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TITLE: PREPARATION OF NORTHERN MID-CONTINENT PETROLEUM ATLAS

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FOREWORD

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ABSTRACT

The prototype Digital Petroleum Atlas (DPA) Project is part of a long-term effort to develop a new methodology to provide efficient and timely access to the latest petroleum data and technology for the domestic oil and gas industry, public sector research organizations and local governmental units. The DPA provides real-time access through the Internet using widely available tools such as World-Wide-Web browsers. The latest technologies and information are “published” electronically when individual project components are completed removing the lag and expense of transferring technology using traditional paper publication. Active links, graphical user interfaces and database search mechanisms of the DPA provide a product with which the operator can interact in ways that are impossible in the paper publication. Contained in the DPA are forms of publication that can only be displayed in an electronic environment (for example, animated exploration histories through time). Improvement in data and technology access for the domestic petroleum industry represents one of the best and cost-effective options that is available for mitigating the continued decline in domestic production.

The prototype DPA concentrated on developing methodologies and computerized procedures to generate and to “publish” a limited set of field and play studies concentrated in Kansas and to a lesser extent the Northern Mid-continent. Access is provided through the DPA to previously existing and new regional, play, field and individual well information. Methodologies, developed in year one of the prototype DPA Project, provide a “published” product and ongoing technology transfer activity that is continuously updated with the latest information and technology.

TABLE OF CONTENTS

FORWARD	2
ABSTRACT	2
EXECUTIVE SUMMARY	4
INTRODUCTION	4
TRADITIONAL PETROLEUM ATLAS.....	5
CHANGE IN SCIENTIFIC AND TECHNICAL PUBLICATION.....	7
USAGE OF THE PROTOTYPE DIGITAL PETROLEUM ATLAS.....	10
RESULTS AND DISCUSSION	12
ATLAS STRUCTURE	12
Digital Petroleum Atlas HomePage.....	12
US Regions and Geologic Provinces HomePage.....	16
Northern Midcontinent HomePage.....	16
Kansas Digital Petroleum Atlas HomePage.....	21
ATLAS NAVIGATION	27
Navigational Buttons.....	27
Interactive Image Maps.....	28
Search Engines.....	29
TECHNOLOGY TRANSFER ACTIVITIES	33
PROBLEMS ENCOUNTERED	34
RECOMMENDATIONS FOR FUTURE WORK	34
CONCLUSIONS	35
REFERENCES CITED	35
APPENDIX	37
APPENDIX A: Selected Abstracts.....	37

FIGURES

Figure 1: Map of Northern Mid-continent Digital Petroleum Atlas.....	9
Figure 2: Weekly Usage Statistics Covering Project Period.....	11
Figure 3: Digital Petroleum Atlas Project HomePage.....	13
Figure 4: Interactive Digital Petroleum Atlas Site Map.....	14
Figure 5: Status Chart of Prototype Digital Petroleum Atlas.....	15
Figure 6: Kansas Digital Petroleum Atlas HomePage.....	18
Figure 7: Interactive Map of Kansas Geologic Provinces.....	19
Figure 8: Map and Plot of Size vs. Discovery Date for Morrowan.....	20
Figure 9: Interactive County Map and Geologic Column.....	23
Figure 10: Arroyo Field HomePage.....	24
Figure 11: Example of Individual Well Data Page.....	25
Figure 12: Digital Petroleum Atlas Navigation Bar.....	30
Figure 13: Field Page Navigation Buttons.....	30
Figure 14: Interactive Image Maps and Figures.....	31
Figure 15: Example Input Panel for Oil and Gas Search Panel.....	32

TABLES

Table 1: Generalized Format of Traditional Published Atlas.....	6
Table 2: List of Presentations and Papers.....	33

