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Cover Picture

Alteration Zones in Volcanic Glass

This scanning-electron photomicrograph illustrates, near the center, a volcanic-ash fragment or glass shard in cross section (×2, 470). The end of another shard is visible at the upper right. This specimen is from a volcanic-ash deposit in the Ogallala Formation (Tertiary) of southern Ellis County, Oklahoma.

Two distinct alteration zones are present on either side of the shard, the dark, central portion of which is unaltered. These alteration zones represent intermediate stages in the argillation of the glass to montmorillonite, which forms on the outer surfaces. The curved lower portion of the shard is a bubble hole.

Chemical analyses by energy-dispersive X-rays of the unaltered center and of the alteration zones on the right side reveal that the ratios of Si, Na, and K to Al decrease from the center to the outer edge, whereas the ratios of Fe, Mg, and Ca to Al increase.

This alteration of volcanic glass is attributed to hydrolysis by ground water.

—*David M. Patrick*

(Photomicrograph by Connie A. Heiden)

Bibliography and Index of Oklahoma Geology 1971[1]

Prepared by John V. Hogan, Jr., and William D. Rose

Bibliography

1. Adler, F. J., 1971, Anadarko basin and central Oklahoma area, *part of* Adler, F. J. (regional leader), Future petroleum provinces of the Mid-Continent, Region 7, *in* Cram, I. H. (ed.), Future petroleum provinces of the United States—their geology and potential: Am. Assoc. Petroleum Geologists Mem. 15, v. 2, p. 1061-1070, 1 fig., 1 table.
2. Adler, F. J. (regional leader), 1971, Future petroleum provinces of the Mid-Continent, Region 7, *in* Cram, I. H. (ed.), Future petroleum provinces of the United States—their geology and potential: Am. Assoc. Petroleum Geologists Mem. 15, v. 2, p. 985-1043, 31 figs., 13 tables. (Includes Oklahoma.)
3. Amsden, T. W., 1971, *Triplesia alata* Ulrich and Cooper, *in* Dutro, J. T., Jr. (ed.), Paleozoic perspectives; a paleontological tribute to G. Arthur Cooper: Smithsonian Contr. Paleobiology, no. 3, p. 143-154, 9 figs., 2 pls. (Includes Oklahoma specimens.)
4. Amsden, T. W., 1971, Late Ordovician-early Silurian brachiopods from the central United States: Colloque ordovicien-silurien, Bur. Recherches Géol. et Minières Bull. 73, p. 19-25, 2 figs., 2 pls. (Includes Oklahoma species.)
5. Amsden, T. W., and Rowland, T. L., 1971, Silurian and Lower Devonian (Hunton) oil- and gas-producing formations [in Oklahoma]: Am. Assoc. Petroleum Geologists Bull., v. 55, p. 104-109, 3 figs., 1 table.
6. Arndt, R. H., 1971, The mineral industry of Oklahoma in 1970 (preliminary): Oklahoma Geology Notes, v. 31, p. 11-12, 1 table.
7. Ash, R. G., 1971, "Boom" describes Anadarko activity: Oil and Gas Jour., v. 69, no. 12 (March 22), p. 166, 169-170, 173-174 (incl. ads), 7 figs., 3 photos.
8. Atkins, R. L., 1971, Oklahoma oil and gas development 1970, *in* Exploration, *part 1 of* International oil and gas development: Internat. Oil Scouts Assoc., v. 41, pt. 1, p. 204-218.

Aud, B. W., *see* Louden, L. R., Matthews, W. R., McClendon, R. T., Rehm, W. A., and Aud, B. W.

[1]Includes some 1970 listings.

9. Ball, S. M., 1971, Westphalia Limestone of the northern Midcontinent: a possible ancient storm deposit: Jour. Sed. Petrology, v. 41, p. 217-232, 11 figs. (Includes northern Oklahoma.)

Bates, R. G., *see* Cohee, G. V., Bates, R. G., and Wright, W. B.

Bennett, J. H., *see* Collins, A. G., Bennett, J. H., and Manuel, O. K.

10. Bickford, M. E., Mose, D. G., Wetherill, G. W., and Franks, P. C., 1971, Rb-Sr isotopic studies, *part 1 of* Metamorphism of Precambrian granitic xenoliths in a mica peridotite at Rose Dome, Woodson County, Kansas: Geol. Soc. America Bull., v. 82, p. 2863-2868, 6 figs., 1 table (appendix). (Relation with northeastern Oklahoma.)

Bickford, M. E., *see* Franks, P. C., Bickford, M. E., and Wagner, H. C.

Bingham, R. H., *see* Marcher, M. V., and Bingham, R. H.

11. Bleakley, W. B., 1971, Cities Service solves urban-area waterflood problems: Oil and Gas Jour., v. 69, no. 41 (Oct. 11), p. 72-74, 5 figs. (Oklahoma City area.)

12. Boardman, R. S., 1971, Mode of growth and functional morphology of autozooids in some Recent and Paleozoic tubular Bryozoa: Smithsonian Contr. Paleobiology, no. 8, 51 p., 6 figs., 11 pls. (Includes Oklahoma specimens.)

13. Breeze, A. F., 1971, Abnormal-subnormal pressure relationships in the Morrow sands of northwestern Oklahoma: Shale Shaker, v. 21, p. 172-193, 11 figs., 1 table.

Brett, G. W., *see* Weld, B. A., Griffin, M. S., and Brett, G. W.

14. Bryant, D. G., 1971, Exploration in Oklahoma and Panhandle of Texas in 1970: Am. Assoc. Petroleum Geologists Bull., v. 55, p. 1043-1047, 1 fig., 4 tables.

Buchanan, R. S., *see* Lumsden, D. N., Pittman, E. D., and Buchanan, R. S.

15. Bucke, D. P., and Mankin, C. J., 1971, Clay-mineral diagenesis within interlaminated shales and sandstones: Jour. Sed. Petrology, v. 41, p. 971-981, 5 figs., 1 table.

16. Busch, D. A., 1971, Genetic units in delta prospecting: Am. Assoc. Petroleum Geologists Bull., v. 55, p. 1137-1154, 24 figs., 1 table. (Examples from Oklahoma.)

Cannon, P. J., *see* Rowan, L. C., Offield, T. W., Watson, Kenneth, Cannon, P. J., and Watson, R. D.

Caplan, W. M., *see* Schramm, M. W., Jr., and Caplan, W. M.

Caudle, B. H., *see* Robertson, R. W., and Caudle, B. H.

17. Chamberlain, C. K., 1971, Bathymetry and paleoecology of Ouachita geosyncline of southeastern Oklahoma as determined from trace fossils: Am. Assoc. Petroleum Geologists Bull., v. 55, p. 34-50, 8 figs., 2 tables.

18. Chamberlain, C. K., 1971, Morphology and ethology of trace fossils from the Ouachita Mountains, southeast Oklahoma: Jour. Paleontology, v. 45, p. 212-246, 8 figs., 4 pls.

19. Chamberlain, C. K., 1971, "By-the-wind-sailor" (Velellidae) from the Pennsylvanian flysch of Oklahoma: Jour. Paleontology, v. 45, p. 724-728, 3 figs., 1 pl.
20. Cline, L. M., 1970, Sedimentary features of late Paleozoic flysch, Ouachita Mountains, Oklahoma, *in* Lajoie, J. (ed.), Flysch sedimentology in North America: Geol. Assoc. Canada Spec. Paper 7, p. 85-101, 3 figs., 3 pls., 2 tables.
21. Cocke, J. M., 1971, Distribution of dissepimental corals in Pennsylvanian Missourian rocks of northeastern Oklahoma: Oklahoma Geology Notes, v. 31, p. 127-135, 3 figs.
22. Cohee, G. V., Bates, R. G., and Wright, W. B., 1971, Changes in stratigraphic nomenclature by the U.S. Geological Survey, 1970: U.S. Geol. Survey Bull. 1354-A, 38 p. (New Oklahoma listings.)
23. Collins, A. G., Bennett, J. H., and Manuel, O. K., 1971, Iodine and algae in sedimentary rocks associated with iodine-rich brines: Geol. Soc. America Bull., v. 82, p. 2607-2610, 2 figs., 2 tables. (Analyses of western Oklahoma samples.)
24. Colvin, W. B., 1971, Loffland rig may set world drilling record, *part 1 of* Unusual rigs aim for record depths: World Oil, v. 172, no. 1 (Jan.), p. 51-54, 2 figs., 1 table. (Anadarko basin deep test.)
25. Cook, K. L., Hoskinson, A. J., and Shelton, G. R., 1971, Principal facts for a gravity survey made in northeastern Oklahoma and southeastern Kansas during 1948: U.S. Geol. Survey PB2-03960, 24 p. [available from Natl. Tech. Inf. Service].
26. Cram, I. H., 1971, Future petroleum provinces of the United States—their geology and potential: summary, *in* Cram, I. H. (ed.), Future petroleum provinces of the United States —their geology and potential: Am. Assoc. Petroleum Geologists Mem. 15, v. 1, p. 1-54, 11 figs., 6 tables. (Includes Oklahoma.)
27. DeGeer, M. W., 1971 [1972], Natural chloride pollution, Arkansas and Red River basins, *in* Rose, W. D. (ed.), Environmental aspects of geology and engineering in Oklahoma: Oklahoma Geol. Survey, Oklahoma Acad. Sci. Annals no. 2, p. 42-46.

Dott, R. H., Sr., *see* Halbouty, M. T., Meyerhoff, A. A., King, R. E., Dott, R. H., Sr., Klemme, H. D., and Shabad, Theodore.

28. Durum, W. H., Hem, J. D., and Heidel, S. G., 1971, Reconnaissance of the selected minor elements in surface waters of the United States: U.S. Geol. Survey Circ. 643, 49 p., 6 figs., 1 table. (Includes Oklahoma data.)

