  Jackfork Group, dish and pillar structure, 153
  Jackfork Mountain fault, 208
  Lynn Mountain syncline, 208
  Octavia fault, 45
  paleoecology, 45
  Paleozoic orogeny, 28
  Potato Hills, 208
  source of Elgin sands, 267, 268
  stratigraphy, 45, 237
  tectonics and structure, 28, 43, 44, 45, 65, 81, 82, 94, 101, 108, 109, 154, 182, 208
  Ti Valley fault, 45
  Triassic sediments, Texas, source of, 5
  Tuskahoma syncline, 208
  Windingstair fault, 45, 208

OZARK MOUNTAINS, OZARK DOME, OZARK UPLIFT:
  Burgen Sandstone deposition, 240
  coal, 84, 85
  coalification, 62
  Hartshorne Sandstone deposition, 148
  Morrowan biostratigraphy, 104, 105

paleobotany: algae, 25, 49, 51, 135; biomers, 75; East Manitou site, 250

PALEOECOLOGY:
  benthic communities, Cretaceous, 235
  Early Paleozoic, 4, 57
  East Manitou site, 250
  morphologic changes, 57
  Morrowan algal facies, 134
  Morrowan bioherms, 25
  Ouachita geosyncline, Mississippian-Pennsylvanian, 45
  Permian, 51, 198
  provincial differentiation, 75
  Simpson Group, 288
  Upper Cambrian, 295
  Wreford megacyclothem, 18, 156

PALEOENVIRONMENTS:
  Atoka Formation, 281
  biomerization, 75
  Blaine Formation, 51
  Boggy Formation, 281
Burgen Sandstone, 240
Dog Creek Formation, 51
Dornick Hills Group, 58
Gasconade Formation, 27
Hartshorne Sandstone, 148
Mississippian, 45
northeast Oklahoma, 244
Ordovician, 238, 240
Ouachita geosyncline, 45
Paleozoic, Early, 4, 57
Pennsylvanian, 45, 244
Permian, 51
sandstones, general, 204, 209
Vamoosa Formation, 267, 268

Paleogeography (including paleoclimates and paleotopography):
  Paleozoic, Early, 5
  Pennsylvanian, 244
  Permian, Middle, 51
  Precambrian, 212
  Vamoosa Formation, 268

Paleozoic:
  cephalopods, 233
  connate waters, 11
  crinoids, bibliography, 284
  environments, Early Paleozoic, 4, 57
  Midcontinent shales, 225
  ore deposits, relation to petroleum accumulation, 89
  orogeny, Late Paleozoic, 28
  sandstones and shales, interstitial waters, 11

Paleozoology:
  ammonoids, 51, 168, 232
  benthonic trace fossils, DSDP cores, 46
  bioherms, 25
  bivalves, 224
  brachiopods, 4, 104, 105, 156
  bryozoans, 25, 78
  cephalopods, 233
  coelenterate, 102
  conodonts, 29, 30, 140, 141, 163, 168, 177, 263
  corals, 25, 53, 55, 261
  crinoids, 32, 34, 196, 197, 198, 199, 258, 284
  cystoid, 258
  faunal assemblages, Cretaceous, 235
  foraminifers, 34, 228, 274
  fossil assemblages, Ouachita geosyncline, 45
  fusulinids, bibliography, 228
  insect biotic provinces, 75
  mollusks, 295
  nautiloids, 51
  ostracodes, 18, 131, 155, 237
  pelecypods, 51
  scaphopods, 88
  sponges, Ordovician reefs, 49, 102
  trilobites, 177, 238, 295
  vertebrates, 23, 24, 93, 150

Palynology:
  East Manitou site, 250
  Missourian, Lower, Tulsa County, 249
Paleozoic provinces, 57
Pennsylvanian, Upper, marker, 176
Permian index palynomorph, 289

**Pennsylvanian:**
Altamont Formation, 15, 17
Atoka Formation, Atoka Series, 26, 45, 148, 153, 224, 237, 244, 261
Bandera Shale, 15, 17
"Bartlesville" sand, 151, 217
Berwyn Conglomerate, 79
biocerates, 75
Boggy Formation, 26, 171, 244, 281
BooJ deltaic sandstone, 35, 36, 204, 209
Buckhorn Limestone, 282
Cabaniss Formation, 171, 272
Checkerboard Limestone, 76
Cherokee Group, organic geochemistry, 12
coal beds, 84, 85
calification, 62
Coffeyville Formation, 76
connate waters, 222
codoncists, 141
crinoids, 196, 197, 199, 259
Deese Formation, 204, 215
Dewey Formation, corals, 53
Dornick Hills Group, 58, 131, 199
Elgin Sandstone, 267, 268
Endicott sandstone reservoirs, 35, 36
Gilcrease sand, crude oil studies, 227
Golf Course Formation, 168
Hartshorne Sandstone, deposition, 148, 244
Hogshooter Formation: corals, 53; stratigraphy, 76
Holdenville Formation, crinoids, 199
Hoxbar Group, palynomorph marker, 176
Inola Limestone, 144, 151, 171
Jackfork Group, dish structures, 153
Johns Valley Shale, 45, 72, 131, 244
Krebs Formation, clays, 272
Labette Shale, 15
Layton sandstone zone, 76
"Lost City" limestone, crinoids, 199
McAlester Formation, 26, 35, 36, 148, 204, 209, 244
Missourian, corals, 53
Morrowan: ammonoids, 168; bioherms, 25; brachiopod zones, 104, 105; corals, 261; crude oil studies, 26; high-wax crudes, 103; sandstones, 35, 36
Morrow Formation, algal facies, 135
"Morrow" sands, 63, 64, 171, 172, 222
Nowata Shale, 15
Oologah Limestone, 15, 16, 17, 218, 271
Oread Limestone, 36
Oswego Limestone, 151, 217
Pawhuska Formation, 244
Pawnee Formation, 15, 17
Pink lime, 151, 171
Savanna Formation, 244
Seminoles Formation, palynomorph marker, 176
Senora shales, 138
Skinner sand, 151, 280
Spiro sandstone, 45
subsurface water, Anadarko basin, 67
"Thirteen Finger lime," 171
Tonkawa sandstone, 36
Vamoosa Formation, 244, 267, 268
Vanoss Formation, 269
Verdigris Limestone, 151, 171
Wann Formation, crinoids, 196, 199
Wapanucka Limestone, 45, 131, 244
Wewoka Formation, scaphopod, 88