EXECUTIVE SUMMARY

The prototype Digital Petroleum Atlas (DPA) Project is the first year of a long-term effort to develop a new methodology to provide efficient and timely access to the latest petroleum data and technology for the domestic oil and gas industry, public sector research organizations and local governmental units. The DPA provides real-time access through the Internet using widely available tools such as World-Wide-Web browsers. The latest technologies and information are “published” electronically when individual project components are completed removing the lag and expense of transferring technology using traditional paper publication. Active links, graphical user interfaces and database search mechanisms of the DPA provide a product with which the operator can interact in ways that are impossible in the paper publication. Contained in the DPA are forms of publication that can only be displayed in an electronic environment (for example, animated exploration histories through time). Improvement in data and technology access for the domestic petroleum industry represents one of the best and cost-effective options that is available for mitigating the continued decline in domestic production.

The prototype DPA concentrated on developing methodologies and computerized procedures to generate and to “publish” a limited set of field and play studies concentrated in Kansas and to a lesser extent the Northern Mid-continent. Kansas fields studied include: Arroyo Field (Morrovan), Stanton County; Big Bow Field (St. Louis), Grant and Stanton counties; and Gentzler Field (Morrovan), Stevens County. Access is provided through the DPA to previously existing and new regional, play, field and individual well information. Methodologies, developed in year one of the prototype DPA Project, provide a “published” product and ongoing technology transfer activity that is continuously updated with the latest information and technology.

Through complete and flexible user access to technology, interpretative products and the underlying geologic and petroleum data, the DPA alters the relationship between interpretative result and data, between technology generation and application.

INTRODUCTION

Oil production in the United States has steadily declined, while consumption and imports are steadily increasing. In September of 1985 the nation produced over 10,636,000 barrels of oil per day (http://www.eia.doe.gov/oil_gas/psm/psmframe.html). For the first 11 months of 1996, production dropped to 8,604,000 barrels per day. Imports have risen from 4,286,000 barrels of oil per day in 1985 (28% of demand) to 8,400,000 barrels of oil per day in 1996 (http://www.eia.doe.gov/oil_gas/psm/psmframe.html). By the end of 1996, import to demand ratio will probably exceed 50%. To help mitigate the decline in U.S. oil production, the United States Department of Energy (USDOE) has initiated programs that enable and encourage development of innovative technologies, and promote the transfer and application of technologies to petroleum operators of all sizes, but especially independent operators. Independent operators now dominate the domestic petroleum industry. Through these methods, the USDOE intends that significant additional production that otherwise would be produced.

One of the most effective methods to gain additional production from known reserves, to add new reserves and to prevent the premature abandonment of wells is to provide oil and gas producers with the access to up-to-date information and technology. The critical information and technology can vary among fields, reservoirs and operators. As an example, a key for one type of reservoir might be sophisticated, inexpensive ways to identify unswept compartments; and for another field type the key might be optional and optimal techniques for additional workover, completion, and production practices that have been successful in analog fields.

Short of conducting a full-scale reservoir analysis of each producing field, an efficient and effective method of communicating this type of key information to operators is by example. For each reservoir type in a producing region, a thoroughly studied and documented analog can illustrate which geologic and engineering procedures are likely to be most successful in increasing ultimate recovery. An analog example provides operators with sufficient information and technology to apply their own producing properties, and increase production and ultimate recovery by copying, modifying and applying proven methods. One way to accomplish the goal of disseminating information by analog is to provide a geological and engineering based, state-of-the-art, petroleum atlas that contains not only historical data and descriptions, but technologically advanced syntheses and analyses of "why reservoirs produce" and "how ultimate production may be increased."