Dziewonski, A., *see* Porath, H., and Dziewonski, A.

29. Ernst, E. A., 1971, New techniques improve deep-well stimulation: World Oil, v. 172, no. 4 (March), p. 52-55, illus., tables. (Oklahoma examples.)

Erskine, W. S., *see* Rozendal, R. A., and Erskine, W. S.

30. Fallin, Steve, Sharp, S. P., and Wolfe, J. L., 1971, Defoaming agents for increased oil production rates of foamy crudes—laboratory screening tests and field results: Jour. Petroleum Technology, v. 23, p. 233-238, 6 figs., 4 tables. (East Velma field, Oklahoma.)
31. Fertl, W. H., and Timko, D. J., 1971, Salinity plots evaluate subsurface formations: World Oil, v. 173, no. 1 (July), p. 93-96, 98, 100 (incl. ads), 4 figs. (Oklahoma examples.)
32. Flower, R. H., 1971, Cephalopods of the Whiterock Stage, *in* Dutro, J. T., Jr. (ed.), Paleozoic perspectives; a paleontological tribute to G. Arthur Cooper: Smithsonian Contr. Paleobiology, no. 3, p. 101-111, 2 pls. (Includes Oklahoma specimens.)
33. Franks, P. C., Bickford, M. E., and Wagner, H. C., 1971, Petrologic and mineralogic studies, *part 2 of* Metamorphism of Precambrian granitic xenoliths in a mica peridotite at Rose Dome, Woodson County, Kansas: Geol. Soc. America Bull., v. 82, p. 2869-2889, 12 figs. (Relation with northeastern Oklahoma.)

Franks, P. C., *see* Bickford, M. E., Mose, D. G., Wetherill, G. W., and Franks, P. C.

34. Furnish, W. M., and Glenister, B. F., 1971, Permian Goniolobocerati dae (Ammonoidea), *in* Dutro, J. T., Jr. (ed.), Paleozoic perspectives; a paleontological tribute to G. Arthur Cooper: Smithsonian Contr. Paleobiology, no. 3, p. 301-312, 2 pls. (Includes Oklahoma specimens.)
35. Galegar, W. C., 1971 [1972], Water pollution, *in* Rose, W. D. (ed.), Environmental aspects of geology and engineering in Oklahoma: Oklahoma Geol. Survey, Oklahoma Acad. Sci. Annals no. 2, p. 9-14.
36. Gatewood, L. E., 1970, Oklahoma City field—anatomy of a giant, *in* Halbouty, M. T. (ed.), Geology of giant petroleum fields: Am. Assoc. Petroleum Geologists Mem. 14, p. 223-254, 28 figs., 4 tables.
37. Gatewood, L. E., 1971, Oklahoma and oil—fifty years of ups and downs: Shale Shaker, v. 21, p. 246-252, 15 figs. (Includes future prospects.)

Glenister, B. F., *see* Furnish, W. M., and Glenister, B. F.

38. Glover, H. A., Temple, H. V., Jr., Lindsly, R. R., Skeith, J. T., Yee, B. Q., Mann, R. K., and Webb, T. O., 1970 [1971], Oklahoma oil and gas development 1969, *in* Production, *part 2 of* International oil and gas development: Internat. Oil Scouts Assoc., v. 40, pt. 2, p. 289-373, 2 maps.
39. Goebel, E. D., 1971, Southeast Kansas—northeast Oklahoma—southwest Missouri, *part of* Adler, F. J. (regional leader), Future petroleum provinces of the Mid-Continent, Region 7, *in* Cram, I. H. (ed.), Future petroleum provinces of the United States—their geology and potential: Am. Assoc. Petroleum Geologists Mem. 15, v. 2, p. 1088-1097, 2 figs.
40. Gordon, Mackenzie, Jr., 1971, *Goniatites americanus* n. sp., a late Meramec (Mississippian) index fossil: U.S. Geol. Sur-

vey Prof. Paper 750-C, p. C39-C43, 3 figs., 1 table. (Includes Oklahoma specimens.)

41. Graff, Tom, 1971, Marchand trend: Shale Shaker, v. 22, p. 40-53, 14 figs. (Anadarko basin.)

Griffin, M. S., *see* Weld, B. A., Griffin, M. S., and Brett, G. W.

42. Halbouty, M. T., 1970, Giant oil and gas fields in United States, *in* Halbouty, M. T. (ed.), Geology of giant petroleum fields: Am. Assoc. Petroleum Geologists Mem. 14, p. 91-127, 25 figs., 2 tables. (Includes data on Oklahoma fields.)

43. Halbouty, M. T., Meyerhoff, A. A., King, R. E., Dott, R. H., Sr., Klemme, H. D., and Shabad, Theodore, 1970, World's giant oil and gas fields, geologic factors affecting their formation, and basin classification, *in* Halbouty, M. T. (ed.), Geology of giant petroleum fields: Am. Assoc. Petroleum Geologists Mem. 14, p. 502-555, 9 figs., 5 tables. (Includes data on Oklahoma fields.)

44. Haley, B. R., and Hendricks, T. A., 1971, Geology of the Van Buren and Lavaca quadrangles, Arkansas and Oklahoma: U.S. Geol. Survey Prof. Paper 657-A, p. A1-A41, 12 figs., 7 pls., 3 tables. (Small portions of Le Flore and Sequoyah Counties.)

45. Ham, W. E., 1970 [1971], Basement rocks and structural evolution of southern Oklahoma: a summary, *2d part of* The structure and igneous rocks of the Wichita Mountains: Compass, v. 48, p. 19-26, 4 figs., 2 tables.

46. Hare, B. D., 1970 [1971], Petrology of the Thurman Sandstone (Desmoinesian), Hughes and Coal Counties, Oklahoma: Compass, v. 48, p. 45-55, 6 figs., 3 tables.

47. Hayes, C. J., 1971 [1972], Landslides and related phenomena pertaining to highway construction in Oklahoma, *in* Rose, W. D. (ed.), Environmental aspects of geology and engineering in Oklahoma: Oklahoma Geol. Survey, Oklahoma Acad. Sci. Annals no. 2, p. 47-57, 5 figs., 1 table.

48. Heath, L. J., and Jones, R. A., 1971, Thermal-chemical alteration of sandstone to increase permeability: U.S. Bur. Mines Rept. Inv. 7586, 22 p., 6 figs., 2 tables. (Includes Oklahoma samples.)

Heidel, S. G., *see* Durum, W. H., Hem, J. D., and Heidel, S. G.

Hem, J. D., *see* Durum, W. H., Hem, H. D., and Heidel, S. G.

49. Hendricks, T. A., 1971, Provenance of Johns Valley boulders in late Paleozoic Ouachita facies, southeastern Oklahoma and southwestern Arkansas: Discussion: Am. Assoc. Petroleum Geologists Bull., v. 55, p. 1365-1366.

Hendricks, T. A., *see* Haley, B. R., and Hendricks, T. A.

50. Henslee, H. T., 1971, Texas and Oklahoma Panhandles, *part of* Adler, F. J. (regional leader), Future petroleum provinces of the Mid-Continent, Region 7, *in* Cram, I. H. (ed.), Future petroleum provinces of the United States—their geology and potential: Am. Assoc. Petroleum Geologists Mem. 15, v. 2, p. 1054-1061, 2 figs.

51. Hibbard, C. W., 1970, Pleistocene mammalian local faunas from the Great Plains and Central Lowland provinces of the United States, *in* Dort, Wakefield, Jr., and Jones, Knox, Jr. (eds.), Pleistocene and Recent environments of the central Great Plains: Kansas Univ. Dept. Geol. Spec. Pub. 3, p. 395-433, 1 fig., 7 tables. (Includes Oklahoma.)
52. Hicks, I. C., 1971, Southern Oklahoma folded belt, *part of* Adler, F. J. (regional leader), Future petroleum provinces of the Mid-Continent, Region 7, *in* Cram, I. H. (ed), Future petroleum provinces of the United States—their geology and potential: Am. Assoc. Petroleum Geologists Mem. 15, v. 2, p. 1070-1077, 3 figs.

Hoskinson, A. J., *see* Cook, K. L., Hoskinson, A. J., and Shelton, G. R.

53. Huang, W. H., and Keller, W. D., 1971, Dissolution of clay minerals in dilute organic acids at room temperature: Am. Mineralogist, v. 56, p. 1082-1095, 9 figs. (Includes Beavers Bend illite.)
54. Hunter, H. E., 1970 [1971], Raggedy Mountain Gabbro Group, *4th part of* The structure and igneous rocks of the Wichita Mountains: Compass, v. 48, p. 27-31, 2 tables.
55. Iranpanah, Assad, 1971, Clay petrology and zonation of the uppermost shale member of the Ada Formation (Pennsylvanian), Seminole and Pontotoc Counties, Oklahoma: Oklahoma Geology Notes, v. 31, p. 51-55, 2 figs.
56. Irwin, J. H., 1971 [1972], Ground-water investigations in Oklahoma, *in* Rose, W. D. (ed.), Environmental aspects of geology and engineering in Oklahoma: Oklahoma Geol. Survey, Oklahoma Acad. Sci. Annals no. 2, p. 58-70, 8 figs.
57. Jenkins, W. A. M., 1971, Palynology and Silurian-Lower Devonian ("Hunton") stratigraphy in the subsurface of [the Anadarko basin] Oklahoma and the Texas panhandle: Geol. Soc. America Bull., v. 82, p. 489-491.
58. Johnson, K. S., 1970 [1971], Geology and mineral resources of Oklahoma: Compass, v. 48, p. 5-18, 12 figs., 1 table.
59. Johnson, K. S., 1971, Introduction, guidelines, and geologic history of Oklahoma, *book 1 of* Guidebook for geologic field trips in Oklahoma: Oklahoma Geol. Survey Educ. Pub. 2, 15 p., 16 figs., 7 photos.
60. Johnson, K. S., 1971, Reclamation of mined coal lands in eastern Oklahoma: Oklahoma Geology Notes, v. 31, p. 111-123, 5 figs., 2 tables.
61. Johnson, K. S., 1971 [1972], Oklahoma's mineral resources and mining-reclamation practices, *in* Rose, W. D. (ed.), Environmental aspects of geology and engineering in Oklahoma: Oklahoma Geol. Survey, Oklahoma Acad. Sci. Annals no. 2, p. 23-35, 11 figs., 2 tables.
62. Johnson, K. S., and McCasland, Willard, 1971, Highway geology in the Arbuckle Mountains and Ardmore area, southern Oklahoma: 22d Ann. Highway Geology Symposium Field

Trip Guidebook, Oklahoma Highway Dept., Oklahoma Geol. Survey, 31 p., 18 figs.

