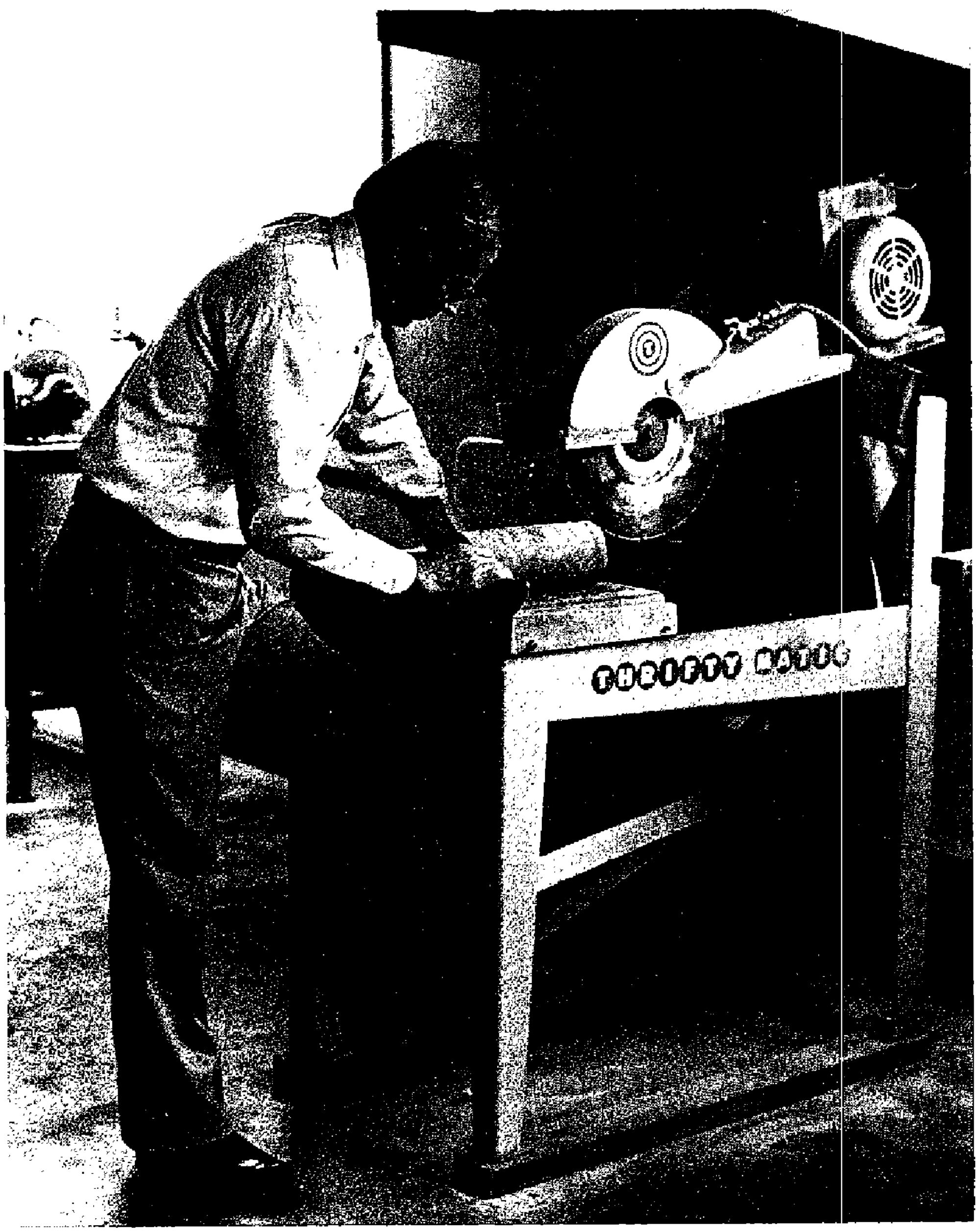
Oklahoma Geology Notes

OKLAHOMA GEOLOGICAL SURVEY / VOL. 43, NO. 1 - FEBRUARY 1983



On the cover—

Cores and Samples Processed at Geological Survey Library

This month's cover photo shows Eldon Cox, manager of the OGS Core and Sample Library, preparing to cut a core in the Library's examination room.

A revised and updated catalog of well cores reposited in the Library has recently been issued as OGS Special Publication 82-6. The listing, which includes material on file as of November 1982, was compiled by Eldon Cox, with assistance from Michelle J. Summers, who computerized the information on the OGS word-processing equipment. L. Joy Hampton verified depth figures and formation designations.

Cores are identified by locality (section, township, and range), by operator, by fee (owner of mineral rights on the lease), by depth, and by geological formation as identified by the operator.

Cox, who has been manager of the Core and Sample Library since 1971, reports that 2,139 wells are represented in the collection and that no out-of-state material is stored in the library. Cores and samples are obtained through donations from petroleum and natural-gas producers. Materials are held confidential for a period of one year, if desired, at the end of which time they are made available to the public. Cores can be examined at the library for $3.00 per box, or they can be borrowed for 30 days for $5 per box plus shipping charges.

The Core and Sample Library also has an extensive collection of cores taken from coal-bearing rocks and other economic-mineral deposits. Cox explains that although these cores are not listed in the catalog, they are readily accessible for borrowers.

The new core-collection catalog can be obtained from the Survey office at the address given below. The price is $3.

Oklahoma Geology Notes

Editor: Connie Smith
Editorial Staff: Elizabeth A. Ham, William D. Rose

Oklahoma Geology Notes, ISSN 0030-1736, is published bimonthly by the Oklahoma Geological Survey. It contains short technical articles, mineral-industry and petroleum news and statistics, reviews, and announcements of general pertinence to Oklahoma geology. Single copies, $1.50; yearly subscription, $6. All subscription orders should be sent to the Survey at 830 Van Vleet Oval, Room 163, Norman, Oklahoma 73019.