TRADITIONAL PETROLEUM ATLAS

Compilation of reservoir, field and play studies into a published petroleum atlas is a time honored approach to illustrating by analog the latest petroleum exploration and development knowledge and application. Notable compilations of such studies include: *Structure of Typical American Fields* (Powers, 1929); *Giant Fields of 1968-1978* (Halbouty, 1981); *Treatise of Petroleum Geology: Atlas of Oil and Gas Fields* (Beaumont and Foster, 1990; Foster and Beaumont, 1991; 1992), *Atlas of Major Texas Oil Reservoirs* (Galloway and others, 1983), *Atlas of Midcontinent Gas Reservoirs* (Bebout and others, 1993), and *Atlas of Major Rocky Mountain Gas Reservoirs* (Robertson and others, 1993). The underlying goals of these petroleum atlases have been to:

- Synthesize information on major reservoirs, fields, plays and basins;
- Assist in efficient exploration and development by increasing technical knowledge of trapping, discovery and production of oil and gas;
- Serve as analogs for reservoirs, fields and plays similar to those described; and
- Provide an overview and introduction to the various petroleum basins described.

Various formats have been developed to facilitate data access, and to meet the requirements and limitations of the particular paper publication. Table 1 shows a generalized format that is common to many of these compilations. The traditional published atlas is a time consuming and expensive process that results in static paper product. Products and data are typically limited by space and cost considerations to summary information at the field or reservoir level. For each play, field or reservoir only a relatively small number of author-selected maps, cross-sections, charts and other summary data are included. The paper atlas does not provide access to well and lease data or to intermediate research products (such as digital geographic and geologic components of maps, interpreted and uninterpreted subsurface data, geochemical analyses, thin section images, and other traditionally unpublished material). Without access to the data and intermediate products, modifying and updating a published field study to fit particular applications or new scientific ideas is a difficult and time consuming process.

Table 1.-- Generalized format outline that is typical for a traditional published atlas containing field, reservoir or play studies (Modified from Beaumont and Foster, 1990).

- Location of Play, Field or Reservoir
- History
 - Pre-Discovery
 - Discovery
 - Post Discovery
- Discovery Method
- Structure
 - Tectonic History
 - Regional Structure
 - Local Structure
- Stratigraphy
- Trap
 - General Description
 - Reservoir(s)
 - Source(s)
- Exploration Concepts
- Development Concepts
- Production Concepts

CHANGE IN SCIENTIFIC AND TECHNICAL PUBLICATION

The traditional role of scientific and technical publication is to formalize and record scientific and technical results in time, and to transfer technology to potential users (Kerkhof, 1994). Over the past century and possibly even in the previous decade, the paper report, journal, monograph or book was the fastest and most efficient method to disseminate, validate, and archive research and technical results. Today, traditional channels of scientific and technical communication are being challenged by the sheer volume of publication, the increased unit costs, the relatively decreased resources of academic and industrial library systems, and the rapidity of technical change (Okerson, 1992). In addition, the growth of networks, storage servers, printers, and software that make up the Internet is rapidly changing the world from one in which research organizations, publishers and libraries control the printing, distribution, and archiving to a world in which individuals can rapidly and cheaply “publish”, provide access and modify scientific results on-line. These changes offer significant challenges and opportunities to the various participants and traditions of scientific and technical publication (Denning and Rous, 1995).

Another drawback of traditional published scientific and technical results is the limitation of paper (cost and space) causing incomplete documentation of the research process. As a result it is often difficult to replicate or modify traditional paper-published research (Claerbout, 1994). The purpose of reproducing research is to transfer research products to the user, to validate research results, and to facilitate extending the research to better fit user needs. Reproduction of research is a fundamental problem in technology transfer in the earth sciences. This problem has been attributed to loss of steps along the research pathway (Claerbout, 1994). Lack of access to theory, methods, data, or results may form a missing step in the earth sciences. For example, it is not common practice to publish detailed production data, well logs, and analyses that formed the basis of a reservoir or field study or map. With the increased publication costs these data are at best archived. The result is a finished product that is difficult to replicate, validate, or modify to new needs or opportunities. The resource investment required to reproduce published research may take many months and forms a barrier to technology transfer of fundamental, regional or site specific petroleum research. This barrier is a significant impediment to merging results from disparate scientific fields into research solutions for societal and industrial problems and for providing timely scientific information for policy decisions. The shortening life cycles of technology and the increased needs for cross-disciplinary research require a change in the unit of research from the published paper to an easily adapted technologic solution.