Jones, R. A., *see* Heath, L. J.

63. Kapp, R. O., 1970, Pollen analysis of pre-Wisconsin sediments from the Great Plains, *in* Dort, Wakefield, Jr., and Jones, Knox, Jr. (eds.), Pleistocene and Recent environments of the central Great Plains: Kansas Univ. Dept. Geol. Spec. Pub. 3, p. 143-155, 3 figs. (Includes northwestern Oklahoma.)

64. Kastner, Miriam, 1971, Authigenic feldspars in carbonate rocks: Am. Mineralogist, v. 56, p. 1403-1442, 9 figs., 9 tables. (Includes data on Arbuckle Formation.)

Keller, W. D., *see* Huang, W. H., and Keller, W. D.

65. Kennedy, J. L., 1971, No. 1 Baden: 28,000 ft calls for planning, more planning: Oil and Gas Jour., v. 69, no. 1 (Jan. 4), p. 83-90, 9 figs., 2 tables. (Anadarko basin deep test.)

66. Keroher, G. C., 1970, Lexicon of geologic names of the United States for 1961-1967: U.S. Geol. Survey Bull. 1350, 848 p. (New Oklahoma listings.)

King, R. E., *see* Halbouty, M. T., Meyerhoff, A. A., King, R. E., Dott, R. H., Sr., Klemme, H. D., and Shabad, Theodore.

Klemme, H. D., *see* Halbouty, M. T., Meyerhoff, A. A., King, R. E., Dott, R. H., Sr., Klemme, H. D., and Shabad, Theodore.

67. Kornfeld, J. A., 1971, New deep pay may boost Marchand trend drilling: World Oil, v. 173, no. 4 (Sept.), p. 80, 82, 2 figs., 1 table. (Anadarko basin.)

68. Lane, B. B., 1971, Determining a proper flood pattern from a three-well pilot in a channel sand: Jour. Petroleum Technology, v. 23, p. 195-201, 6 figs., 1 table. (Wells in southeastern Oklahoma.)

Lane, H. R., *see* Straka, J. J., II, and Lane, H. R.

69. Larson, T. G., 1971, Hydrodynamic interpretation of Mid-Continent, *part of* Adler, F. J. (regional leader), Future petroleum provinces of the Mid-Continent, Region 7, *in* Cram, I. H. (ed.), Future petroleum provinces of the United States—their geology and potential: Am. Assoc. Petroleum Geologists Mem. 15, v. 2, p. 1043-1046, 2 figs. (Includes Oklahoma.)

70. Latham, J. W., 1970, Petroleum geology of Healdton field, Carter County, Oklahoma, *in* Halbouty, M. T. (ed.), Geology of giant petroleum fields: Am. Assoc. Petroleum Geologists Mem. 14, p. 255-276, 12 figs., 2 tables.

71. Lawrence, J. R., and Taylor, H. P., Jr., 1971, Deuterium and oxygen-18 correlation: clay minerals and hydroxides in Quaternary soils compared to meteoric water: Geochim. et Cosmochim. Acta, v. 35, p. 993-1003, 3 figs., 1 table. (Includes Oklahoma soil data.)

Lindsly, R. R., *see* Glover, H. A., Temple, H. V., Jr., Lindsly, R. R., Skeith, J. T., Yee, B. Q., Mann, R. K., and Webb, T. O.

72. Linville, Bill, 1971, Petroleum and oil-shale research of the Bureau of Mines, fiscal year 1969: U.S. Bur. Mines Inf. Circ. 8525, 117 p., 35 figs. (Includes Oklahoma projects.)
73. Linville, Bill, and Spenser, J. D., 1971, Review of Bureau of Mines energy program, 1970: U.S. Bur. Mines Inf. Circ. 8526, 111 p., 44 figs., 1 table. (Includes research in Oklahoma.)
74. Loeblich, A. R., Jr., and MacAdam, R. B., 1971, North American species of the Ordovician acritarch genus *Aremoricanium*: Palaeontographica, sec. B, v. 135, p. 41-47, 6 pls. (Specimens from the Bromide Formation of Oklahoma.)
75. Loeblich, A. R., Jr., and Tappan, Helen, 1971, New observations of the ultrastructure of *Asketopalla*, an Ordovician acritarch: Jour. Paleontology, v. 45, p. 899-901, 2 pls. (Oklahoma specimens.)
76. Louden, L. R., Matthews, W. R., McClendon, R. T., Rehm, W. A., and Aud, B. W., 1971, Ultra-deep drilling guided by seismic data [part 1]: World Oil, v. 172, no. 6 (May), p. 67-70 (incl. ads), 3 figs., 1 map, 2 tables. (Anadarko basin.)
77. Louden, L. R., Matthews, W. R., McClendon, R. T., Rehm, W. A., and Aud, B. W., 1971, Ultra-deep drilling guided by seismic data, part 2: World Oil, v. 172, no. 7 (June), p. 97-99, 102, 4 figs. (Anadarko basin.)
78. Lumsden, D. N., Pittman, E. D., and Buchanan, R. S., 1971, Sedimentation and petrology of Spiro and Foster sands (Pennsylvanian), McAlester basin, Oklahoma: Am. Assoc. Petroleum Geologists Bull., v. 55, p. 254-266, 13 figs., 2 tables.
79. Lyon, G. M., 1971, Subsurface stratigraphic analysis, lower "Cherokee" Group, portions of Alfalfa, Major, and Woods Counties, Oklahoma: Shale Shaker, v. 22, p. 4-26, 17 figs.
80. Mankin, C. J., 1971, Oklahoma Geological Survey, annual report, July 1, 1970-June 30, 1971: Oklahoma Geology Notes, v. 31, p. 91-95.

Mankin, C. J., *see* Bucke, D. P., and Mankin, C. J.

Mann, R. K., *see* Glover, H. A., Temple, H. V., Jr., Lindsly, R. R., Skeith, J. T., Yee, B. Q., Mann, R. K., and Webb, T. O.

Manuel, O. K., *see* Collins, A. G., Bennett, J. H., and Manuel, O. K.

81. Marcher, M. V., and Bingham, R. H., 1971, Reconnaissance of the water resources of the Tulsa quadrangle, northeastern Oklahoma: Oklahoma Geol. Survey Hydrol. Atlas HA-2, 4 sheets, scale 1:250,000.

Matthews, W. R., *see* Louden, L. R., Matthews, W. R., McClendon, R. T., Rehm, W. A., and Aud, B. W.

McCasland, Willard, *see* Johnson, K. S., and McCasland, Willard.

82. McCaslin, J. C., 1971, Anadarko's Hunton play at decisive stage: Oil and Gas Jour., v. 69, no. 20 (May 17), p. 223, 1 map, 1 table.

83. McCaslin, J. C., 1971, Bright future seen for Anadarko gas search: Oil and Gas Jour., v. 69, no. 47 (Nov. 22), p. 89, illus.
84. McCaslin, J. C., 1971, Journal survey of active fields: Oil and Gas Jour., v. 69, no. 38 (Sept. 20), p. 144, 146, 148, 150, 152-154, 156 (incl. ads). (Oklahoma fields.)
85. McCaslin, J. C., 1971, Superdeep tests growing in Anadarko basin: Oil and Gas Jour., v. 69, no. 15 (April 12), p. 95, 1 map.
McClendon, R. T., *see* Louden, L. R., Matthews, W. R., McClendon, R. T., Rehm, W. A., and Aud, B. W.
Melton, F. A., *see* Speer, J. H., and Melton, F. A.
86. Merritt, C. A., 1970 [1971], Mount Scott Granite, *3d part of* The structure and igneous rocks of the Wichita Mountains: Compass, v. 48, p. 26-27.
Meyerhoff, A. A., *see* Halbouty, M. T., Meyerhoff, A. A., King, R. E., Dott, R. H., Sr., Klemme, H. D., and Shabad, Theodore.
Moore, R. C., *see* Strimple, H. L., and Moore, R. C.
87. Morris, R. C., 1971, Stratigraphy and sedimentology of Jackfork Group, Arkansas: Am. Assoc. Petroleum Geologists Bull., v. 55, p. 387-402, 12 figs., 1 table. (Adjoins Oklahoma Ouachitas.)
Mose, D. G., *see* Bickford, M. E., Mose, D. G., Wetherill, G. W., and Franks, P. C.
88. Newton, G. B., 1971, Rhabdomesid bryozoans of the Wreford Megacyclothem (Wolfcampian, Permian) of Nebraska, Kansas, and Oklahoma: Kansas Univ. Paleont. Contr. Art. 56 (Bryozoa 2), 73 p., 19 figs., 2 pls., 10 tables.
Offield, T. W., *see* Rowan, L. C., Offield, T. W., Watson, Kenneth, Cannon, P. J., and Watson, R. D.
89. Oil and Gas Journal, 1971, Marchand play sparks Oklahoma action: Oil and Gas Jour., v. 69, no. 8 (Feb. 22), p. 43, 1 map.
90. Oil and Gas Journal, 1971, Oklahoma discoveries fire up Marchand sand oil search: Oil and Gas Jour., v. 69, no. 40 (Oct. 4), p. 136-137, 1 map, 1 photo.
91. Oklahoma Water Resources Board, 1970, Appraisal of the water and related land resources of Oklahoma—Region Seven: Oklahoma Water Resources Board Pub. 29, 141 p., illus. (Area in central eastern Oklahoma. Corrects listing in 1970 bibliography.)
92. Oklahoma Water Resources Board, 1971, Appraisal of the water and related land resources of Oklahoma—Region Eight: Oklahoma Water Resources Board Pub. 34, 141 p., illus. (Area in east-central Oklahoma.)
93. Oklahoma Water Resources Board, 1971, Appraisal of the water and related land resources of Oklahoma—Region Nine: Oklahoma Water Resources Board Pub. 36, 149 p., illus. (Area in northeastern Oklahoma.)