Short articles on aspects of Oklahoma geology are welcome from contributors. A set of guidelines will be forwarded on request.

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Contents

This publication, printed by the Transcript Press, Norman, Oklahoma, is issued by the Oklahoma Geological Survey as authorized by Title 70, Oklahoma Statutes, 1971, Section 3310, and Title 74, Oklahoma Statutes, 1971, Sections 231–238. 1,800 copies have been prepared for distribution at a cost to the taxpayers of the State of Oklahoma of $1,928.

CROMWELL-UNION VALLEY (LOWER PENNSYLVANIAN) RELATIONS IN EASTERN OKLAHOMA

Julian M. Busby[1]

Introduction

The Cromwell sandstone sequence (Lower Pennsylvanian, Morrowan) is possibly one of the least understood stratigraphic units in eastern Oklahoma. This is true both in its stratigraphic makeup and in its relationship to the formations above and below.

The Cromwell is overlain unconformably by the Union Valley limestone, with the Union Valley truncating the Cromwell northward and westward (shoreward) on a regional basis. This angular unconformity is especially marked in several local areas, including T12N–R11E, in eastern Okfuskee County, Oklahoma (fig. 1).

In this note, both the Cromwell sandstone and the Union Valley limestone are treated in an informal stratigraphic sense, as the Union Valley Formation has been defined to contain sandstone beds in its lower part that have been correlated with the Cromwell (see, e.g., Jordan, 1957, p. 52, 199).

Cromwell Stratigraphy

In the late 1950's, I made a study of the Cromwell sandstone sequence in which I constructed two regional electric-log cross sections that were "hung" on a key well in sec. 12–T4N–R8E, in Pontotoc County, Oklahoma, the Pine 1 Busby. Three Cromwell sandstone intervals, separated by two shale units, are well developed and easily distinguished on the electric log from this well. The basal sandstone is more than 100 ft thick, and the middle sandstone, 70 ft.

As determined from this cross-section study, the entire Cromwell unit thins shoreward, generally to the northwest, in all of these members. Also, each of these members is progressively truncated by the overlying Union Valley limestone to the north and (or) west to the point at which the Cromwell has been entirely truncated and the Union Valley limestone rests on a Lower Pennsylvanian shale stratigraphically lower than the Cromwell.

[1]Busby and Associates, Muskogee, Oklahoma.

Union Valley Stratigraphy

The Union Valley limestone, which overlies the Cromwell sandstone unconformably, is also of Morrowan (Early Pennsylvanian) age. It is composed of buff to white, microcrystalline to coarsely crystalline limestone. In many areas the unit is a microfossil coquina, and locally it contains fine-grained sandy intervals. The basal part of the unit is dolomitic locally.

Near the contact with the underlying Cromwell sandstone, several constituents indicative of unconformities are commonly present, including glauconite, pyrite, and a microbreccia of limestone with some sand.

The thickness of the Union Valley limestone in many areas varies little over an entire township, thinning gradually shoreward. It is in these areas that it is a reliable structural marker.

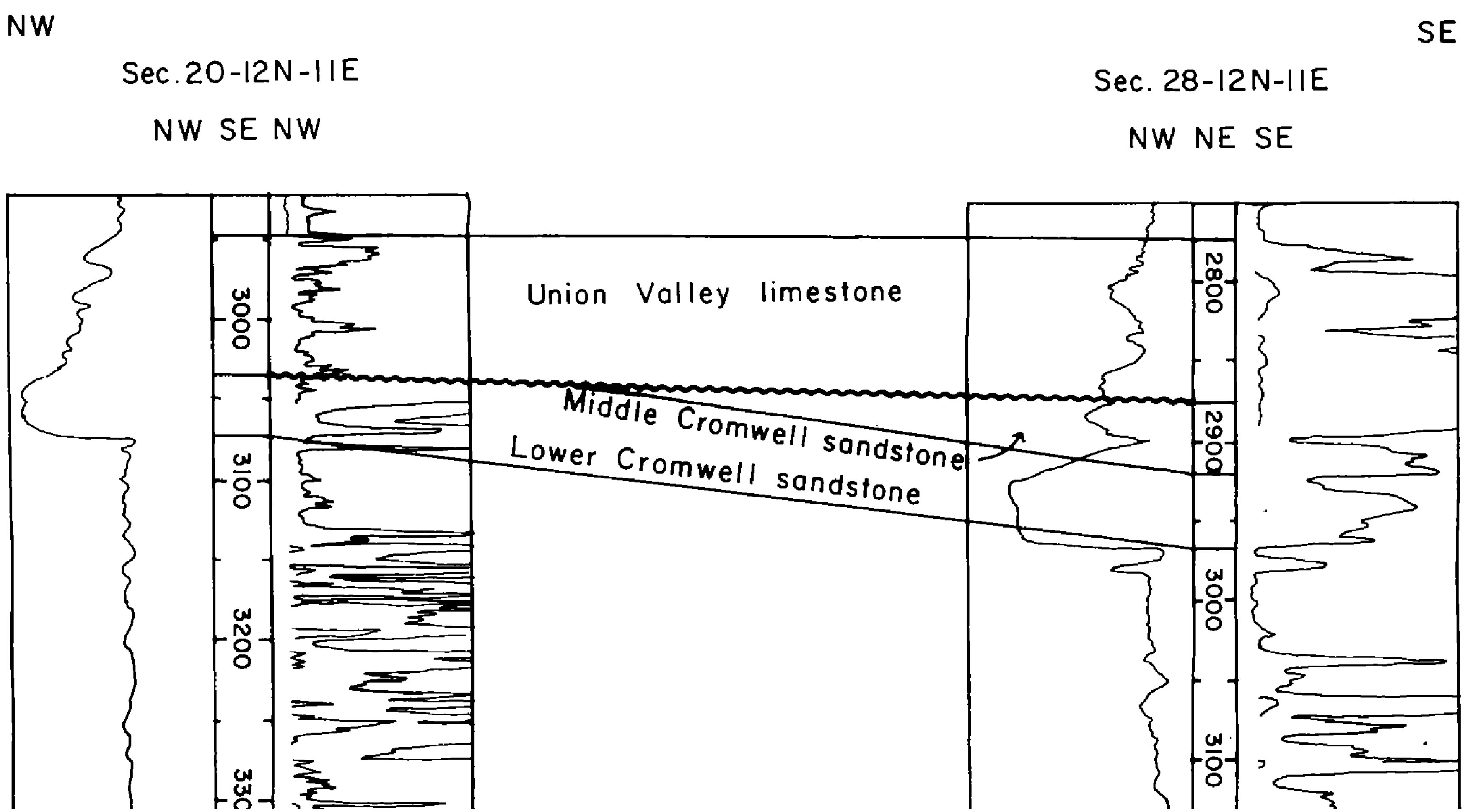
But shoreward, as in the eastern part of T12N–R10E, in northern Okfuskee County, the Union Valley limestone is completely unreliable for use as a marker because of its abrupt thinning from about 100 ft to 10 ft over a horizontal distance of 660 ft (fig. 2). The area of this thin lime deposition extends for some 15 mi shoreward from the massive member. Streams flowing southeastward to the sea from the headlands to the north and west eroded the thin limestone in this region and replaced it with sand (which is glauconitic). Many of these meandering stream channels can be mapped for more than 20 mi.