The Midcontinent Digital Petroleum Atlas (<http://www.kgs.ukans.edu/DPA/dpaHome.html>) radically changes traditional models and approaches to generating and disseminating petroleum field, play and basin studies (Carr and others, in press). The Digital Petroleum Atlas (DPA) is an electronic publication that is available on-line over the world-wide-web. The DPA is designed to provide easily adapted technologic solutions and to be a dynamic product that is constantly evolving with new structure, research results, and data. Through complete and flexible user access to both the interpretative products and the underlying reservoir and well data, the DPA alters the relationship between interpretative result and data.

The first year of the DPA Project developed a prototype for a digital atlas of petroleum fields and reservoirs in Kansas. A very limited number of reservoirs in Kansas were included in the prototype project, but the goal is to expand beyond the prototype atlas to include all significant reservoirs representing the major plays in the Northern Midcontinent (Figure 1a). The Northern Midcontinent as defined for the DPA includes all of Kansas, Nebraska, South Dakota, North Dakota, the Williston basin portion of Montana, and the Denver-Julesburg basin of eastern Colorado (Figure 1b).

The DPA was constructed using standardized templates and navigation tools to give the product a consistent look and feel. Active links, graphical user interfaces and database search mechanisms provide a product with which the reader can interact in ways that are impossible in a paper atlas. The DPA also contains forms of publication that can only be displayed in an electronic environment. These electronic only forms of publication include: searches based on user-defined geologic, engineering and production criteria; hypertext search and manipulation functions to generate customized maps and plots; and access to animated products (e.g., exploration histories through time). Electronic products such as the DPA are far more efficient tools for rapid technology transfer and resource sharing. The DPA can use available digital materials to create on-demand products that better fit user-defined needs.

Primary products of the prototype atlas are on-line accessible digital data bases covering two significant petroleum plays in Kansas. The regional databases are supplemented with selected geological field studies in each play. Digital imagery, digital mapping, relational data queries, and geographical information systems are integral to the field studies and regional data sets. Data sets have relational links to provide opportunity for history-matching, feasibility, and risk analysis tests on contemplated exploration and development projects. The flexible "web-like" design of the atlas provides ready access to data, and technology at a variety of scales from regional, to field, to lease, and finally to the individual bore. The digital structure of the atlas permits the operator to access comprehensive reservoir data, interpretative products (e.g., maps and cross-sections) and to customize the products to their needs. The atlas is accessible in digital form on-line using a World-Wide-Web browser as the graphical user interface.

Regional data sets and field studies are free-standing entities that are made available on-line through the Internet to users as they are completed. Technology transfer activities commenced in the early part of this project, providing data information sets to oil and gas operators, government and research organizations and other interested individuals prior to the full digital atlas compilation.