94. Olson, E. C., 1971, Skeleton of *Lysorophus tricarinatus* (Amphibia: Lepospondyli) from the Hennessey Formation (Permian) of Oklahoma: Jour. Paleontology, v. 45, p. 443-449, 3 figs.
95. Padgett, Ward, 1971, Sixty-second annual report, Department of Mines, Chief Mine Inspector, year ending December 31, 1970: Oklahoma Dept. Mines, 55 p.
96. Painter, John, 1971, 28,000-foot Anadarko well depends on new technology: World Oil, v. 173, no. 1 (July), p. 105-106, 109 (incl. ads), 3 figs.
97. Parcher, J. V., 1971 [1972], Foundation problems, *in* Rose, W. D. (ed.), Environmental aspects of geology and engineering in Oklahoma: Oklahoma Geol. Survey, Oklahoma Acad. Sci. Annals no. 2, p. 15-22, 6 figs.
Pert, D. M., *see* Zanier, A. M., and Pert, D. M.
Phares, R. S., *see* Visher, G. S., Saitta B., Sandro, and Phares, R. S.
98. Pippin, Lloyd, 1970, Panhandle-Hugoton field, Texas-Oklahoma-Kansas—the first fifty years, *in* Halbouty, M. T. (ed.), Geology of giant petroleum fields: Am. Assoc. Petroleum Geologists Mem. 14, p. 204-222, 17 figs.
99. Pitt, W. D., 1971, Potato Hills problem area: Oklahoma Geology Notes, v. 31, p. 99-107, 6 figs. (Ouachita Mountains.)
Pittman, E. D., *see* Lumsden, D. N., Pittman, E. D., and Buchanan, R. S.
100. Porath, H., and Dziewonski, A., 1971, Crustal electrical conductivity anomalies in the Great Plains province of the United States: Geophysics, v. 36, p. 382-395, 12 figs. (Includes Oklahoma.)
Rehm, W. A., *see* Louden, L. R., Matthews, W. R., McClendon, R. T., Rehm, W. A., and Aud, B. W.
101. Roberts, J. F., 1971, Statistics of Oklahoma's petroleum industry, 1970: Oklahoma Geology Notes, v. 31, p. 67-74, 4 figs., 4 tables.
102. Robertson, R. W., and Caudle, B. H., 1971, Permeability continuity of laminae in the Calvin Sandstone: Jour. Petroleum Technology, v. 23, p. 661-670, 11 figs. (Oklahoma formation.)
103. Rose, W. D., 1971, Bibliography and index of Oklahoma geology, 1970: Oklahoma Geology Notes, v. 31, p. 23-37.
104. Rose, W. D. (ed.), 1971 [1972], Environmental aspects of geology and engineering in Oklahoma: Oklahoma Geol. Survey, Oklahoma Acad. Sci. Annals no. 2, 70 p., 31 figs., 4 tables.
105. Rowan, L. C., Offield, T. W., Watson, Kenneth, Cannon, P. J., and Watson, R. D., 1970 [1971], Remote sensor application studies progress report, July 1, 1968, to June 30, 1969: Remote sensing reconnaissance, Mill Creek area, Arbuckle Mountains, Oklahoma: U.S. Geol. Survey PB1-97100, 53 p. [available from Natl. Tech. Inf. Service].
106. Rozendal, R. A., and Erskine, W. S., 1971, Deep test in Ouachita structural belt of central Texas: Am. Assoc. Petroleum

Geologists Bull., v. 55, p. 2008-2017, 4 figs., 1 table. (Relation with Ouachita outcrop in Oklahoma.)

Saitta B., Sandro, *see* Visher, G. S., Saitta B., Sandro, and Phares, R. S.

107. Sarles, Les, 1971, Anadarko basin drilling costs cut: Oil and Gas Jour., v. 69, no. 27 (July 5), p. 79-82, 2 figs., 2 tables.

108. Saunders, W. B., 1971, Somoholitidae: Mississippian to Permian Ammonoidea: Jour. Paleontology, v. 45, p. 100-118, 6 figs., 2 pls. (Includes Oklahoma specimens.)

109. Schramm, M. W., Jr., and Caplan, W. M., 1971, Southeastern Oklahoma and northern Arkansas, *part of* Adler, F. J. (regional leader), Future petroleum provinces of the Mid-Continent, Region 7, *in* Cram, I. H. (ed.), Future petroleum provinces of the United States—their geology and potential: Am. Assoc. Petroleum Geologists Mem. 15, v. 2, p. 1077-1082, 2 figs.

Shabad, Theodore, *see* Halbouty, M. T., Meyerhoff, A. A., King, R. E., Dott, R. H., Sr., Klemme, H. D., and Shabad, Theodore.

Sharp, S. P., *see* Fallin, Steve, Sharp, S. P., and Wolfe, J. L.

Shelton, G. R., *see* Cook, K. L., Hoskinson, A. J., and Shelton, G. R.

110. Shideler, G. L., 1971, [Provenance of Johns Valley boulders in late Paleozoic Ouachita facies, southeastern Oklahoma and southwestern Arkansas] Reply [to Jack L. Walper]: Am. Assoc. Petroleum Geologists Bull., v. 55, p. 1363-1365.

111. Shideler, G. L., 1971, [Provenance of Johns Valley boulders in late Paleozoic Ouachita facies, southeastern Oklahoma and southwestern Arkansas] Reply [to Thomas A. Hendricks]: Am. Assoc. Petroleum Geologists Bull., v. 55, p. 1366-1368.

Skeith, J. T., *see* Glover, H. A., Temple, H. V., Jr., Lindsly, R. R., Skeith, J. T., Yee, B. Q., Mann, R. K., and Webb, T. O.

112. Speer, J. H., and Melton, F. A., 1971, Outcrop geomorphic study of basal unconformities and related movements, upper Gulf Cretaceous basin of Oklahoma and Arkansas: Am. Assoc. Petroleum Geologists Bull., v. 55, p. 241-253, 11 figs.

Spenser, J. D., *see* Linville, Bill, and Spenser, J. D.

113. Stitt, J. H., 1971, Repeating evolutionary pattern in Late Cambrian trilobite biomeres: Jour. Paleontology, v. 45, p. 178-181, 3 figs. (Includes Arbuckle Mountain specimens.)

114. Stitt, J. H., 1971, Late Cambrian and earliest Ordovician trilobites, Timbered Hills and lower Arbuckle Groups, western Arbuckle Mountains, Murray County, Oklahoma: Oklahoma Geol. Survey Bull. 110, 83 p., 4 figs., 12 pls., 1 table.

115. Stone, G. T., 1970 [1971], Introduction, *1st part of* The structure and igneous rocks of the Wichita Mountains: Compass, v. 48, p. 19.

116. Stone, J. E., 1971 [1972], Why are we all here?, *in* Rose, W. D. (ed.), Environmental aspects of geology and engineering in Oklahoma: Oklahoma Geol. Survey, Oklahoma Acad. Sci. Annals no. 2, p. 1-8.

117. Straka, J. J., II, and Lane, H. R., 1970, Evolution of some Lower Pennsylvanian conodont species: Lethaia, v. 3, p. 41-49, 2 figs. (Includes Ardmore area specimens.)
118. Strimple, H. L., 1971, Ethelocrinids from the vicinity of Bartlesville, Oklahoma: Oklahoma Geology Notes, v. 31, p. 80-81, 1 fig.
119. Strimple, H. L., 1971, Occurrence of *Hydriocrinus* in Oklahoma and Russia, *part 3 of* Strimple, H. L., Moore, R. C., Allison, R. C., Kline, G. L., Horowitz, A. S., Boardman, D. R., II, and Miller, J. F., Fossil crinoid studies: Kansas Univ. Paleont. Contr. Paper 56, p. 16-18, 1 fig.
120. Strimple, H. L., and Moore, R. C., 1971, Crinoids of the LaSalle Limestone (Pennsylvanian) of Illinois: Kansas Univ. Paleont. Contr. Art. 55 (Echinodermata 11), 48 p., 19 figs., 23 pls. (Oklahoma forms illustrated.)
121. Strimple, H. L., and Moore, R. C., 1971, Crinoids of the Francis Shale (Missourian) of Oklahoma: Kansas Univ. Paleont. Contr. Paper 55, 20 p., 10 figs.
122. Strimple, H. L., and Moore, R. C., 1971, The family Diphuicrinidae, *part 1 of* Strimple, H. L., Moore, R. C., Allison, R. C., Kline, G. L., Horowitz, A. S., Boardman, D. R., II, and Miller, J. F., Fossil crinoid studies: Kansas Univ. Paleont. Contr. Paper 56, p. 2-9, 3 figs. (Includes Oklahoma specimens.)