Permian:
amphibians, 23, 24
biomeres, 75
Blaine Formation, deposition, 51, 251
Claypool shales, 138
connate waters, 222
copper mineralization, Permian basin, 136; Doyle Shale, 1; Garrison Shale, 1;
Matfield Shale, 1
crinoids, 198
Dog Creek Formation, deposition, 51
Doyle Shale, copper mineralization, 1
Duncan Sandstone, 251
Eskridge Shale: origin of mudrocks, 225; rare-earth elements, 60
Flowerpot Formation, 68, 87, 118, 119, 125, 150, 250, 251, 289, 294
fossil fish, 250
Garber Formation, 250
Garrison Shale, copper mineralization, 1
Havensville Shale, rare-earth elements, 60
Hennessey Group, 250
karst topography, 179
Konawa Formation, 71
Leonard Series, copper shales, 214
Matfield Shale, copper mineralization, 1
Oscar Formation, 250
red-bed alteration over hydrocarbons, 69, 70, 71
reptiles, 23, 24
Rush Springs Sandstone, 71
salt, 165
subsurface water, Anadarko basin, 67
Vanoss Formation, 269
Wellington Formation, 247, 250
Wolfcampian, corals, 261
Wreford megacyclothem, 18, 156

PERMIAN BASIN:
copper mineralization, 136
rare-earth elements, 60; hydrocarbon province, 109
salt solution, 264
structure, 136
tectonics, 109, 136

PETROGRAPHY:
basement rocks, northeast Oklahoma, 212
Creta copper ore, 87
eclogites and granulites, 169
Elgin Sandstone, 267, 268
Gasconade Formation, 27
northeast Oklahoma, 212
Oologah Limestone, 15, 218, 271
Skinner sand zone, 280
PETROLEUM AND NATURAL GAS:
Anadarko basin: see Anadarko Basin; see also Petroleum and Natural Gas:
statistics
Apache field, 223
Britt trend, 167
Burbank field, 12, 111
Camrick field, 103
Cement field, 70, 71, 273
conservation, 188, 189, 190
crude oils, geochemistry, 26, 80
Cumberland field, 223
Cunningham trend, 167
Davenport field, 71
Delaware-Childers field, 149
exploration and development: Arbuckle traps, 212; Ardmore basin, 134; Arkoma basin, 133, 158, 293; computer data, 112, 223; delta prospecting, 35; digitized logs, 292; ERTS imagery, 54; fluvial and eolian sand, 124; general, 188, 189, 190, 293; Hunton fields, 159, 293; magneto-electretlicuric exploration, 206; Morrow-Springer trend, 63, 127, 160, 292, 293; Mustang field, 129, 151; new discoveries, 6; North Dibble field, 144; Osage Nation, 134; Palo Duro basin, 285; reflection seismograph, 120; seismic studies, 9, 223; Sholom Alechem field, 215; Sho-Vel-Tum area, 127, 293; Springer sand, 160, 167; stratigraphic traps, 36; surface evidence, 69, 70, 71; Tertiary oil, 149
fracture traps, 99
Glen pool, 273
Harper Ranch field, 171
Hawksins pool, 36
Healdton field, 273
Hewitt field, 273
high-wax crudes, 103
Hunton fields analysis, 266
Lovedale field, 171
Marietta SE field, 103
methane, Gilcrease sand, 227
Morrow-Springer trend, 63, 64, 127, 160
Mustang field, 129, 151
Newman field, 103
North Buffalo field, 171
North Dibble field, 144
Oklahoma City field, 273
Oklahoma Energy Advisory Council, 170, 188, 189, 190, 191, 192, 234
Osage Nation, 134
Permian-basin hydrocarbon province, 109
pollution, Lake Keystone, 91
Ponca City field, 103
pressure zones, 9, 172
producers, 234
producing formations, 8
Putnam field, 293
regulations, 234
relation of accumulations to ore deposits, 89
reservoir rocks: connate waters, 222; metamorphism, thermal gradients, 139; pressure patterns, 172, 217
Seminole area: crude oils, 26; McAlester sand, 36
Sholom Alechem field, 215
Sho-Vel-Tum area, 127, 293
Sooner Trend, 99
statistics: deep wells, 73, 157, 158, 219, 220, 293; demand, 128, 189, 192; drilling and leasing, 137, 203; economics, 73, 97, 113, 114, 127, 188, 189, 191, 203, 234, 290; exploration and development, 6, 7, 73, 97, 113, 128, 129, 134, 144, 157, 190, 191, 215, 216, 252, 255, 273, 293; general, 203, 277; natural gas liquids, 290; petroleum products, 128; production, 2, 8, 73, 77, 97, 113, 114, 128, 144, 188, 190, 191, 203, 216, 254, 255, 290; projections, 2, 97, 127, 188, 189, 190; recovery projects, 21, 114, 152; reserves, 2, 63, 97, 113, 114, 127, 128, 188, 190, 191, 216, 255, 273, 290; storage, 97; stripper wells, 114; transportation, 128; well data, 8
stratigraphic traps, 36, 171
Sycamore pool, 293
technology: COFCAW process, 56; digitized logs, 292; drilling, 149, 215, 219, 220, 221; drilling fluids, 161; exploration, 36, 63, 120, 206; hydraulic fracturing, 111; recovery methods, 21, 56; waterflooding, 111, 152
well-stimulation treatments, 14
Wewoka Lake pool, 36