Geologic Interpretation and Economic Success

Recognition of the three sandstone zones in the Cromwell is of more than academic interest; it has economic significance. But in most reports (drillers' and geologists') the term Cromwell is applied to the first sandstone below the Union Valley limestone without differentiating which of the three sand zones of the Cromwell was encountered. Indeed, it would be impossible to tell unless the well were drilled into correlatable beds below the basal Cromwell sand.

In the area of the Lyons-Quinn Pool, in the eastern half of T11N–R11E, Okfuskee County, two sand zones are present below the Union Valley limestone. The upper sand was called the Cromwell, and the lower, the Jefferson.

In the early drilling of this pool the oilmen of the day faced an enigma. The first, or top, sand of the Cromwell produced oil in large quantities. The second sand of the Cromwell, called the Jefferson in this area, produced gas up to rates of 30 MMcfd. This vertical sequence of hydrocarbon accumulation is the opposite of what one generally expects in a structural trap: gas in the high part, then oil, and last, water. To further compound the confusion of the early oilmen, water was present in the upper sand on the flanks of the structural dome, whereas gas was still encountered in the Jefferson sand below. The reason for this now is obvious: the reservoir in the lower sand is more extensive than in the upper sand. This is a good illustration of the confusion that can result whenever a sandstone body encountered in a well


NW
Sec. 20-12N-11E
NW SE NW
SE
Sec. 28-12N-11E
NW NE SE
Union Valley limestone
Middle Cromwell sandstone
Lower Cromwell sandstone
3000
3100
3200
330
2800
2900
3000
3100