Tappan, Helen, *see* Loeblich, A. R., Jr., and Tappan, Helen.
Taylor, H. P., Jr., *see* Lawrence, J. R., and Taylor, H. P., Jr.
Temple, H. V., Jr., *see* Glover, H. A., Temple, H. V., Jr., Lindsly, R. R., Skeith, J. T., Yee, B. Q., Mann, R. K., and Webb, T. O.
Timko, D. J., *see* Fertl, W. H., and Timko, D. J.
Urban, J. B., *see* Wilson, L. R., and Urban, J. B.

123. U.S. Army Corps of Engineers, 1970, Flood plain information, Cottonwood Creek, Guthrie, Oklahoma: U.S. Army Corps Engineers, 31 p., 8 figs., 13 pls.
124. U.S. Bureau of Mines, 1971, Crude petroleum, petroleum products, and natural-gas liquids; 1970 (final summary): U.S. Bur. Mines Mineral Industry Surveys, Ann. Petroleum Statement, 2 figs., 34 tables. (Includes Oklahoma data.)
125. U.S. Geological Survey, 1970, Geological Survey research 1970: U.S. Geol. Survey Prof. Paper 700-A, 426 p., 10 figs. (Reports on Oklahoma hydrology and geology.)
126. U.S. Geological Survey, 1971, Bibliography of North American geology, 1968: U.S. Geol. Survey Bull. 1268, 1301 p.
127. U.S. Geological Survey, 1971, Lower Mississippi River basin and western Gulf of Mexico basins, *parts 7, 8 of* Quality of surface waters of the United States, 1966: U.S. Geol. Survey Water-Supply Paper 1994, 815 p., 1 fig.
128. Vaught, W. L., 1971 [1972], Erosion control, *in* Rose, W. D. (ed.), Environmental aspects of geology and engineering in Oklahoma: Oklahoma Geol. Survey, Oklahoma Acad. Sci. Annals no. 2, p. 36-41.

129. Visher, G. S., Saitta B., Sandro, and Phares, R. S., 1971, Pennsylvanian delta patterns and petroleum occurrences in eastern Oklahoma: Am. Assoc. Petroleum Geologists Bull., v. 55, p. 1206-1230, 15 figs., 1 table.

Wagner, H. C., *see* Franks, P. C., Bickford, M. E., and Wagner, H. C.

130. Waller, R. L., 1971, Northwest Avard pressure maintenance project. Jour. Petroleum Technology, v. 23, p. 1074-1080, 3 figs., 2 tables. (Data on Oklahoma Hunton reservoir.)

131. Walper, J. L., 1971, Provenance of Johns Valley boulders in late Paleozoic Ouachita facies, southeastern Oklahoma and southwestern Arkansas: Discussion: Am. Assoc. Petroleum Geologists Bull., v. 55, p. 1362-1363.

Watson, Kenneth, *see* Rowan, L. C., Offield, T. W., Watson, Kenneth, Cannon, P. J., and Watson, R. D.

Watson, R. D., *see* Rowan, L. C., Offield, T. W., Watson, Kenneth, Cannon, P. J., and Watson, R. D.

Webb, T. O., *see* Glover, H. A., Temple, H. V., Jr., Lindsly, R. R., Skeith, J. T., Yee, B. Q., Mann, R. K., and Webb, T. O.

132. Weld, B. A., Griffin, M. S., and Brett, G. W., 1971, Reports and maps of the Geological Survey released only in the open files, 1970: U.S. Geol. Survey Circ. 638, 23 p. (Includes one Oklahoma report.)

Wetherill, G. W., *see* Bickford, M. E., Mose, D. G., Wetherill, G. W., and Franks, P. C.

133. Wilshire, L. M., 1971, Northeast Citra pool, Hughes County, Oklahoma: Shale Shaker, v. 21, p. 237-238, 7 figs.

134. Wilson, L. R., 1971, Palynological [techniques in] deep-basin stratigraphy: Shale Shaker, v. 21, p. 124-139, 12 figs., 2 pls., 1 table. (Includes data on Arkoma basin.)

135. Wilson, L. R., and Urban, J. B., 1971, Electron microscope studies of the marine palynomorph *Quisquilites*: Micropaleontology, v. 17, p. 239-243, 2 pls.

136. Witt, W. J. (chm.), 1971, Cross section of Oklahoma from SW to NE corners of state: Oklahoma City Geol. Soc., 1 sheet, 97½ by 23 in.

Wolfe, J. L., *see* Fallin, Steve, Sharp, S. P., and Wolfe, J. L.

Wright, W. B., *see* Cohee, G. V., Bates, R. G., and Wright, W. B.

137. Wu, D. C., 1971, Origin of greenish-gray spots and layers in the upper Flowerpot Shale (Permian), northwestern Oklahoma: Oklahoma Geology Notes, v. 31, p. 3-10, 3 figs., 3 tables.

Yee, B. Q., *see* Glover, H. A., Temple, H. V., Jr., Lindsly, R. R., Skeith, J. T., Yee, B. Q., Mann, R. K., and Webb, T. O.

138. Zanier, A. M., and Pert, D. M., 1971, The salinity log: a tool to determine producing properties of reservoirs: Oil and Gas Jour., v. 69, no. 30 (July 26), p. 144, 148, 150, 152-156 (incl. ads), 8 figs., 3 tables. (Examples from Morrow trend fields, western Oklahoma.)

Mineral-Development Symposium Rated a Success

The 94 participants who attended the symposium on Oklahoma mineral-development opportunities held in Norman on March 10 gained new insight into the possibilities and feasibility of expanded development of the State's nonpetroleum resources. The symposium, held at the Oklahoma Center for Continuing Education and sponsored by the Oklahoma Section of the American Institute of Professional Geologists, the Oklahoma Industrial Development and Park Department, and the Oklahoma Geological Survey, attracted consulting geologists, industry personnel, and representatives from various local, state, and Federal government agencies.

The Survey furnished five speakers: Charles J. Mankin, director, gave the keynote address, in which he pointed out the need for diversification in development of the State's mineral resources in order to avoid undue reliance on petroleum, which presently accounts for 94 percent of the State's mineral income. T. L. Rowland spoke on carbonate deposits, Kenneth S. Johnson on gypsum and salt resources, Samuel A. Friedman on coal exploration and development, and William H. Bellis on clay and shale products.

Other speakers were Charles R. Sewell, Tucson, Arizona, consultant, on metallic mineral occurrences; Robert H. Arndt, U.S. Bureau of Mines liaison officer for Oklahoma, on sand and gravel deposits; and I. E. Chenoweth, deputy director of Tulsa-Rogers County Port Authority, on commodity transportation along the Arkansas River Navigation System.

A highlight of the meeting was a luncheon speech by Frank N. Ikard, president of the American Petroleum Institute and former Congressman from the 13th Congressional District of Texas. He emphasized the need for national self-sufficiency in petroleum resources instead of relying heavily on foreign imports. He explained that the United States was not exhausting its reserves but that sufficient economic incentives were needed to enable a healthy domestic petroleum industry to explore for and develop these reserves. In the area of environmental concern, Mr. Ikard stated that the industry was doing its best to provide both adequate energy development and a decent environment but that it must have government understanding and public support. He concluded: "It doesn't have to be a case of Energy versus the Environment; it can be Energy plus the Environment."

Session co-chairmen were Suzanne Takken, president of the Oklahoma Section of AIPG; Thomas H. Green, president of the Tulsa Geological Society; J. N. ("Sandy") King, representing the Ardmore Geological Society; and John W. Erickson, president of the Oklahoma City Geological Society.

Of the 39 participants who turned in evaluation questionnaires at the close of the meeting, 15 gave the symposium an "excellent" rating, 23 a "good" rating, and 1 a "fair" rating. All respondents felt that additional conferences on Oklahoma's mineral resources were merited, and a majority recommended that they be held annually.

Frank N. Ikard, right, president of the American Petroleum Institute and former Texas Congressman, with Charles J. Mankin, director of the Oklahoma Geological Survey, at the symposium on mineral-development opportunities in Norman.

National Petroleum Council Releases Oil-Shale Report

The National Petroleum Council, an industry advisory body to the Secretary of the Interior, recently released an initial comprehensive appraisal on the role of oil shale in the overall energy-supply situation in the United States. The report, entitled *An Initial Appraisal by the Oil Shale Task Group,* is available at a cost of $8.00 from the National Petroleum Council, 1625 K Street, N.W., Washington, D.C. 20006. Prepayment is required.

The oil-shale report covers the full range of geological, technological, economic, and other factors that affect the potential of energy supply from national oil-shale resources. Specific sections are concerned with oil-shale reserves, mining and crushing of oil shale, retorting of oil shale to produce crude shale oil, and upgrading crude shale oil to syncrude. Operations on a commercial scale are analyzed, and estimates are made of capital and operating costs. Coverage is also given to factors relating to development of oil-shale resources, such as by-products, the availability of oil-shale lands for development, and water supply. Finally, an estimate is made of a probable range in syncrude value and a possible development schedule for production of syncrude. A final report on oil shale is planned for completion later this year.

This report by the Oil Shale Task Group is one of eight in a series of reports which represent the working papers of several task groups in their preparation of the National Petroleum Council's *U.S. Energy Outlook: An Initial Appraisal—1971-1985.*

Brine-Well Production Resumed at Sayre

A small brine-well system 2 miles southwest of Sayre in Beckham County was placed back in production during the fall of 1971 by its new owner, Permian Brine Sales and Service, whose home offices are in Odessa, Texas. Since last October the company has sold an average of 2,000 barrels of saturated brine per month to petroleum operators in the Anadarko basin and surrounding regions of western Oklahoma for use as drilling fluid.

Production comes from two 1,500-foot wells drilled in 1934 and 1942 into 38 feet of bedded salt of the Upper Cimarron salt unit of Permian age. Fresh water is injected into the salt bed through one well, and brine formed by dissolving the salt is recovered from the second well 310 feet away. Earlier information on geology and production was given by K. S. Johnson in an article entitled "Brine-Well Production of Permian Salt at Sayre, Beckham County, Oklahoma" (*Oklahoma Geology Notes*, v. 23, 1963, p. 83-93).