PETROLOGY:
Cherokee Group underclays, 272
Desmoinesian rocks, northeast Oklahoma, 12
Elgin Sandstone, 267, 268
Flowerpot Formation, 150
Hartshorne Sandstone, 148
McLish Formation, carbonate porosity, 47
Oswego Limestone, 217
Pleistocene deposits, central plains, 22
Vanoss Formation, 269
"Wilcox" sand, 217
plate tectonics, Ouachita Mountains, 43, 94, 213
Pleistocene, central plains deposits, 22
Potato Hills, 208

PRECAMBRIAN:
Ouachita geosyncline, 154
paleotopography, northeast Oklahoma, 212
rift system, 213
Spavinaw Granite, 130, 147
Tishomingo Granite, 147

Proterozoic, Ouachita geosyncline, 154

REMOTE SENSING:
Anadarko basin, ERTS-1 imagery, 54
Dougherty anticline, aerial photography, 40
Mill Creek area, radar and infrared imagery, 39
south-central Oklahoma, radar and infrared imagery, 38
Wichita and Arbuckle Mountains, radar imagery, 42

reviews: Origin of Petroleum II, 80

SANDSTONES:
Booch delta sands, 35, 36, 204, 209
Burgen sands, grain orientation, 240
connate waters, 222
Deese Formation, petrography, 204
Elgin Sandstone, 267, 268
general, 204, 209
Hartshorne Sandstone, deposition, 148
interstitial waters in Paleozoic sands, 11
Layton sand, delta deposits, 76
Morrowan sand: deposition, 35, 36; pressure patterns, 172
Pennsylvanian, northeast Oklahoma, 244
reservoir bodies, 145, 222
Simpson sand, chemical composition, 204
Skinner sandstone zone, 280
South Canadian River, 124
terminology, 204, 209

SEDIMENTOLOGY:

- Anadarko basin, 35, 36
- Ardmore basin, 58
- Arkansas River, bed-load transport, 265
- Arkoma basin, 35, 36
- Atoka Formation, depositional sequences, 281
- bedded barite deposits, Ouachita Mountains, 13
- Blaine Formation, deposition, 51
- Boggy Formation, depositional sequences, 281
- Burgen Sandstone, grain orientation, 240
- Canadian River sediment, 239
- Cimarron River, 241, 243
copper-silver solution fronts, 247
delta deposits, 35, 36, 76, 145, 204, 209, 280
-diagenesis: Arbuckle Group, 229; Flowerpot Formation, 118, 119, 294; Gasconade Formation, 27; Vanoss Formation, 269
dish structures, Jackfork Group, 153
Dog Creek Formation, deposition, 51
Elgin Sandstone, 267, 268
Eskridge Shale, origin of mudrocks, 225
flysch deposits: Oologah Limestone banks, 17; Ouachita geosyncline, 45, 153, 205
ground deposition, Johns Valley Shale, 72
Hartshorne Sandstone deposition, 148, 244
Keel-Edgewood biofacies, 4
Lower Missourian, vertical profile, 249
McAlester Formation, 35, 36, 204, 209
Morrowan bioherms, 25
Morrowan sand deposition, 35, 36
Oologah Limestone banks, 15, 16, 17, 218, 271
Ordovician carbonate reefs, 49, 102
Ouachita geosyncline, 13, 45, 153, 154, 205
Pennsylvanian sandstones and carbonates, 244
Permian, East Manitou site, 250
Purgatoire Formation, lithofacies, 235
river deposits: Cimarron River, 241, 243; South Canadian River system, 124
sabkha process, copper-shale deposits, 214, 251
sandstone deposition, general, 204, 209

SILURIAN, SILURIDALEVONIAN:

- Blaylock Formation, folds, 81, 82
- brachiopods, 4
- Henryhouse Formation, 4
- Hunton Group, 151
- palynomorph provinces, 57
- Sylvan Shale, 4, 151
-soils: Craig County, 184; mineral concentrations, 236

South Canadian River, 124, 239

STRATIGRAPHY:

- Ardmore-Sherman quadrangles, 100
- Arkoma basin, 45
- Buckhorn Limestone, 282
- Chester Series, 232
colb beds, Ozarks Region, 84
- Coffeyville Formation, 76
- Desmoinesian, northeast Oklahoma, 12
- Dornick Hills Group, 58
Flowerpot Formation, 118, 119
Hogshooter Formation, 76
Keel-Edgewood strata, 4
Mississippian, northwest Oklahoma, 171
Mustang pool area, 151
Oologah Limestone banks, 15, 16
Ordovician, Middle, 238, 260
Panhandle, Permian to Tertiary, 181
Pennsylvanian: northeast Oklahoma, 244; northwest Oklahoma, 171
Pleistocene deposits, central plains, 22
Sholom Alechem area, 215
Simpson Group, 78, 260
Vamoosa Formation, 267, 268