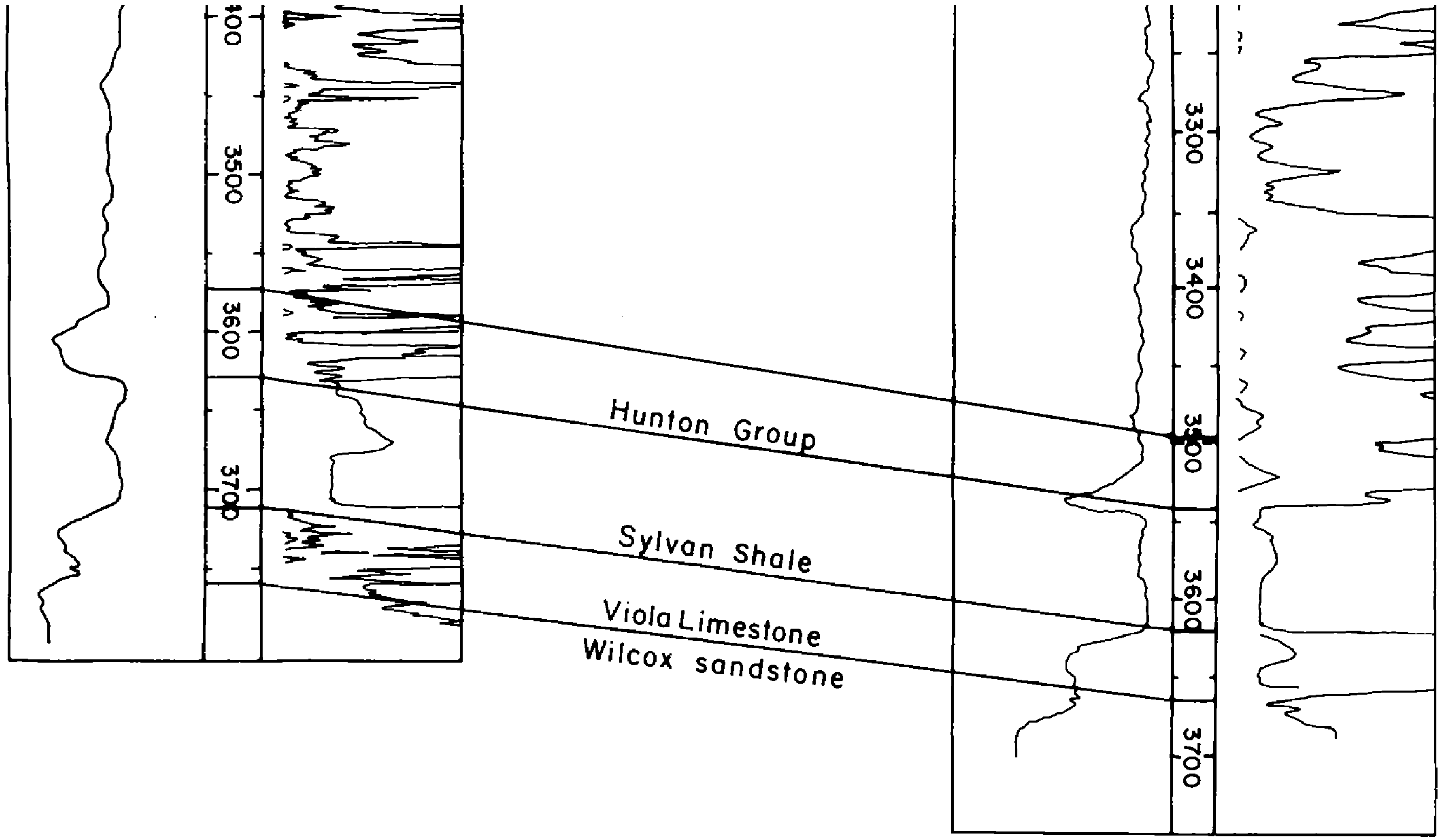


Figure 1. Electric-log cross section in T12N–R11E, Okfuskee County, Oklahoma, showing Cromwell sandstone sequence being truncated northwestward (shoreward) by overlying Union Valley limestone.

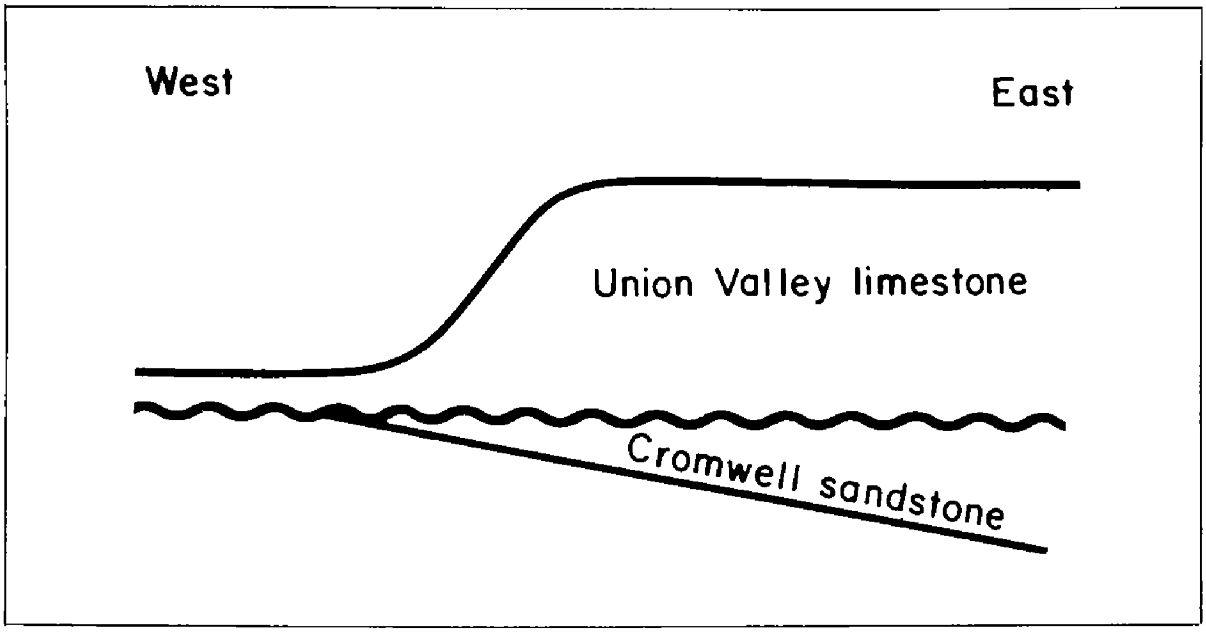


Figure 2. Cross section illustrating abrupt thinning of Union Valley limestone from east to west, as in eastern part of T12N–R10E, Okfuskee County.

is termed "Cromwell" without regard to its stratigraphic position within the entire Cromwell interval — in other words, whether it is the upper, the middle, or the lower sand unit.

Another example of how an understanding of the Cromwell sands and the unconformably overlying Union Valley limestone can be of economic value is demonstrated by examining an area 6 mi west of Okemah, Oklahoma, in sec. 18–T11N–R9E, in western Okfuskee County.

North and east of sec. 18, structural domes are present. Several oil wells in sec. 7 were completed in the Union Valley limestone. Completion data, however, reported the completion zone as Union Valley-Cromwell, or Cromwell. In this area the geology around these domes is much the same as that illustrated in figure 1; that is, the Union Valley overlies the Cromwell in unconformable angularity. But here the Union Valley has completely truncated the entire Cromwell sequence and rests on the Lower Pennsylvanian shale below the Cromwell. Electric logs from wells downdip from these domes show the basal Cromwell sand to be present in these structurally lower areas.

By constructing cross sections, the extent of this basal Cromwell sand unit, which has been eroded updip, was predicted. As the limit of this sand was 30 to 50 ft downdip from the crest of the domes, it was only a matter of contouring the post-Cromwell-unconformity surface to determine the structurally high part of this sand, which turned out to be an embayment between the two domes and an area flanking the domes.

The analysis resulted in the completion of several wells in the basal Cromwell sand. Incidentally, some of these wells were offset by dry holes, drilled by operators of adjoining leases, because the locations were staked beyond the limit of the sand.

One last comment can be made about interpreting Cromwell-Union Valley relations and lithology.