The Sayre salt wells, originally developed by Oklahoma Salt Industries, Inc., were formerly owned and worked by Tom-Feld Salt Company. Tom-Feld ceased production of brine and evaporated salt in 1963. Some of the salt-making equipment was then purchased by Western Salt Company of Erick, Beckham County, but the well system was left intact. Improvements necessary for the present owners to bring the system back to use included two new fresh-water wells and a 1,000-barrel brine-storage tank. The surface storage tank is kept full by intermittently pumping saturated brine from the wells at a rate of 100 barrels per hour (about 70 gallons per minute).

Information on current activities has been provided by Carl Hickerson of Martha, Oklahoma, a retired vice-president of the Odessa-based company.

—*Kenneth S. Johnson*

Oklahoma Well Captures Depth Record from Texas

The Lone Star Producing Co. 1 Baden Unit, 6 miles east of Sayre in Beckham County, has captured the world's depth record from a Texas well, having reached a total depth of 30,050 feet in the Viola Limestone of Ordovician age. The previous depth record of 28,500 feet was established in January 1972 by the Ralph Lowe Estate 1-17 University, Pecos County, Texas, which bottomed in the Ellenburger Dolomite of Cambrian-Ordovician age.

The Lone Star well, located in the deep part of the Anadarko basin, in sec. 28, T. 10 N., R. 22 W., had been projected to a depth of 30,500 feet to test rocks of the Arbuckle Group, but drilling was halted short of this objective by the risk of excessive strain on the

drill pipe. By the middle of March the operator had run a 5-inch liner to a depth of 28,550 feet to test rocks of the Hunton Group of Silurian-Devonian age. A conventional drill-stem test of this zone was thwarted by high bottom-hole temperatures and extreme mud-column weight.

The deep test, expected to cost some $5.5 million, was spudded on September 4, 1970, and reached total depth on February 29, 1972. The well was drilled by Loffland Brothers of Tulsa.

OKLAHOMA ABSTRACTS

GSA Annual Meeting, Southeastern Section
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The following abstract is reprinted from the Southeastern Section Program of The Geological Society of America and Associated Societies, v. 4, no. 2. The page number is given in brackets below the abstract. Permission of the author and of Mrs. Jo Fogelberg, managing editor of GSA, to reproduce the abstract is gratefully acknowledged.

Carboniferous Rocks of the Ouachita Mountains, Arkansas—A Flysch Facies

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Carboniferous Stanley-Jackfork rocks in the Ouachita Mountains are a flysch facies with unique lithologic associations, bedding characteristics, and sedimentary structures which vary according to basin position and geologic age. Field and laboratory studies confirm the presence of recurring rock types differentiated into proximal turbidites, distal turbidites, pelagic facies, and disturbed beds. Proximal turbidites (fluxoturbidites) include either massive, scoured sandstones or even-bedded turbidites with thin, interbedded mudstones. Distal turbidites, consisting of sandy flysch and shaly flysch, generally contain the sedimentary structures of a complete Bauma sequence. Laminated sandstones dominate sandy flysch whereas shales exceed siltstones and sandstones in distal turbidites. The pelagic facies includes shales, ferruginous siltstones, siliceous shales, and impure cherts, all commonly

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OKLAHOMA ABSTRACTS is intended to present abstracts of recent unpublished papers relating to the geology of Oklahoma and adjacent areas of interest. The editors are therefore interested in obtaining abstracts of formally presented or approved documents, such as dissertations, theses, and papers presented at professional meetings, that have not yet been published.

associated with distal turbidites. Disturbed beds developed at the feet of unstable slopes surrounding a probable east-west trending trench, the resulting types dependent upon kind of material involved, its state of consolidation, and the distance moved. Highest sand-shale ratios parallel the axis of the trough while more shaly slope deposits are frequently disturbed. Paleocurrent mean (323°) for Stanley turbidites suggests dominance of a feldspathic, southeastern provenance. Lower Jackfork (260°) and upper Jackfork (266°) paleocurrents and mixed mature-immature sandstones suggest increasingly important cratonic contributions in the later Mississippian. [95]

Columbia University

Carbonate Paleoenvironments in the Arbuckle Group West Spring Creek Formation, Lower Ordovician, in Oklahoma

WILLIAM JOSEPH BURGESS, Columbia University, Ph.D. dissertation, 1968

The Arbuckle Group West Spring Creek Formation in southern Oklahoma consists of a sequence of carbonate rocks deposited under near-tidal conditions. A picture of regional geography at the time the sediments were being deposited indicates the presence of a low-lying land to the north and west of a broad shallow shelf area on which the West Spring Creek carbonates of southern Oklahoma were accumulating. In a trench or basinal area to the east, in the Ouachita Mountains, terrigenous sediments were being deposited, the main source of which was probably an island arc system to the south and east.

Four main environments occur in West Spring Creek beds in the vicinity of the Arbuckle Mountains: subtidal, intertidal, supratidal, and shallow-lagoonal. The environments may be recognized by distinct lithic parameters and fossil content. Very generally subtidal environments are distinguished by the presence of marine fossils, burrows and a lithology consisting of calcilutites and fairly well sorted calcarenites which often reveal a lack of stratification as compared with rocks of other environments. Intertidal mud-flat environments contain some fossil forms, calcilutites with stromatolites, and tidal channel deposits of calcirudites and calcarenites; intertidal shoals also occur with oolitic and fine calcarenite beds. Supratidal environments are characterized by an abundance of stromatolitic calcilutites and a general absence of fossils with occasional beds of coarse calcirudites or edge-wise conglomerates. Shallow lagoonal deposits may be recognized by fossil-barren calcilutites and the possible occurrence of anhydrite.

Penecontemporaneous dolomitization of supratidal and associated beds was accomplished by mechanisms that included the creation and widespread distribution of waters with high Mg/Ca ratios. Both lagoonal reflux and pore water concentration methods were probably involved; necessary prerequisites included a dry climate and a nearly flat near-tidal sediment surface.

Continuous shifting of environments during West Spring Creek time created a great complexity in the distribution of rock types and environmental entities. However, the percentage distribution of environments among the outcrop sections was able to be mapped. Lagoonal and supratidal beds show the least concentration near the depocenter (10%-20%) and increase in directions away from the depocenter (reaching 50%+). The percent distribution of intertidal and subtidal beds shows a marked reciprocal relationship to the lagoonal-supratidal percentages with the greater percentages of intertidal and subtidal beds occurring near the depocenter and decreasing away from the depocenter.

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Michigan State University

Palynomorphs of the Woodford Shale of South Central Oklahoma with Observations on Their Significance in Zonation and Paleoecology

WILLIAM FREDERICK VON ALMEN, Michigan State University, Ph.D. dissertation, 1970

This study was made to describe the palynomorphs of the Woodford Formation of south central Oklahoma, establish environmental zones, correlate these environmental zones, determine the geologic age of the formation and make a logical interpretation of the environment of deposition of the formation.

Fifty-five outcrop and core chip samples were processed and organic residue slides were utilized to identify palynomorphs, make counts and compare the types of palynomorphs observed to establish environmental zones, compare individual significant palynomorph species to identify the age of the formation and, based on a lithologic examination and the types of palynomorphs and organic detritus (not assignable to known palynomorphs or whole organisms) present in the residues, postulate a logical environment of deposition for the formation.

Ninety-seven palynomorphs are described and/or discussed of which 59 are microspores, 34 are acritarchs, 2 are scolecodonts and 2 are of uncertain affinity. Two of these palynomorphs are described as new genera and three are described as new species. Three palynomorph zones, that illustrate cycles of marine transgression and regression, are present in the formation, although these zones are not definitely correlative from one section to another. Leiosphere zones are also present and in some cases correlative, although their environmental significance is not known.

Data pertaining to the occurrence of palynomorphs of different groups together, separately, and in stratigraphic units of the same

lithology, illustrate that acritarchs possessing processes or membranes are significant in environmental interpretation. They are more abundant in sediments deposited where microspores occur and land-derived nutrients are abundant, than in sediments deposited where leiospheres are the most abundant type of palynomorph, and in cases where they occur in the same lithologic unit they are apparently facies controlled.

Microspore species obtained from the "Woodford (?) Brown Carbonate" are significant in identifying the age of this basal, subjacent unit of the Woodford Formation in the Texas Company #1 Gipson well in Marshall County, Oklahoma as Middle Devonian (Erian). Microspore species obtained from the 333-foot section of the Woodford Formation at Hickory Creek are 1) significant in identifying the basal 10 feet of the formation as probable Upper Devonian (Senecan) in age, 2) inconclusive in identifying the age of the succeeding 298 feet of the formation and 3) significant in identifying the top 25 feet of the formation as Lower Mississippian (Kinderhookian) in age. Microspore species recovered in the Woodford Formation residues of this study are not conspecific with those reported from Devonian-Mississippian black shales in other parts of the United States.

The lithologic similarity of the formation throughout the area of study and the presence of well-preserved organic material in all samples are significant because they support a locus of deposition where reducing conditions were present. Land-derived palynomorphs are not significant in determining water depths in the area although the presence of microspores and acritarchs possessing processes or membranes, and the constant abundance of leiospheres in all samples is suggestive of a relatively constant water depth.