**Structural Geology:**
- Anadarko basin, 28, 35, 36, 219, 220
- Arbuckle Mountains, 28, 40, 58, 108
- Ardmore basin, metamorphism, 28, 139
- Arkoma basin, 35, 36, 62, 84, 117
- Cimarron uplift, 242
- coal fields, eastern Oklahoma, 84, 117
differential compaction structures, 171
Mississippian, northwest Oklahoma, 36
Morrowan sandstones, 36
Mustang field, 129, 151
Ouachita Mountains, Ouachita fold-belt, Ouachita geosyncline, 43, 44, 45, 65, 81, 82, 94, 101, 108, 109, 153, 154, 182, 208
Ozark dome, 62
Paleozoic faulting, 28
Panhandle, 181
Permian basin, 109, 136
Potato Hills, 208
Sholom Alechem area, 215
Sooner trend, fractures, 99
Spavinaw arch, 130

**Tectonics:**
- Anadarko basin, 28
- Arbuckle Mountains, 28, 58, 108, 229
- Ardmore basin, 28
- convection cells, 108
eometamorphism, effect on hydrocarbons, 139
- Ouachita Mountains, 28, 43, 44, 65, 81, 82, 94, 101, 108, 109, 154, 182, 208
Paleozoic orogeny, 28
Permian basin, 109, 136
plate tectonics, 43, 94, 213
Precambrian rift system, 213
relation to stress fields, 121
Sholom Alechem anticline, 215
Tertiary: Ogallala Formation, aquifer, 48, 66; petroleum, 149
topographic mapping, survey of Oklahoma coverage, 95
Tri-State area: barite-lead-zinc deposits, mineralization, 143; origin of ores, 106; relation of ore deposits to petroleum accumulations, 89
uranium-lead age dating, 147
Washita River: alluvial water geochemistry, 123; bank stability, 90; dam seepage, 296; permeability studies, 183
Wichita Mountains: grooved granites, 98; radar imagery, 42; source of Permian sediments, 250
Wreford megacyclothem, 18, 156

121
EAGLE-PICHER CLOSES CRETA COPPER MINE AND MILL

Eagle-Picher Industries, Inc., has shut down the open-pit copper mine it had operated at Creta in southwestern Oklahoma since 1965. The mine, located about 15 miles southwest of Altus in Jackson County, produced about 200,000 tons of ore annually. The ore is a chalcocite-bearing shale of Permian age that is about 7 inches thick, and the copper content averages about 2.3 percent.

The mine closing, according to company officials, resulted from lower copper prices and higher production costs. After reaching a record domestic price of about 87 cents a pound for electrolytic copper in June, July, and August 1974, the price of copper fell to about 63 cents a pound in March and April of 1975. The price reduction resulted from a copper surplus caused by the construction slump that began early in 1974 and accelerated during the second half of the year.

Rising production costs were standard for the mining industry during 1974-75; expenses for labor, materials, and mining operations were all higher at Creta. In addition, increased costs for smelting the copper concentrate in El Paso reduced the return to Eagle-Picher. Higher wages, more expensive materials, and the addition of pollution-control devices to minimize adverse environmental effects from the smelting of copper-sulfide ores combined to increase smelter costs.

Mining at Creta ceased February 23, and the 1,000-ton-per-day mill closed March 28. The future of the mine is undecided, but, inasmuch as there are still reserves on the property, it is possible for the mine to reopen if the demand for copper and the price of copper both increase.

—Kenneth S. Johnson

1975 Petroleum Encyclopedia Available

A publication date of July 1 has been announced for *International Petroleum Encyclopedia 1975*. The Petroleum Publishing Company, which also publishes the *Oil and Gas Journal*, bills their encyclopedia as the "oilman's total reference book" and affirms that it contains "more information . . . than any other single volume on petroleum."

In addition to updating information in last year's volume, the new edition features a rundown on the world's geothermal areas; a special section on the technology, pipeline facilities, new discoveries, and production potential of the North Sea area; a report on the outlook for synthetic natural gas; and new maps of the Gulf Coast of the United States.

Individual copies of the encyclopedia sell for $37.50; orders should be addressed to The Petroleum Publishing Company, P.O. Box 1260, Tulsa, Oklahoma 74101.
Colorado Headquarters Set for OU Energy-Fuels Course

Switchback road leading to oil shales in cliff face, Piceance basin, near Rifle, Colorado.

For the third straight summer, Kenneth S. Johnson, economic and environmental geologist with the Oklahoma Geological Survey, will direct the Energy Fuels Field Course and Workshop sponsored by The University of Oklahoma School of Petroleum and Geological Engineering.

The 3-week course—actually three 1-week courses—will be held July 28-August 15. It is designed to explore the geologic setting and the energy-fuel resources of the Piceance basin, the Uinta basin, and the Uravan mineral belt—all on the north side of the Colorado Plateau and the western slope of the Rockies. Oil shales, nuclear fuels, nuclear stimulation, coal, petroleum, and asphalt will be major topics. Informal discussion and instruction by engineers and scientists actively engaged in energy production by current and experimental methods are invaluable aspects of the program.