By referring to figure 1, it can be seen from the electric log of the well drilled in sec. 20 that the Cromwell sandstone zone is represented by a clean, porous sand. Thus the unconformable Cromwell-Union Valley contact can be identified with no difficulty. The electric log of the well drilled in sec. 28, however, illustrates the problem of picking the Cromwell-Union Valley contact on the log without analyzing the samples as well.

As can be seen on the electric log, the upper part of the Cromwell sand zone is calcareous, which attenuates the SP (spontaneous-potential) curve on the left side of the log so that it tends to resemble the electric-log characteristics of the overlying Union Valley limestone. On such electric logs therefore, it is almost impossible to pick the top of the Cromwell with assurance.

I interpret the calcareous content of the upper part of the Cromwell in such areas as the result of redeposition or reworking of the lime within the sand from the calcareous environment associated with deposition of the overlying Union Valley limestone.

An example of this condition is provided by an oil pool developed in sec. 16–T10N–R11E, just west of Weleetka, Oklahoma, in southern Okfuskee County. In the structurally high wells in this pool the Cromwell sand is impermeable and nonporous, owing to the secondary deposition of lime within the sand in several of the wells. As a result, these structurally high wells are dry in this zone, whereas the downdip wells produce oil from clean, porous sand.

Naturally, this situation would be most frustrating to any explorationist who believes that being structurally high is always good. But those geologists who examine all the geologic evidence on both a local and a regional basis are better equipped to discern hydrocarbon reservoirs and traps, whether structurally or stratigraphically controlled.

Reference Cited

Jordan, Louise, 1957, Subsurface stratigraphic names of Oklahoma: Oklahoma Geological Survey Guidebook 6, 220 p.

GOVERNOR'S ENERGY CONFERENCE FOCUSES ON COAL IN OKLAHOMA

On Wednesday, November 17, 1982, Governor George Nigh, in conjunction with the State Chamber of Commerce, convened the third Annual Governor's Energy Conference, in Tulsa, featuring coal for the first time.

Some 300 persons crowded into the meeting room in a hotel amid spinning tapes from local radio stations and mini-cameras from Tulsa and Oklahoma City television.

In his keynote address, Governor Nigh said that his office is working with federal agencies to draft more realistic environmental guidelines so that more Oklahoma coal can be used within the State. This action is required because Oklahoma's air is of such pure quality that federal clean-air standards for the State are high, and any additional pollution pushes it over the federal limits that forbid any deterioration in the State's air quality. Nigh said that energy-producing states must convince nonproducing states that if the country is to be energy independent, "You've got to be pro-producer."

The second speaker was Kenes Bowling, executive director of the Interstate Mining Compact, of which Oklahoma is a member. Bowling said that America's coal industry offers energy dependability that no foreign country can match. He urged the conference participants to lobby for government action to aid a generally depressed coal industry, and to find a balance between free-wheeling capitalism and overregulation.

The third speaker was the Oklahoma Geological Survey's senior coal geologist, Samuel A. Friedman, who announced that it was time to bring those concerned about Oklahoma coal up to date on recently completed OGS coal investigations and other coal facts. For example, OGS Map GM-23, *Map Showing Potentially Strippable Coal Beds in Eastern Oklahoma,* consists of four maps showing 21 strippable coal beds, and Map GM-24, *Map of Eastern Oklahoma Showing Locations of Active Coal Mines, 1977–79,* shows the locations of coal mines that were active in 1977–79 in eastern Oklahoma. The maps, which show sulfur contents, Btu values, thicknesses, and depths of the coal resources plus thicknesses of overburden, should provide an excellent basis for coal exploration and development.

Tabulating production data provided by the Oklahoma Department of Mines, Friedman observed that in 1981 a new record high of 5.7 million tons of coal was produced in Oklahoma despite high costs and soft markets. He also stated that most of this coal averaged 3.6 percent sulfur content and was shipped to Kansas and Missouri for electric-power manufacture, while 12 million tons of subbituminous coal, averaging 0.4 percent sulfur and 8,200 Btu content, from the Powder River Basin region of Wyoming was shipped by rail to seven Oklahoma electric-power-generating units.

Friedman reported on the latest summaries of Oklahoma's coal reserves by stating that 7.8 billion short tons of bituminous-rank coal make up the identified resources in 19 counties and 8,000 sq mi in eastern Oklahoma. These resources average 2.3 percent sulfur content and occur in 21 coal beds that are at least 1 ft thick. One coal, the Hartshorne, is 7 ft thick at some places.

Only 2.5 billion tons of the total resources are net recoverable reserves accessible by surface- and underground-mining methods. Net recoverable reserves consist of coal that is recoverable in spite of social obstacles such as conflicting land use and coal underlying urban areas, rivers, and lakes. And it is coal that is recoverable in spite of complex geologic structures, such as overturned folds and faults, and that is recoverable in spite of excessive depths. Net recoverable reserves are also restricted to beds no greater than 1,500 ft deep (in Oklahoma), and this coal must be ≥ 3 ft thick for underground mining and ≤ 150 ft deep and ≥ 12 in thick for strip (surface) mining. The remaining strippable resources reported by the OGS are 680 million tons, and the recoverable reserves reported by the U.S. Department of Energy's Energy Information Administration are 390 million tons. Friedman stated that cumulative coal production from 1873 through 1981 in Oklahoma is 236 million tons.

Coal investigations continue at a rapid pace at the OGS and include projects on coal-bed mapping, stratigraphy, resources and reserves, and analyses including trace and minor elements.

Following the three key speakers, many individuals from government and industry spoke for 5 minutes each on topics such as "The Government Perspective: Regulatory Outlook" (they have a smaller staff and smaller budget than last year); "Transportation Issues: Getting Coal to Market" (Oklahoma ships coal by rail, truck, and barge at ever-increasing costs); "The Producers Perspective: Barriers to Production" (primarily government overregulation and labor problems); and finally, "Future for Oklahoma Coal" (in-State use of Oklahoma coal in local cement plants and industries continues, and possible use of Oklahoma coal in in-State electric-power plants was considered but may not be economically feasible).