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The Pennsylvania State University

The Rhabdomesidae of the Wreford Megacyclothem (Wolfcampian, Permian) of Nebraska, Kansas, and Oklahoma

GEOFFREY BRUCE NEWTON, The Pennsylvania State University, Ph.D. dissertation, 1970

A detailed study of the rhabdomesid cryptostome bryozoans from the Wreford Megacyclothem (Wolfcampian) of Nebraska, Kansas and Oklahoma was undertaken, attempting at all times to satisfy the two criteria of (a) reproducibility by other paleobryozoologists working on other ramose cryptostomes and (b) as wide-ranging applicability as possible to all bryozoan groups. To establish uniformly applicable concepts, techniques were standardized at all levels of the investigation. Collection (sampling) methods and labelling systems were based on established practices. Modification and extension of the cellulose acetate peel method facilitated examination of about 1100 specimens. Statistics were computed (by an IBM 360/67) for a set of numerical

morphological characters which had been standardly symbolized, in part based on previous work, in part new. These characters of the Wreford Rhabdomesidae were then coded into two-state form, and a cluster analysis with resultant dendrogram was machine generated.

Stratigraphic analysis indicated that very rapid facies changes occur at the Nebraska-Kansas and Kansas-Oklahoma borders with marine Wreford units giving-way rapidly to continental redbeds and channel deposits.

The monothetic generic concepts *Rhabdomeson, Saffordotaxis,* and *Nicklesopora* are synonomized with *Rhombopora.* The generic concept *Syringoclemis* is expanded to include solid-ramose as well as epithecate-ramose zoaria, and the new species *Syringoclemis wrefordensis* is proposed. The skeletal morphology of the two Wreford rhabdomesids, *Rhombopora lepidodendroides* and *Syringoclemis wrefordensis,* is examined in great detail. The apparently non-analogous nature of the mesopores and acanthopores between the Trepostomata and Cryptostomata is explored. Comparison with the skeletal wall structure of the Fenestellidae indicates that laminations of the peripheral zone of the Wreford Rhabdomesidae may represent diurnal periodicity; based on this, the largest of the Wreford rhabdomesids were 18 months to two years old at death. Coordinated with this detailed skeletal analysis, the first reconstruction of ramose cryptostome soft-parts is proffered.

Rhombopora lepidodendroides shows extreme morphologic conservatism, but considerable random variability. The numerical characters of its type specimens show that its average morphologic condition throughout its range (Virgil through Wolfcamp) was constant. Within the Wreford, no systematic variation, either in a geographic (clinal) sense or stratigraphic (microevolutionary) sense was observed.

Paleoecologically the Wreford Rhabdomesidae were most numerous in, and therefore apparently preferred, environments that were of normal marine salinity, quiet, and furthest from shore, that is environments lithologically represented by calcareous shale in the Wreford. The competitive exclusion principle, on the basis of world-wide, North American, and Wreford evidence, may provide an explanation for *Rhombopora lepidodendroides'* dominance over, and eventual total replacement of *Syringoclemis wrefordensis* in the Wreford Megacyclothem.

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Pt. B, v. 32, no. 1, p. 380-B)

The University of Iowa

Upper Mississippian (Chesterian) Ammonoids from the Imo and Rhoda Creek Formations, Arkansas and Oklahoma

WILLIAM BRUCE SAUNDERS, The University of Iowa, Ph.D. dissertation, 1971

The Imo Formation of northeastern Arkansas and the Rhoda Creek Formation of south-central Oklahoma contain rich ammonoid

assemblages of approximately equivalent age. The Imo ammonoids include *Anthracoceras discus* Frech, 1899; *Cravenoceras friscoense* (Miller & Owen, 1944), *Cravenoceras* n. sp. A, *Cravenoceras* n. sp. B; new genus A (type species, *Cravenoceras miseri* Gordon, 1965); *Eumorphoceras richardsoni* McCaleb, Quinn & Furnish, 1964, *Eumorphoceras* n. sp. A; *Peytonoceras ornatum* Saunders, 1966; *Syngastrioceras* n. sp. A; *Somoholites cadiconiformis* (Wagner-Gentis, 1963); *Delepinoceras bressoni* Ruzhencev, 1958; and *Paradimorphoceras* sp. Of these, the Rhoda Creek assemblage contains *Cravenoceras friscoense, Cravenoceras* n. sp. B; new genus A (type species, *C. miseri*); *Eumorphoceras* n. sp. A(?); *Somoholites cadiconiformis* and *Delepinoceras bressoni.* Ammonoid faunas which include common or similar elements are known from the British Isles, France, Spain, Belgium, Holland, Germany, Poland, Yugoslavia; from the Soviet Union, in the Donetz Basin, the Southern Urals, Novaya Zemlaya and Central Asia, and from the Algeria-Morocco border area.

The interval represented by the Imo-Rhoda Creek ammonoid fauna should be known as the *Eumorphoceras richardsoni-Cravenoceras friscoense* assemblage zone. This overlies the well known *Eumorphoceras bisulcatum-Cravenoceras richardsonianum* assemblage, represented in the Sand Branch Member of the Caney Formation in Oklahoma, and in the upper portion of the Pitkin Limestone, northeastern Arkansas. The *E. richardsoni-C. friscoense* Zone correlates to the upper *Eumorphoceras* (E_2) Zone (lower Namurian, Arnsbergian Stage), within the *E. bisulcatum* s.s. (E_2a) and *Nuculoceras nuculum* (E_2c) Zones of the standard European succession.

(Reprinted from Dissertation Abstracts International, Pt. B, v. 32, no. 3, p. 1737-B)

The University of Nebraska

Earthquakes of the Stable Interior, with Emphasis on the Midcontinent. (Volume 1: Text. Volume 2: Catalogue)

JERRY DOCEKAL, The University of Nebraska, Ph.D. dissertation, 1970

This report had two objectives: (1) the study of seismic disturbances, and subsurface information and geophysical-geochemical data pertaining to the tectonic elements of the *Midcontinent Seismic Trend,* which is the major earthquake alignment in the Midcontinent region; and (2) the analysis of pertinent earthquake records, especially as to the relation between isoseismal patterns and basement configuration, structures, and lithology. The latter especially develops a neglected field for systematic investigation, documented by a catalogue of earthquakes and summarized on maps.

The recognition of the *Midcontinent Seismic Trend* is in itself new, being best defined by earthquakes with maximum intensities

ranging from VII to VIII on the Modified Mercalli Scale of 1931. The felt-areas range from about 35,000 to 247,000 square miles. Thus defined, this trend includes the following reference points from south to north: Paris (Texas), El Reno (Oklahoma), Manhattan (Kansas), Tecumseh and Lincoln (Nebraska), Le Sueur (Minnesota), and the Keweenaw Peninsula (Michigan). Earthquakes of this trend are genetically related to the Arbuckle, Nemaha-Table Rock, and Keweenawan Mafic Belt structures, or to combinations of them.

The analysis of isoseismal patterns, which has been mostly unproductive until now, holds great promise, especially for the northern Midcontinent. One important generalization now can be made in this regard: *The isoseismal patterns for earthquakes of the Midcontinent Seismic Trend are especially reflective of basement configuration, structures, and lithology.* Further, the reflection of lithology in isoseismal patterns appears to be closely related to elasticity contrasts of basement rocks.

(Reprinted from Dissertation Abstracts International, Pt. B, v. 31, no. 8, p. 4777-B)

Paleoecology of the Ervine Creek Limestone (Late Pennsylvanian) in the Midcontinent Region

ALLAN DAVID GRIESEMER, The University of Nebraska, Ph.D. dissertation, 1970

The late Pennsylvanian (Virgil Series) Ervine Creek Limestone is a member of the Deer Creek Formation of the Shawnee Group. The Ervine Creek is directly underlain by the Larsh-Burroak Shale and overlain by the Calhoun Shale from southeastern Nebraska to correlative beds in northern Oklahoma.

Samples of the immediately adjacent shales and of the highly variable Ervine Creek lithologies and biologic assemblages demonstrate that extremely shallow water conditions prevailed at the beginning of the Larsh-Burroak deposition and gradually increased in depth through early Ervine Creek deposition. Prior to the middle of Ervine Creek deposition very gradual regression began which ended with extremely shallow intertidal and supratidal conditions. The combination of lithologic and fossil examination reveals seven assemblages within the Ervine Creek Limestone which, from the bottom up, and north to south are the (1) *Crinoid Community Wackestone* (2) *Mixed Assemblage Wackestone* (3) *Fusulinid Assemblage Wackestone* (4) *Phylloid Algal Assemblage Wackestone* (5) *Phylloid Algal Mound Packstone* (6) *Transported Assemblage Packstone* and (7) *Restricted Assemblage Mudstone.*

Water depth during Ervine Creek deposition varied geographically between the three major tectonic regions in the outcrop belt; the Forest City and Cherokee Basins, and the Northeastern Oklahoma Platform, as well as from maximum regression to transgression. In general the depth varied from a maximum of a few tens of feet during deposition

of the *Fusulinid Assemblage Wackestone* and early *Phylloid Algal Assemblage Wackestone* to supratidal during the deposition of the *Restricted Assemblage Mudstone* in southwestern Iowa, northwestern Missouri, and Oklahoma. The most common depth ranged from moderate subtidal to low intertidal. Soft, light buff to white, mudcracked, highly dolomitic mudstone and dolostone are indicative of supratidal conditions along the northeastern shore of the Forest City Basin in Iowa, Missouri and into northeastern Kansas. Finely disseminated dolomite contents as high as 88% were recorded in northwestern Missouri. These dolomitic mudstones contain well-developed laminated and unlaminated, filled and unfilled birdseye structures similar to those described from modern supratidal dolomitic sediments.

Ervine Creek phylloid algal mounds of limited extent were developed in Nebraska and Missouri. However, major algal mound development was restricted to Greenwood and Elk Counties, Kansas where double the normal Ervine Creek thicknesses are recorded. The best phylloid algal mound development is on the flanks of the abutting Beaumont and Bourbon structures. In this area the mounds are developed over megaripples apparently formed originally in the underlying Larsh-Burroak Shale by tidal and other currents in response to movements of the adjacent structures.