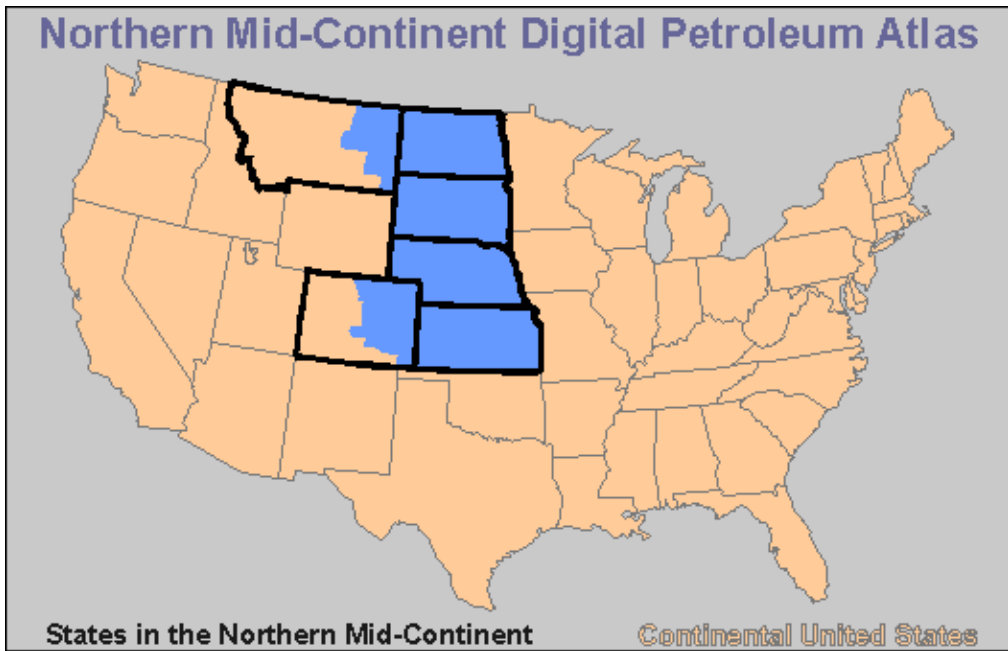


Figure 1a

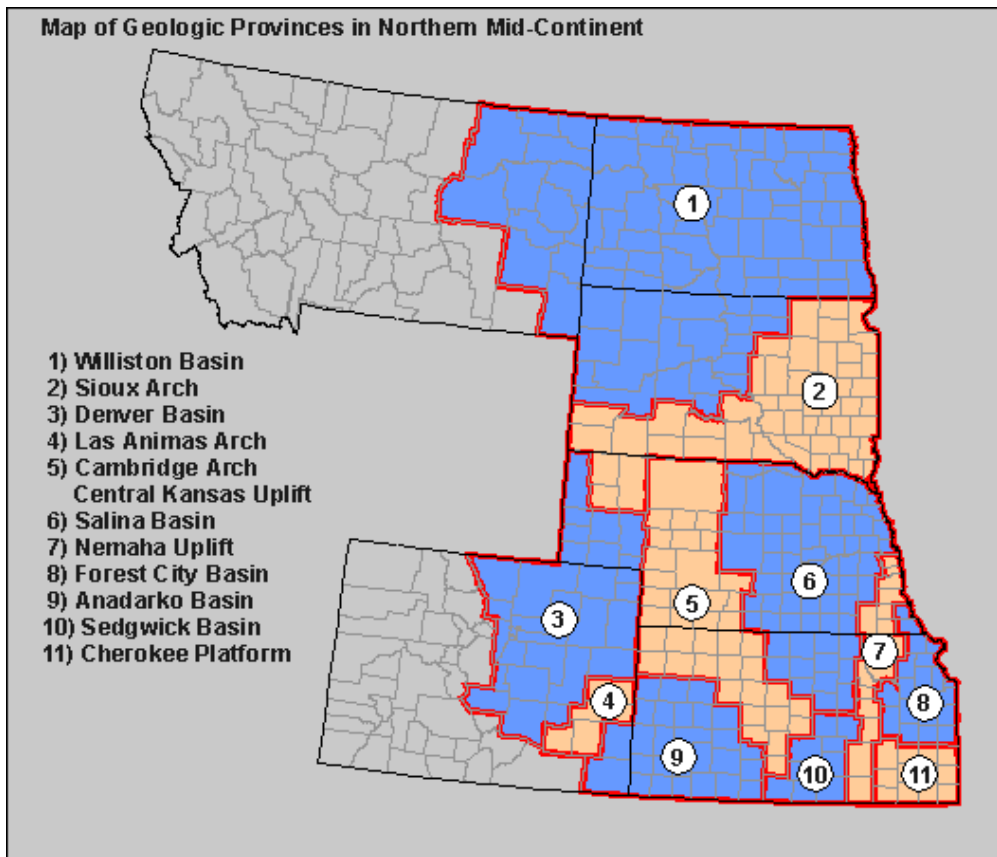


Figure 1b

Figure 1. a) Map showing area covered by the proposed Northern Mid-continent Digital Petroleum Atlas (<http://www.kgs.ukans.edu/DPA/NMC/nmc.html>). b) Interactive map of geologic provinces (<http://www.kgs.ukans.edu/DPA/NMC/nmcProv.html>).