Although enrollment is offered on the basis of 1, 2, or 3 weeks, last year 15 of the 17 participants attended the entire course sequence, and the others signed up for 2 weeks. The group taking the course consisted of 6 faculty members from other colleges and universities, 5 geology graduate students, 2 geography students, 1 physics major, and 3 engineering students. Academic credit is assigned at the rate of 1 credit hour per week of instruction.

Headquarters for the class will be in Grand Junction, Colorado, but participants will camp out four nights on the Colorado Plateau and in the Rocky Mountains. Scenic areas surrounding the Colorado, Dinosaur, Black Canyon of the Gunnison, and Arches National Monuments will be high points of the field excursions.

For additional information concerning the course, please contact Dr. Johnson at the Oklahoma Geological Survey, The University of Oklahoma, Norman, Oklahoma 73069 (phone 405/325-6541 or 325-3031).
Survey Director Appointed to NRC Panel

Charles J. Mankin, director of the Oklahoma Geological Survey and The University of Oklahoma School of Geology and Geophysics, was recently named to the National Research Council (NRC) Panel on Gas Reserve Estimates.

The panel was established as a result of a request made to the National Academy of Sciences (NAS) by the Secretary of the Interior. The Secretary asked for an evaluation of the techniques and procedures used by the Federal Power Commission, in cooperation with the U.S. Geological Survey, in preparing a report on gas reserves in shut-in leases on the outer continental shelf. The NRC, which is the research arm of the NAS, turned to one of its member boards, the Board on Mineral Resources, for assistance, and the creation of an 8-member panel (under the direction of Dr. Charles L. Drake of Dartmouth College) ensued.

The Panel on Gas Reserve Estimates has already met twice, once in Dallas and once in New Orleans, and a second meeting is scheduled for New Orleans in July. That city was chosen because of the accessibility of data on shut-in leases. The group will restrict itself to data available to the Federal Power Commission staff in early 1974 when the agency made its study. The report issued by the FPC was severely criticized by some individuals, including several congressmen, for being biased toward the oil industry. Determining the validity of the charge will be the underlying task of the investigative panel.

Dr. Mankin is president of the Association of American State Geologists, and he served as co-chairman last year of the Crude Oil Committee for the Oklahoma Energy Advisory Council.

Robin Vaught Receives BEST Award

The National Association of Geology Teachers has selected Robin Eugene Vaught, a teacher at Broken Bow High School, for the BEST—Best Earth-Science Teacher in Oklahoma—Award.

The award is presented each year to reward excellence in earth-science teaching. John Naff, OSU professor of geology and chairman of the selection committee for the BEST Award, reports that approximately 30 teachers were nominated for the honor by their colleagues and their principals.

Mr. Vaught has been teaching for 15 years. He received his B.S. degree in education from Southeastern State College, Durant, Oklahoma; he was a
2-year participant in an NSF (National Science Foundation) earth-science institute at Oklahoma State University from 1970 to 1971; and he completed requirements for an M.S. degree from OSU in July 1973. He is a member of the Oklahoma Education Association, the Southwestern Naturalists Association, the American Society of Mammalogists, the Broken Bow Jaycees, and the McCurtain County Education Association. In 1969, he was named the Oklahoma Jaycees’ Outstanding Young Educator.

Our compliments to Mr. Vaught for his fine work; we extend our congratulations to him on receipt of this recognition.

OKLAHOMA ABSTRACTS

AAPG-SEPM Annual Meetings
Dallas, Texas, April 7-9, 1975

The following abstracts are reprinted from The American Association of Petroleum Geologists and Society of Economic Paleontologists and Mineralogists Annual Meetings Abstracts, v. 2, April 1975. Page numbers are given in brackets below each abstract. Permission of the authors and of Gary Howell, AAPG managing editor, to reproduce the abstracts is gratefully acknowledged.

Rock Type Discrimination Using Radar Imagery

P. JAN CANNON, Bureau of Economic Geology, The University of Texas at Austin, Austin, Texas

Geologic mapping from radar imagery of the Wichita and Arbuckle Mountains of southern Oklahoma indicates that in areas of sparse to moderate vegetation, certain rock types can be readily discriminated on the radar imagery. They can be distinguished because the returns of radar energy from rock outcrops are strongly influenced by the geometry of the rock surfaces. The angular configuration exhibited by the outcrop is the most important factor in returning the propagated radar energy to an air-
borne receiver. The outcrop geometry can vary greatly between rock types due to the differences in grain size, rates of weathering, and structure. The scale of the outcrop geometry in relation to the wavelength of the propagated radar energy is also an influencing factor of importance. [8-9]

Middle Pennsylvanian (Strawn Group) Depositional Systems, North-Central Texas

ARTHUR W. CLEAVES, Department of Geology, Wayne State University, Detroit, Michigan

Fluvial and deltaic facies comprising the Strawn Group were deposited within the Fort Worth Foreland Basin and on the adjacent Concho Platform. Variations in the rates of subsidence within the adjacent basins led to development of unique sandstone geometry, facies distribution patterns and sandstone thickness.

Nine cycles of delta progradation and abandonment were delineated; 5,000 wells provided the principal source of data. Both high-constructive elongate and lobate deltaic facies have been recognized. Principal source areas include the Arbuckle Mountains of Oklahoma and the Ouachita Fold-belt of Texas.