The Deer Creek Limestone of northern Oklahoma exhibits the thickest continuous carbonate section in the outcrop area. The lower five feet are black crystalline dolostone, and the upper fifteen feet are lime mudstones deposited in a restricted, quiet, lagoonal environment with a strongly fusulinid dominated fauna. The uppermost beds are relatively unfossiliferous but contain finely laminated cross bedding and intermittent intraformational breccia related to mudflat, tidal breccias in modern sediments.

The rising Arbuckle Mountains in southern Oklahoma were a major clastic source area during Ervine Creek deposition. However, a second source area existed north and east of the southwestern Iowa-northwestern Missouri region. This northern source supplied a continuous flow of sediments into the Forest City Basin throughout Ervine Creek deposition. The only area unaffected by this source area was eastern Nebraska where the most stable carbonate environment in the outcrop area was maintained throughout Ervine Creek deposition.

(Reprinted from Dissertation Abstracts International, Pt. B, v. 31, no. 8, p. 4778-B)

The University of Oklahoma

Palynology of the Sand Branch Member of the Caney Shale Formation (Mississippian) of Southern Oklahoma

REGINALD WILSON HARRIS, JR., The University of Oklahoma, Ph.D. dissertation, 1971

Palynology of the Sand Branch Member of the Caney Shale Formation is described from outcrop samples collected at two mea-

sured sections in Johnston County, Oklahoma. At the type locality of the Sand Branch Member, forty-four channel samples were collected; and from exposures of uppermost Sand Branch strata on Sandy Creek south of Wapanucka, Oklahoma, five additional channel samples were collected. The plant palynomorph assemblage contains 72 genera and 154 species, of which 21 genera and 93 species are considered new. The marine acritarch assemblage consists of 10 genera and 39 species, of which 32 species are considered new. A single questionable plant palynomorph type and a questionable acritarch type were recovered. The acritarch assemblage in the Sand Branch is the largest such assemblage reported to date from Mississippian or Pennsylvanian sediments.

Relative percentages of acritarchs and plant spores in the Sand Branch afford a tripartite zonation of this member. The dominance of acritarchs (99.5% to 100%) in Zone I, the basal 35 feet of Sand Branch strata at the type locality, suggests that the site of deposition was at that time effectively isolated from terrigenously derived plant spores. Zone II, the succeeding 65 feet of sediments, contains acritarchs and plant spores that are approximately equal in number, but which alternate in dominance. Zone II represents the cyclic transition from Zone I into Zone III. Zone III consists of the upper 82.5 feet of strata exposed at the Sand Branch type locality and the 24 feet of Sand Branch exposed on Sandy Creek. With the exception of a single sample that contains predominantly marine palynomorphs, plant spores comprise from 68.5% to 98% of the palynomorphs in Zone III. It is proposed that in southern Oklahoma the dominance in palynomorph assemblages assumed by plant spores in late Sand Branch time (Zone III) was maintained through Goddard and Springer times into the Pennsylvanian.

A minor percentage of Sand Branch palynomorphs were recycled from older stratigraphic units. Acritarchs which were apparently recycled from the Sylvan and Woodford Formations are rare in Zone I, but increase steadily in abundance upward to the middle of Zone III. Their presence suggests that rocks at least as young as Devonian and as old as Ordovician were exposed to erosion during Sand Branch time.

Comparison of the Sand Branch palynomorph assemblage with similar assemblages reported from Mississippian strata of North America, Europe, and Russia suggests an age of Late Mississippian (early to middle Chesterian) for the Sand Branch. On the basis of palynomorph content, upper beds of the Sand Branch (Zone III) and strata comprising the lower part of the Goddard Formation at its type locality are considered time equivalents.

(Reprinted from Dissertation Abstracts International,
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Subsurface stratigraphic Analysis, Lower Hoxbar Group (Pennsylvanian), Dutton-Verden-Norge Trend, Caddo and Grady Counties, Oklahoma

O. A. SAWYERR, The University of Oklahoma, M.S. thesis, 1971

The area of investigation is approximately 168 square miles in western Grady and eastern Caddo Counties, Oklahoma. It is on the northeastern flank of the Anadarko Basin, a northwestward trending structural and depositional basin in southwestern Oklahoma where Paleozoic sediments reach a thickness of more than 35,000 feet. This investigation involves a stratigraphic analysis of the lower part of the Late Pennsylvanian (Missourian) Hoxbar Group, which attains a total thickness of 2,800 feet in this area.

The Hoxbar Group includes strata between the top of the No-Ho-Co "formation" and the base of Marchand. Major sandstone developments in this group are (in descending order): Wade sand, Hedlund sand, Medrano sand and Marchand sand. The Marchand sand is the only sand of economic importance to date in the area investigated.

The major objectives of this investigation were (1) to determine the geometry of the Marchand sand, (2) to reconstruct the paleodepositional environment of the sands and (3) to determine the relative importance of structure versus stratigraphy in oil accumulation in the Marchand sand.

The Marchand sand appear to be marine offshore bars, the tops of which have been partially truncated during a still-stand or regression of the sea. Vertical and lateral variations in porosity and permeability in the reservoir rocks result in oil accumulation in upper, middle, lower and even multiple units within the sand. Structure exerts only minor effects upon accumulation; the trapping mechanism being essentially stratigraphic.

One probable source area of the Marchand sand is to the southeast where sediments were carried by longshore currents from tectonically active source lands within and along the eastern flanks of the Anadarko Basin. Other possible sources include the Wichita Mountains to the southwest, local growth structures such as the Cement anticline, and the shelf area to the northeast which may have been exposed to subaerial erosion intermittently in Early Missourian time.

The Marchand sand extends for more than 16 miles trending northwest-southeast. The first production in the area was discovered in 1967 in N. E. Verden Field. At the end of December, 1970, 45 wells were producing and by the end of May, 1971, 74 producing wells had been completed utilizing 160-acre spacing. The reservoir sand ranges in thickness from zero to 260 feet, the sand is undersaturated and the gas/oil ratios are approximately 700 to 1. Reserves for wells with thickest pay sections are more than 750,000 barrels of oil (Graff, 1971, p. 1687-88).

Similar stratigraphic trends may be present in the upper units of the Hoxbar Group in the area investigated.

Stratigraphy and Origin of Tuffs in the Stanley Group (Mississippian), Ouachita Mountains, Oklahoma and Arkansas

ALAN RANDOLPH NIEM, The University of Wisconsin, Ph.D. dissertation, 1971

Five major tuff sequences (8-120 ft thick) and three minor tuff sequences (96 in to 7 ft thick) are interbedded with marine graywackes and shale in the 10,000 ft thick Mississippian Stanley Group. Seven of these tuffs occur in the basal 1500 ft and one major tuff sequence occurs in the upper 350 ft of the highly folded flysch group. The tuffs in the basal Stanley Group are thickest and best exposed in the southern Ouachitas but are traceable to the central Ouachitas. The uppermost tuff is best exposed in the central Ouachitas.

Three tuff sequences are composed of massive and bedded crystal tuff; two are composed of massive and bedded pumiceous vitric tuff. All five major sequences have massive and locally laminated fine-grained vitric upper portions. Crystal-rich and pumiceous tuff sequences probably reflect different settling and/or eruptive histories.

Crystal tuff sequences originated from crystal enrichment by gravity sorting of pyroclastic debris settling through long water columns, possibly as a result of Vulcanian-type submarine eruptions. Doubly graded bedded crystal tuff was deposited from a series of tuffaceous turbidites and possibly from ash falls. Widespread slumping of bedded crystal tuff produced massive crystal tuff.

Pumiceous tuff sequences probably formed from "nuée ardente" type eruptions. Thick, nonwelded pumiceous vitric tuffs commonly overlain by thin-bedded pumiceous tuffs were produced from submarine ash flows covered by nearly contemporaneous ash falls.

Fine-grained vitric tuff formed from slow settling of very fine ash. The ash was possibly the finest size remnants suspended in settling columns after major eruptions and/or was produced by less violent ash falls. Rare cross-bedding is evidence for some current reworking. Tuff thickness, grain size trends, paleocurrent indicators, and paleogeography suggest a southern volcanic source, possibly the buried Luling overthrust front in Texas.

A southern proximal and northern distal flysch facies occurs in the strata between the lower Stanley tuffs. Sandstone geometry, lithology, sedimentary structures, and sandstone to shale ratio in the proximal and distal facies are similar to modern deep sea fan and associated basin sediments off the California coast. A local high existed in the Ouachita trough in northeastern Montgomery County, Arkansas, during the deposition of lower Stanley strata as indicated by 1) the occurrence of local novaculite conglomerate lenses; 2) an unconformity; and 3) thinning of the tuffs and strata between the tuffs toward the high.

(Reprinted from Dissertation Abstracts International, Pt. B, v. 32, no. 7, p. 4013-B)

Geologists and Planners Meet in Wichita

Interdisciplinary collaboration meshed successfully in a 1-day symposium entitled "The Role of the Earth Scientist in Community Planning and Development," held in Wichita, Kansas, on February 12, 1972. Co-sponsors of the meeting were the Arkansas Valley Chapter of the American Institute of Planners (AIP) and the Oklahoma Section of the American Institute of Professional Geologists (AIPG). Technical sessions dealt with several aspects of geological and engineering information essential for intelligent planning in the urban environment.

Oklahoma was represented on the program by Tulsa geologists Arthur R. Troell and James E. O'Brien, who spoke on problems of surficial drainage alteration and on pollution, and by W. H. Watson and Adelaide Binstock of the Oklahoma City Department of Planning, whose topic concerned the utilization of geological data in a planning approach based on computer evaluation.

The meeting, which attracted some 75 participants, was co-chaired by W. B. Creath (AIPG) of Tulsa and Pat Painter (AIP) of Oklahoma City.

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