USAGE OF THE PROTOTYPE DIGITAL PETROLEUM ATLAS

Since the prototype Digital Petroleum Atlas is an electronic publication, on-line access was provided to the public soon after project inception. Use of the DPA products was almost immediate and has grown steadily over the year (Figure 2). This near real-time transfer of technology and information to the client is one advantage demonstrated by the DPA.

The pages that comprise the DPA make up the bulk of the web site for the Petroleum Research Section (PRS) of the Kansas Geological Survey. Usage statistics show that access to these pages has grown steadily from 1,000 to over 5,000 access "hits" per week (Figure 2). In measuring access "hits" on the PRS site, all access to graphics is removed. This eliminates the multiple counting of access hits that result from multiple figures (buttons, bars, arrows, etc.) on a single web page. In addition, all access from the Kansas Geological Survey subdomain (kgs.ukans.edu) is removed. This measurement protocol produces a consistent and conservative measure of external usage. Current usage statistics are collected daily and weekly and are available on the Petroleum Research Section of the Kansas Geological Survey web site (http://www.kgs.ukans.edu/usage/past_stats.html).

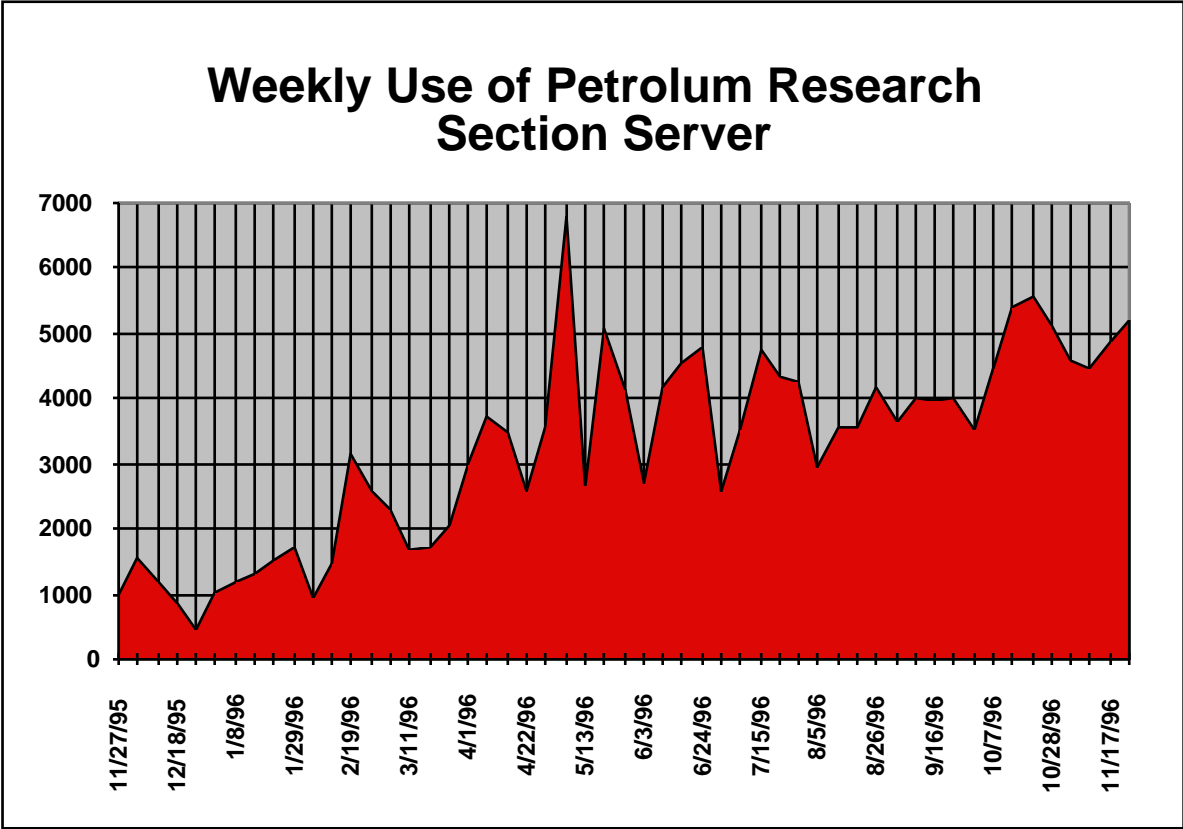


Figure 2. Weekly usage statistics measuring separate pages viewed. Miscellaneous graphics and access from Kansas Geological Survey computers are removed prior to analysis. Current usage statistics are collected daily and weekly and are available on the Petroleum Research Section of the Kansas Geological Survey web site (http://www.kgs.ukans.edu/usage/past_stats.html).

RESULTS AND DISCUSSION

ATLAS STRUCTURE

The prototype digital petroleum atlas is constructed around a set of basic units called “homepages”. The homepages are organized into a loose hierarchy from the general overview of the project, increasing in detail through the regional, play and field scales. At the greatest level of detail are individual web pages that provide technology, information and data on a focused topical discussion, a well bore or a single analysis from a well. Each homepage provides a point of access to number of “pages” containing relevant information and technology. Navigation among pages is provided by a set of standardized tools or through search engines. The navigation