When subsidence decreased within the Fort Worth Basin, deltas of the Strawn Group prograded across the foreland basin and onto the slowly subsiding Concho Platform. Deltaic facies deposited on the platform comprise thin (less than 200 feet thick), elongate, multilateral lobate delta systems. A typical vertical sequence of facies includes (upward) prodelta mudstone, delta front sheet sandstone, channel-mouth bar sandstone, distributary channel-fill sandstone and delta plain mudstone. Initial deltas prograded to the western edge of the Concho Platform; the Midland Basin to the west was poorly defined and no shelf-edge or slope facies of Middle Pennsylvanian age have been recognized.

High-constructive elongate delta systems (greater than 200 feet thick) were deposited in the northwestern end of the Fort Worth Basin during periods of active subsidence. These thicker deltas are characterized by linear, multistory sandstone bodies resembling barfinger sands of the Holocene Mississippi Delta. Incised, valley-fill fluvial deposits commonly overlie the high-constructive deltaic facies. [11-12]

Seismic Stratigraphic Model of Depositional Platform Margin, Eastern Anadarko Basin

W. E. GALLOWAY, M. S. YANCEY, and A. P. WHIPPLE, Continental Oil Company, Ponca City, Oklahoma

Three-dimensional stratigraphic analysis of cratonic basin margins has, in recent years, demonstrated complex interrelationships between shelf, shelf edge, and basinal facies. Application of seismic stratigraphic modeling has proved useful in analyzing the geometry of a cratonic platform margin in the Hoxbar Group (Missourian) of the eastern Anadarko Basin.
Seismic modeling requires four principal steps: (1) Tabulation of petrophysical parameters of the lithologies included in the model; (2) Construction of a series of model stratigraphic sequences along a line of section; (3) Generation of synthetic seismograms for each model sequence; (4) Comparison of the synthetic traces with corresponding field traces. Results of such a model study, combined with subsurface geologic data, suggest the following interpretation of Hoxbar platform evolution.

A progradational deltaic platform extended westward into the basin, producing an initial relief of approximately 500 feet (Phase I). Abandonment of the delta resulted in compactional subsidence and deposition of shallow water carbonates along the platform margin (Phase II). Contemporaneous with carbonate deposition on the platform, terrigenous clastic sediment accumulated on the basin floor as a submarine fan complex. Renewed influx of terrigenous sediment produced a second cycle of deltaic progradation, which extended across the carbonate shelf as a rapidly deposited, thin clastic veneer and constructed a thick progradational wedge basinward of the subjacent platform edge (Phase III). This younger progradational wedge is capped by distributary channel and delta margin sands of a fluvial-dominated, lobate delta system.

Ammonoids of the Upper Wapanucka Limestone and Their Bearing on the Morrowan-Atokan Boundary in Oklahoma


Ammonoids from the upper part of the Wapanucka Limestone are latest Morrowan in age. A small collection of these fossils was made by Sutherland from a roadcut on the Indian Nations Turnpike, 13.4 miles northwest of Daisey, Oklahoma, in the frontal Ouachita Mountains. The ammonoids include *Gastrioceras* sp., *Diabloceras neumiei* Quinn and Carr, *Christioceras?* sp., *Proshumardites morrowanus* Gordon, and *Stenopronororites arkansensis* (Smith), as identified by Gordon. These are typical of the *Diabloceras neumiei* Zone, which, in the type Morrowan section of northwest Arkansas, is found in the upper part of the Trace Creek Member of the Floyd Shale and is the highest Morrowan ammonoid zone.

Data from collections of the U.S. Geological Survey indicate that the underlying *Axinolobus modulus* Zone of middle Floyd age is represented in the middle part of the Wapanucka Limestone and the *Branneroceras brannt* Zone of early Floyd (Brentwood) age probably has equivalents in the lower part of the formation. Two species of *Gastrioceras* of Brentwood age are also fairly common in the upper few hundred feet of the underlying Springer Shale of the frontal belt.

This evidence indicates a lateral equivalence of the Wapanucka Limestone with most of the Floyd Shale, excluding only the lower part of the Brentwood Limestone Member. It would preclude the correlation of any part of the Wapanucka with the Atoka Formation, or any part of the Atoka, including the Barnett Hill Formation and its zone of *Profusulinella*, with the type Morrowan.
Evaporites from the Sea? A Western Kansas Permian Enigma

KATRINE A. HOLDOWAY, University of Kansas, Lawrence, Kansas

An unusual red-bed evaporite sequence of the Nippewalla Group, upper Leonardian, Permian, in Wichita County, Kansas, was cored for the Atomic Energy Commission in 1972. The core is 170 meters long, and extends upwards from the Harper and Salt Plains Siltstones, through the Cedar Hills Sandstone, Flowerpot Shale and the Blaine Formation. In the core, the Harper and Salt Plains Siltstones and the Cedar Hills Sandstone are typical red-bed deposits, frequently cemented by halite. Overlying the Cedar Hills, the sediments corresponding to the Flowerpot Shale and the Blaine Formation are composed of fine to coarsely crystalline halite crystals, which are intimately associated with varying amounts of red, silty mudstone.

The bromine concentration of the halite is very low throughout the section, frequently being less than 5 ppm. The textural and stratigraphic relationships of the sediments suggest that this is not the result of widespread post-depositional recrystallization.

The low bromine concentration of the halite, minor amount of carbonate in the sequence, and the intimate association of evaporites with red-beds suggest that the deposition of these sediments took place in a continental basin, which was subject to occasional flooding by the sea.