Samuel A. Friedman

MANKIN NEW PRESIDENT OF MID-CONTINENT SEPM

Dr. Charles J. Mankin, director of the Oklahoma Geological Survey and executive director of The University of Oklahoma's Energy Resources Institute, is the new 1982–83 president of the Mid-Continent Section of the Society of Economic Paleontologists and Mineralogists (SEPM).

Serving with Dr. Mankin are: president-elect, Raymond L. Ethington, Department of Geology, University of Missouri, Columbia, Missouri; vice-president, John David McFarland III, Arkansas Geological Commission, Little Rock, Arkansas; secretary, Harold A. Brown, TXO Production Corp., Wichita, Kansas; and treasurer, Dorothy Jung Echols, Department of Geology, Washington University, St. Louis, Missouri.

SURVEY ISSUES PUBLICATION ON GEOLOGICAL-INFORMATION SYSTEMS

The Oklahoma Geological Survey has published a two-volume set containing the proceedings of the Second International Conference on Geological Information which was held May 23–27 of 1982 at the Colorado School of Mines in Golden, Colorado. Attending the conference were approximately 170 delegates, representing 16 countries.

Issued as OGS Special Publication 82–4, the proceedings were edited by Claren M. Kidd, geology librarian in the School of Geology and Geophysics of The University of Oklahoma.

Volume 1 of the 427-page publication contains 20 papers that cover the "state of the art" of selecting, storing, and making accessible published, graphic, and computerized items pertaining to the earth sciences and related disciplines. Volume 2 incorporates 23 papers that explain specific systems and services offered in various parts of the world.

OGS Special Publication 82–4 can be obtained from the Survey at the address given inside the front cover. The price is $10 per set.

NEW OKLAHOMA MAP OUTLINES REPORTED URANIUM OCCURRENCES

A new map released by the Oklahoma Geological Survey shows 394 localities where uranium and other radioactive substances, almost entirely in trace amounts, have been reported in Oklahoma. Issued as OGS Map GM-25, *Map of Oklahoma Showing Localities of Reported Uranium and Radioactive Values* was compiled by Matthew W. Totten, former OGS research assistant, now with K & E Petroleum Co. in Wichita, Kansas, and Robert O. Fay, OGS geologist.

Totten and Fay point out that only one locality has produced commercial uranium ore. In 1956, 13 tons of carnotite ore that averaged 2.2 percent U_3O_8 was mined at Cement, in Caddo County, from the Rush Springs Sandstone of Permian age. Virtually all the State's other uranium occurrences are currently considered to be noncommercial.

GM-25 has been printed on a single large sheet at a scale of 1:750,000, or 1 in. equals approximately 12 mi. Included on the sheet is information on the type of samples taken from each locality for testing; the geologic formation or other source; the exact location by section, township, range, and county; and results of testing if available. The 16-page booklet accompanying the map summarizes what has been learned in past investigations of uranium and radioactivity in Oklahoma in rocks of various geologic ages and also discusses the geology, isotope chemistry, and mineralogy of uranium, and methods used in analyses for detecting and measuring uranium content.

Map GM-25 can be obtained from the Oklahoma Geological Survey at the address given inside the front cover. The price is $4.

SO WHAT'S THE WORTH OF A GEOLOGIC REPORT?

In a recent article, Arthur A. Socolow, state geologist of Pennsylvania, has taken a look at criteria for measuring the worth of geological publications (Pennsylvania Geology, *v. 13, no. 5, October 1982).*

With his permission, we are reprinting his thought-provoking article.

Recently a highly dedicated watchdog of space and dollars suggested we dispose of our stock of published geologic reports because many of them are more than two years old. People who publish are supposed to know that it's all over for a book after a year and a half. I tried to explain that while Pennsylvania has undergone numerous geological upheavals over the millions of years, our geological reports would still be valid and useful after several decades. Our efficiency expert didn't give up. How come, said he, most of the geologic reports we have issued only sell 20 to 50 copies a year—how important can they be?

Good question: How important is a geologic report? How much is the report worth if it enables the highway department to pick a route that saves millions of dollars in construction costs? What's the value if the report identifies the location of mineral deposits needed to provide lime for the farmers, clay for the brickmakers, or coal for the steel industry? To justify its existence, how many copies of a geologic map must be sold which shows the location of geologic faults hazardous to nuclear power plants, and the location of sinkholes hazardous to schools and dams? How do you assess the value of a geologic report which identifies the location of groundwater needed to locate a new glass factory employing hundreds, or a sprawling, new multimillion dollar bottling operation? If our reports lead to natural gas occurrences that heat our homes, and dam sites that keep them from being flooded, must we sell as many copies as *Gone With the Wind* to justify their existence? Among those who tunneled the Turnpike, designed routes 80 and 81, engineered the renewal of Philadelphia, developed water wells for thirsty Lehigh, Bucks, and Chester Counties, rehabilitated the stripped lands of Western Pennsylvania, none of those eager users of our geologic reports were less thankful because the reports were done 10 years ago and the sale of the publications did not make the Times' best seller list.

To those who concern themselves over cost benefit ratios, turnover, and timeliness, we who issue geologic reports say: Rest easy. Be assured the value of the report is not measured by its $4.75 price (plus tax); nor does its 1962 date relegate it to the uselessness of a vintage phone book; nor does its annual sale of 47 copies measure real need. Whether they provide mineral raw materials for our industries, locate the waters needed for our survival, identify the geologic hazards that can ruin us, or assist the roadbuilders, farmers, and recreation planners, our geologic reports measure up well to the test of time and value.