tools permit the user to move through the DPA in a more or less linear path, similar to a traditional book, or to skip rapidly among related subjects and scales. The Digital Petroleum Atlas leverages the power of electronic publication through numerous cross-links, the “web-like” non-linear structure and search engines. The client has the power to tailor access and the final products to fit user-defined requirements and needs.

Digital Petroleum Atlas HomePage

The Digital Petroleum Atlas HomePage provides an overview and one of many points entrance to the DPA project (<http://www.kgs.ukans.edu/DPA/dpaHome.html>). The DPA HomePage provides links to overall project information, quarterly progress reports and topical reports (Figure 3). As part of a methodology section, an interactive schematic map of the entire DPA project is provided (<http://www.kgs.ukans.edu/DPA/dpaMap.html>). The site map provides a graphical overview of the DPA structure and progress. The DPA site map is also an interactive graphical user interface (GUI) that can be used to directly navigate to specific areas of the DPA (Figure 4). A status chart of DPA progress, also included under the methodology section, provides a more detailed look at progress of each atlas component down to the field level (Figure 5, (<http://www.kgs.ukans.edu/DPA/Reports/statusChart.html>)).

The DPA HomePage also provides active links to DPA information at the Bartlesville Project Office of the US Department of Energy (e.g., Project Fact Sheets) and to the Department of Energy homepage. The DPA project contains petroleum information at three geographically defined levels -- national, Northern Midcontinent region and Kansas. Each level is a homepage that provides access to discussion of plays, basins and geological provinces and to information and technology focused on individual fields, reservoirs and wells. Regional geologic and petroleum perspectives were developed that span and link the three geographically defined levels. As part of the prototype, work on individual fields, reservoirs and wells was restricted to Kansas. However, the structure and methodologies are designed to be appropriate for focused petroleum studies throughout the US. All discussion topics and levels are cross-linked and searchable across geographic boundaries providing the user unrestricted access across all DPA components.