[36]

Stratigraphy of the Permian Blaine Formation and Associated Strata in North-Central Texas


A Permian red bed-evaporite sequence, consisting of (ascending order) the San Angelo, Flowerpot, Blaine, and Dog Creek Formations, comprises 600 to 700 feet of strata cropping out on the northeast shelf of the Permian basin. The three uppermost formations were previously called the "Blaine of Texas," but they can be subdivided now on the basis of cores and detailed field work. The proposed subdivisions are consistent with nomenclature and stratigraphic concepts used for these same formations northward for 300 miles along their outcrops into Oklahoma and Kansas.

A complete cycle of evaporite deposition in the region includes (ascending) dolomite, gypsum/anhydrite, salt (halite), red-brown shale, and gray shale. Individual beds in each cycle are typically 3-20 feet thick. The main part of the evaporite sequence contains 15 to 20 complete or partial cycles.

Strata dip gently to the southwest into the basin, but outcropping units are collapsed and disturbed where soluble evaporite layers have been dissolved by ground water. Gypsum layers have been removed at a number of places at and near the outcrop, and salt layers have been dissolved where they are within 500 to 800 feet of the present surface: these solution and collapse features locally obscure the stratigraphic and structural relations.

[39-40]
Evidence for and Use of the Model of a Hot Deep Origin of Petroleum in Exploration

L. C. PRICE, U.S. Geological Survey, Geologic Division, Office of Energy Resources, Branch of Oil and Gas Resources, Denver Federal Center, Bldg. 25, Rm. 2403, Denver Colorado

The model of a hot deep origin of petroleum places rigid constraints on the migration and entrapment of crude oil. Specifically, oil escaping from depth must migrate vertically along faults and be emplaced in suitable traps at shallower horizons. This model predicts that petroleum accumulations are situated in traps adjacent to and updip from faults extending into the basin deep. The model also predicts several new exploration plays, the major one being stratigraphic trapping updip from major faults. Empirical evidence from petroleum basins worldwide is consistent with such a model.

The basin structural style governs the distribution, types, and amounts of hydrocarbons expected and thus the exploration strategy. For example, production from Tertiary depocenters (U.S. Gulf Coast, Niger Delta) is from structures associated with major growth faults, and structures not associated with such faulting are barren. Production in block-faulted basins is from horst blocks next to deep troughs (Central Basin Platform of West Texas and the Sirte basin, Libya). Major accumulations are also found in traps adjacent to basin-margin upthrusts (Southern Oklahoma and some Laramide basins of the Rocky Mountains). In highly structured basins (Los Angeles and Ventura) the main oil occurrences can be specifically predicted by analysis of both the fault systems and possible hydrocarbon migration routes. This model also applies to prospecting on the stable shelf (Western Canada and Anadarko Shelf). There hydrocarbons from the deep basin undergo long lateral migration and are emplaced in a generally predictable manner in laterally continuous reservoirs and are not charged into isolated reservoirs from a local source. [60-61]

The Significance of Light Mineral Fractions in Sandstone Provenance Studies

JOHN B. THOMAS, Department of Geology, College of William and Mary, Williamsburg, Virginia

It is common for much emphasis to be placed on the suite of heavy minerals when studying sandstone provenance. Less value is placed on clay mineral and light mineral fractions of the same rock. A detailed study of the Permo-Pennsylvanian Vanoss Formation in south-central Oklahoma was undertaken to test the validity of this generalization and to map its mineralogic dispersal patterns.

Since the source rocks for the Vanoss are exposed in the Arbuckle Mountains, it is possible to compare directly source rock mineralogy to that of the Vanoss Formation. Without knowledge of the two principal sources; (1) the pre-Vanoss Paleozoic sedimentary rocks and (2) the Precambrian “core” granites of the Arbuckles, interpretations as to the nature of the source rocks would have been incorrect.
Dominant in the non-opaque heavy minerals are zircon, tourmaline, rutile and garnet. These minerals are found in both known source rock complexes, but their presence in the Vanoss implies either a sedimentary, metamorphic or mixed sedimentary-metamorphic source. Intrastratal solution has removed most of the heavies which would have been diagnostic of the igneous source.

Diagenesis has obscured the original clay mineralogy of the Vanoss, too. Only in more argillaceous portions of the Formation has kaolinitization not completely destroyed the original clay suite.

The light mineral fraction is zoned into carbonate-chert rock fragment material in westernmost outcrops of the Vanoss, a mixed carbonate-silicate clastic phase in the middle and a quartz-feldspar granite rock fragment suite along the eastern outcrop margins. According to Slemons (1962) the high ratios of albite-to-Carlsbad-twinned plagioclase is a good metamorphic indicator. High ratios in the Vanoss, however, are found to be due to disintegration of the coarser, simple Carlsbad twins during transport from the granitic source.

It is concluded, therefore, that the mineralogy of the light mineral fraction should be carefully considered in future provenance studies of sandstones, especially when comparison to the original source rocks is impossible.