Arthur A. Socolow

COURSES SLATED BY OU

A series of courses, workshops, and seminars ranging from "Oil Patch Communications" to "Hazardous Waste and Water Quality Management" is being offered through The University of Oklahoma's Center for Continuing Education. The courses are designed for professionals in the fields of real estate, accounting, banking, law, marketing, computer and data processing, and for petroleum landmen and Chamber of Commerce officers.

The courses, which last from one to four days, are offered on a general subscription basis or can be specifically tailored to meet the particular needs of an organization. The list of sessions available falls into such categories as computer courses, economic-development courses, petroleum-landmen's institutes, professional-skills courses, and courses for women in business.

For additional information about the programs, or if you want to be added to the mailing list, write: Research and Marketing, Continuing Education and Public Services, 1700 Asp Ave., Norman, OK 73037.

HAMPTON AND HARRISON SERVE ON CORPORATION COMMISSION COMMITTEE

L. Joy Hampton and William E. Harrison, petroleum geologists with the Oklahoma Geological Survey, have received distinguished service citations from the Oklahoma Corporation Commission's Oil and Gas Division for their work done while serving on the division's Emergency Contingency Plan Industry Advisory Committee. In January of 1982, the Commission invited representatives from major companies, independents, service companies, and state agencies to Roman Nose State Park to participate in developing a contingency plan to deal with any emergency field situations in the State.

Four committees were formed at the first meeting: Accidents & Fatalities; H_2S Toxic Gas; Blowouts & Fires; and Spills, which was later subdivided into two subcommittees on (a) Spills and (b) Removal of Hazardous Waste From the Drill Site.

Harrison represented the Oklahoma Geological Survey on the H_2S Toxic Gas Committee, and Hampton represented the Survey on the committee considering the removal of hazardous waste from the drill site.

The members of the five committees met a number of times and submitted their recommendations to the Corporation Commission for consideration before a public hearing which took place in July 1982. The committee reports have been compiled by the Corporation Commission staff, and this final report is offered before the public hearings that were slated for January 1983.

Copies of the guidelines are available at no charge from Oklahoma Corporation Commission Oil & Gas Division, Attention: Linda Keeling, 220 Jim Thorpe Building, Oklahoma City, OK 73105.

COAL RESOURCES, ACTIVITY MAPPED BY OGS

New maps released recently by the Oklahoma Geological Survey will provide information both on coal fields that are considered to be minable by surface methods and on coal-mining activity during the period 1977–79 in 14 counties in eastern Oklahoma.

Map GM-23, *Map Showing Potentially Strippable Coal Beds in Eastern Oklahoma,* consists of four sheets that delineate the many potentially minable coal beds in an area extending from Craig and Nowata Counties in the northeastern part of the State southward into Coal, Atoka, Pittsburg, Latimer, and Le Flore Counties. For purposes of showing the coal beds, authors Samuel A. Friedman, OGS senior coal geologist, and assistant Ronald J. Woods, former student research specialist with the Survey, divided the area into a northern segment, a central segment, a southwestern segment, and a southeastern segment.

In addition to delineating the many potentially minable coal beds in this part of Oklahoma, the authors have provided information on maximum strippable depths and on outcrops. Previously strip-mined areas are indicated also. A geologic column printed on each sheet shows the stratigraphic positions and the lithologies of formations in which the coal beds occur and indicates the positions of the coals within those formations. With the exception of the Late Pennsylvanian (Missourian) Dawson coal, all the commercial coal beds are of Middle Pennsylvanian (Desmoinesian) age.

Much of the information offered in GM-23 represents the unpublished results of field investigations by Friedman and LeRoy A. Hemish, who is also a coal geologist with the Survey. Additional information was obtained from the Oklahoma Department of Mines, from industry, and from OGS and U.S. Geological Survey publications.

Map GM-24, *Map of Eastern Oklahoma Showing Locations of Active Coal Mines, 1977–79,* locates coal mines, preparation plants, two loading docks, two port facilities, and a tailings-recovery operation in the coal fields of the eastern part of the State.

Map author Friedman includes for 196 localities data on the producers, names of the coal beds mined, thicknesses of coals and of overburden, sulfur content, Btu values, uses to which the coal from each mine was put, and annual production ranges. Friedman was assisted in preparing the map by K. C. Sawyer.

Maps GM-23 and GM-24 can be obtained from the Oklahoma Geological Survey by writing to the address given inside the front cover. The price for GM-23 is $5; GM-24 is $3.

USGS COMPUTER FILE LISTS OKLAHOMA PLACE NAMES

A computerized file of Oklahoma place names has been developed by the U.S. Geological Survey and is now available for use through its office in Rolla, Missouri. The file includes the names and locations of more than 12,200 places and features within the State.

The system, which is part of the nationwide Geographic Names Information System (GNIS) developed by the USGS, is capable of retrieving, manipulating, arranging, and analyzing geographic-name information to meet a variety of needs. For each feature listed, the alphabetical finding list for Oklahoma provides information on the name, type of feature, location by county and by geographic coordinates, elevation where applicable, and names of USGS topographic maps on which the feature is located. Included in the listing are such features as towns, schools, reservoirs, parks, streams, valleys, springs, and ridges.

The GNIS is being developed to assist in establishing uniform name usage in the federal government, to provide an up-to-date index of names found on federal maps, and to eliminate duplication and the need for different government agencies, private companies, and institutions to spend large amounts of money and time in organizing similar basic-data files for varying needs.

The data have been formatted to save users time and hence money in being able to quickly pinpoint latitude and longitude coordinates of geographic places or features which, in turn, will enable users to provide specific information for searching product or information data bases.

The geographic names of all states and territories are included in GNIS. Products of the system include the spiral-bound alphabetical finding lists that are now available for Oklahoma and 42 other states. The finding lists eventually will be replaced by the more complete National Gazetteer series.

The GNIS listing for Oklahoma, or information on specific geographic names in the State, is available from the National Cartographic Information Center, Mid-Continent Mapping Center, U.S. Geological Survey, 1400 Independence Road, Rolla, MO 65401.

A computer printout of the entire GNIS listing for Oklahoma can be purchased for $18 from the same address. Microfiche copies are $2, and magnetic tapes are $75. Mail orders must include checks or money orders payable to the U.S. Geological Survey.

NOTES ON NEW PUBLICATIONS

AGI Data Sheets for Geology in the Field, Laboratory, and Office, revised

AGI's recently released set of data sheets covers 65 topics, including geologic-map symbols, criteria for determining top and bottom of beds and size of sedimentary particles, earthquake effects, classification of soils, outline for environmental-impact statements, sources of geological information, geologic distribution of life forms, and the plate-tectonics hypothesis.

The set was compiled by Richard V. Dietrich, J. Thomas Dutro, Jr., and Richard M. Foose. The 170-page set has been issued in loose-leaf form on 4- by 7-in. tear-resistant paper, encased in a sturdy notebook.

Order from: American Geological Institute, 5205 Leesburg Pike, Falls Church, VA 22041. Price: $12.95.

Directory of Geoscience Departments in the United States and Canada

The new 21st edition of this directory reports an astonishing 100-percent response rate from the colleges and universities surveyed to compile the statistics presented in this 190-page volume. Among the statistics: 778 departments, 19 more than before; 896 new faculty names; and a number of other interesting and useful breakdowns of information. Only 127 of the departments are actually called "Department of Geology" or "Geology Department," while variants such as "Department of Earth and Space Sciences" seem to be in vogue.

Order from: American Geological Institute, 5205 Leesburg Pike, Falls Church, VA 22041. Price: $16.50.

Uranium Exploration Methods

Papers presented at a June 1982 major international symposium in Paris on uranium-exploration methods are now available in a proceedings volume.

Presented at the symposium were approximately 50 papers that summarized results of collaborative work in eight areas.

Order from: OECD Publications and Information Center, Suite 1207, 1750 Pennsylvania Ave., NW, Washington, D.C. 20006. Price: $48.

Simple Seismics

A new title in a series of short-course handbooks, *Simple Seismics* is aimed at geologists, reservoir engineers, log analysts, processing technicians, and others in the field who may not practice the seismic method but need an understanding of it to solve other problems. The author feels that the book might also be of value to the practitioner who would like to take a broader view.

Included in the 168-page publication are 110 illustrations and chapters on seismics and structure, borehole seismics, and the proper functions and cost-effectiveness of seismic tools.

Order from: IHRDC Publications, Book Order Dept., 137 Newbury St., Boston, MA 02116. Price: $26.50 cloth, $18 paper.

Sandstone Depositional Environments

AAPG Memoir 31 has been specifically designed for use by the non-sedimentologist, the petroleum geologist, or the field geologist who needs to use sandstone depositional environments in facies reconstruction and environmental interpretations.

The book emphasizes the importance of environmental analysis to exploration and production geologists. Prediction of sandstone trends depends on the accurate interpretation of environments. Likewise, predictions of diagenetic alteration and isolation of the most favorable reservoir bodies within an environment generally depend critically on detailed study of microenvironments. The book, which has been called AAPG's most ambitious book ever, is illustrated with cross sections, diagrams, and pictures of sedimentary structures. The text focuses on the recognition of depositional environments rather than on hydrodynamic mechanisms of sediment movement.

Included in the 410-page book are chapters on glacial sediments, eolian deposits, alluvial-fan deposits, and other features.

Order from: AAPG, P.O. Box 979, Tulsa, OK 74101. Price: $32, AAPG–SEPM members; $38, nonmembers.

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This updated 22d edition includes information on 26,500 key personnel from more than 3,500 companies at more than 7,000 locations. A black-and-white version of PennWell's *Petroleum Basin Map of the U.S.* is included with purchase of the 1983 *Directory*.

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User Guide to the Bibliography and Index of Geology

Editor John Mulvihill, at American Geological Institute headquarters, has put together a 160-page guide for those who want to use the *Bibliography* more effectively.

Chapters 1–3 tell the new or occasional user what to expect. Included are tips on scanning the monthly issues for current-research awareness and guidelines for planning a systematic search of the cumulative volumes. The publication also describes types of documents covered and lists the general criteria for inclusion and specific exclusions.

Chapters 4–6 provide tools with which to search the subject index effectively and explain the three-level index system used. A listing of all entry terms used in the subject index is also included.

Order from: American Geological Institute, 5205 Leesburg Pike, Falls Church, VA 22041. Price: $8.95. Discounts are available for bulk orders. One copy of the *User Guide* will be mailed, free of charge, to each subscriber of the *Bibliography and Index of Geology* for 1983. Call toll-free (800) 336-4764.

Handbook of Geothermal Energy

Gulf Publishing Co.'s new book on geothermal energy outlines both technical and economic considerations for those interested in this field, and focuses on recent U.S. advances in geothermal exploration and production. The material presents a review of significant "hands-on" developments for using this energy source, and discusses the equipment and methods in use today.

The book was edited by L. M. Edwards, G. V. Chilingar, H. H. Rieke III, and W. H. Fertl, and each of its 10 chapters was written by a different author. Chapter titles include: "Worldwide Geothermal Resources," "Geology of Geothermal Systems," "Exploration for Geothermal Energy," "Geothermal Well Drilling and Completion," and "Formation Evaluation." The written material is liberally augmented with tables, graphs, charts, and photographs, and a 25-page index.

Order from: Gulf Publishing Co., P.O. Box 2608, Dept. 16, Houston, TX 77001. The price is $69.95, plus $1.50 for shipping. Texas residents must add 6 percent tax.