Geotectonic Evolution of Fort Worth Basin

JACK L. WALPER, Texas Christian University, Fort Worth, Texas

The Fort Worth basin had its origin in the culminating Ouachita orogeny which formed as the result of a sequence of Paleozoic tectonic events and associated sedimentation. A Precambrian continent, composed of what is now North and South America and Africa, rifted forming a proto-Atlantic Ocean. Thermal doming associated with this rifting produced the Wichita and Delaware aulacogens of Oklahoma and West Texas respectively. Epeiric seas transgressed the retreating and subsiding plate margin flooding into the aulacogens, as they subsided more rapidly, to deposit the thick carbonates of Cambro-Ordovician age in Texas and Oklahoma. Subsequent closing of the proto-Atlantic began with subduction along the North American margin of this sea, forming volcanic arcs that supplied clastic detritus for the "Ouachita facies" of the early Paleozoic. It is suggested that, as the Afro-South American plate collided with the volcanic arcs, an orogenic welt grew and was thrust toward the craton. This orogenic welt and back-arc thrust belt supplied the early synorogenic deposits of the Stanley-Jackfork sequence and its correlatives. As plate collision continued the orogen grew and was thrust cratonward, particularly where it encountered the weaker, aulacogen zones, composed of a thick, incompetent sedimentary prism. Broad dilation arcs of thrust faults and folds comprising the Ouachita and Marathon salients formed in these areas. In areas where the craton was rigid and stable, as was the Texas craton, the advancing plate impinged against this buttress forming pericratonic basins such as the Kerr and Fort Worth. Here the early-formed synorogenic sequence or flysch was crushed and thrust against the cratonic margin which subsided along a
series of migrating hinge lines, under the onslaught of the advancing tectonic belt to allow for the deposition of a postorogenic or molasse sequence represented by the Atoka and Strawn Series.

GSA ANNUAL MEETING, NORTH-CENTRAL SECTION
WATERLOO, ONTARIO, MAY 15-17, 1975

The following abstract is reprinted from the Abstracts with Programs of The Geological Society of America, v. 7, no. 6. The page number is given in brackets below the abstract. Permission of the authors and of Mrs. Jo Fogelberg, managing editor of GSA, to reproduce the abstract is gratefully acknowledged.

Exceptional Radiolaria and Associated Conodonts from the Sycamore Limestone, Arbuckle Mountains, Oklahoma

ALLEN R. ORMISTON and H. RICHARD LANE, Research Center, Amoco Production Company, P.O. Box 591, Tulsa, Oklahoma

An abundant (40,000 specimens) and diverse (D=0.8) fauna of exceptionally preserved Radiolaria has been recovered together with conodonts from a burrowed lime mudstone near the base of the Sycamore Limestone. Ten spumellarine and three alfaiellarine genera are present. Some of these have European Lower Carboniferous occurrences; others are new. The Sycamore Radiolaria supply data on structure and variability conducive to a more rational taxonomy of Paleozoic Radiolaria.

This Sycamore radiolarian fauna is associated at its lowest occurrence with Gnathodus punctatus Zone conodonts assignable to the Siphonodella biofacies of Duce (1973) and 35 feet higher with a younger Osage, gnathodid-dominated fauna. The equivalent interval in the Lawrence Uplift (pre-Welden Shale, Welden Limestone, and, possibly, part of the post-Welden Shale) contains abundant conodont faunas with more varied platform elements but no Radiolaria.

The presence of a low-diversity, gnathodid-dominated conodont fauna, seemingly analogous with gnathodid-rich Permian faunas regarded as shallow water by Clark (1974), seems incongruous in a radiolarian-rich lime mudstone which is extensively burrowed by Scalarituba and Zoophycos, devoid of shelled benthos, and has other biotic and sedimentary attributes incompatible with a shallow setting. Although the common equation of abundant Radiolaria and deep water settings is questionable in light of Casey’s (1971) studies of modern radiolarian distributions, the radiolarian horizons in the Sycamore seem at least to qualify as intermediate-depth deposits. The Sycamore example may be a warning against facile analogies of conodont environmental requirements through time.

[832]
AAPG Researches Oil Probability

The Kansas Geological Survey and Stanford University are sponsoring a conference that will survey the application of probability methods to oil exploration. The American Association of Petroleum Geologists Computer Application Committee is assisting with arrangements for the August 2-22 meeting, which has been set up as an AAPG Research Conference, and Stanford University, Stanford, California, will be the site.

Topics for discussion include statistical forecasting of the volume of undiscovered oil and gas in sedimentary basins; the use of statistical methods for the combined analysis of structural, stratigraphic, geophysical, and production data; statistical relationships between oil-field size and sequence of discoveries; estimating numerical probabilities of favorable results for specific oil plays and prospects before drilling; the state of the art in computer mapping and analysis; the use of computer well-data systems in subsurface mapping; and the statistical assessment of the reliability of exploration maps.

John C. Davis, Geologic Research Section, Kansas Geological Survey, and John W. Harbaugh, Professor of Applied Earth Sciences, Stanford University, are the conference conveners. For additional information, please contact Dr. Harbaugh, Department of Applied Earth Sciences, Stanford University, Stanford, California 94305.

OKLAHOMA GEOLOGY NOTES

Volume 35 June 1975 Number 3

Bibliography and Index of Oklahoma Geology, 1974

ELIZABETH A. HAM and WILLIAM D. ROSE............................. 83
Tombstone Topography in Arbuckle Group, Wichita Mountains ........ 82
Eagle Picher Closes Creta Copper Mine and Mill .................. 122
1975 Petroleum Encyclopedia Available ............................. 122
Colorado Headquarters Set for OU Energy-Fuels Course ............ 123
Survey Director Appointed to NRC Panel .......................... 124
Robin Vaught Receives BEST Award ................................. 124
Oklahoma Abstracts .................................................. 125
AAPG-SEPM Annual Meetings ........................................ 125
GSA Annual Meeting, North-Central Section ....................... 131
AAPG Researches Oil Probability ................................. 132

132