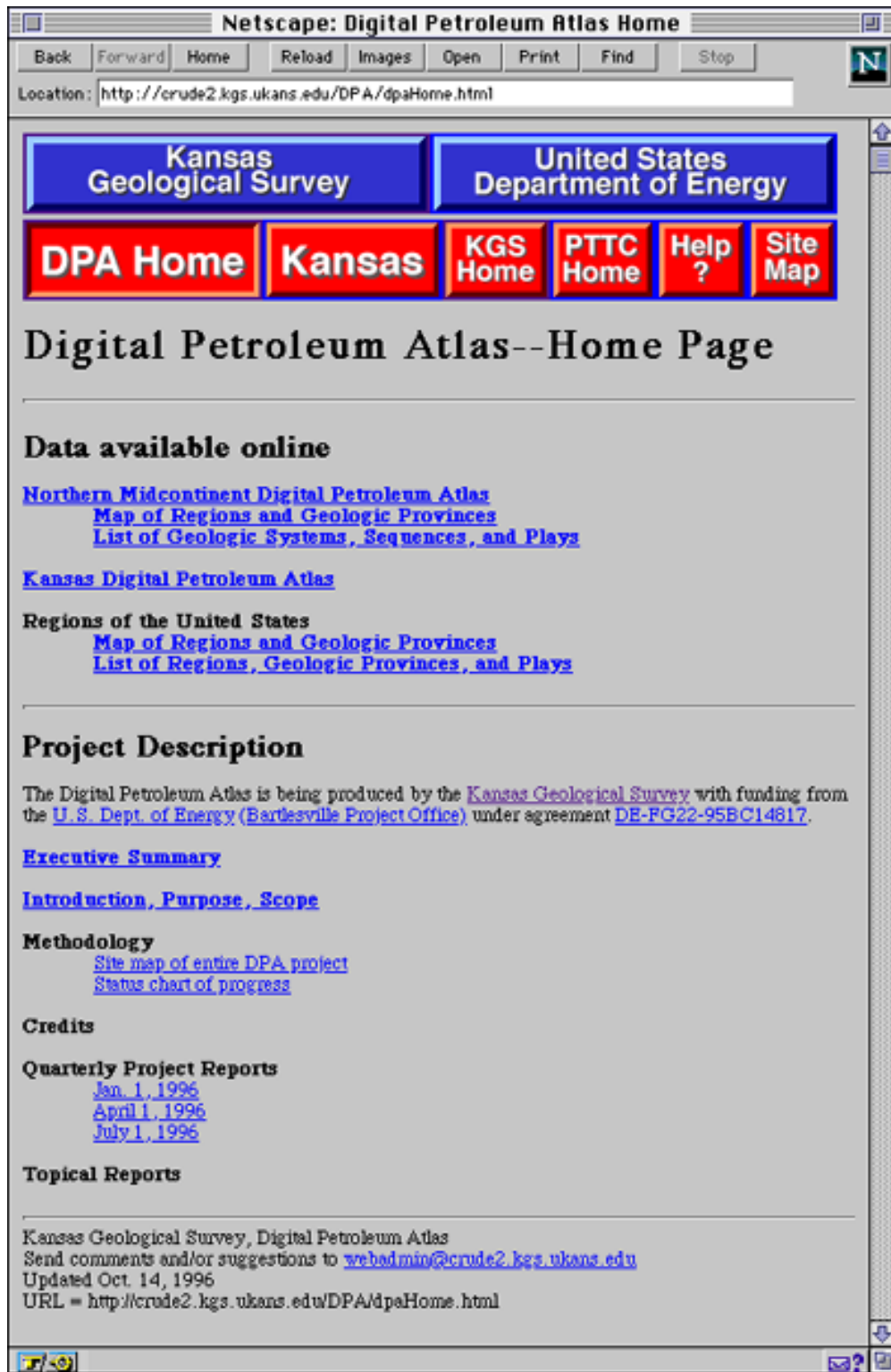


Figure 3. Digital Petroleum HomePage provides background information and links to other areas of the DPA (<http://www.kgs.ukans.edu/DPA/dpaHome.html>).

Color Key Kansas Section of DPA General Section of DPA Other parts of KGS Web Site

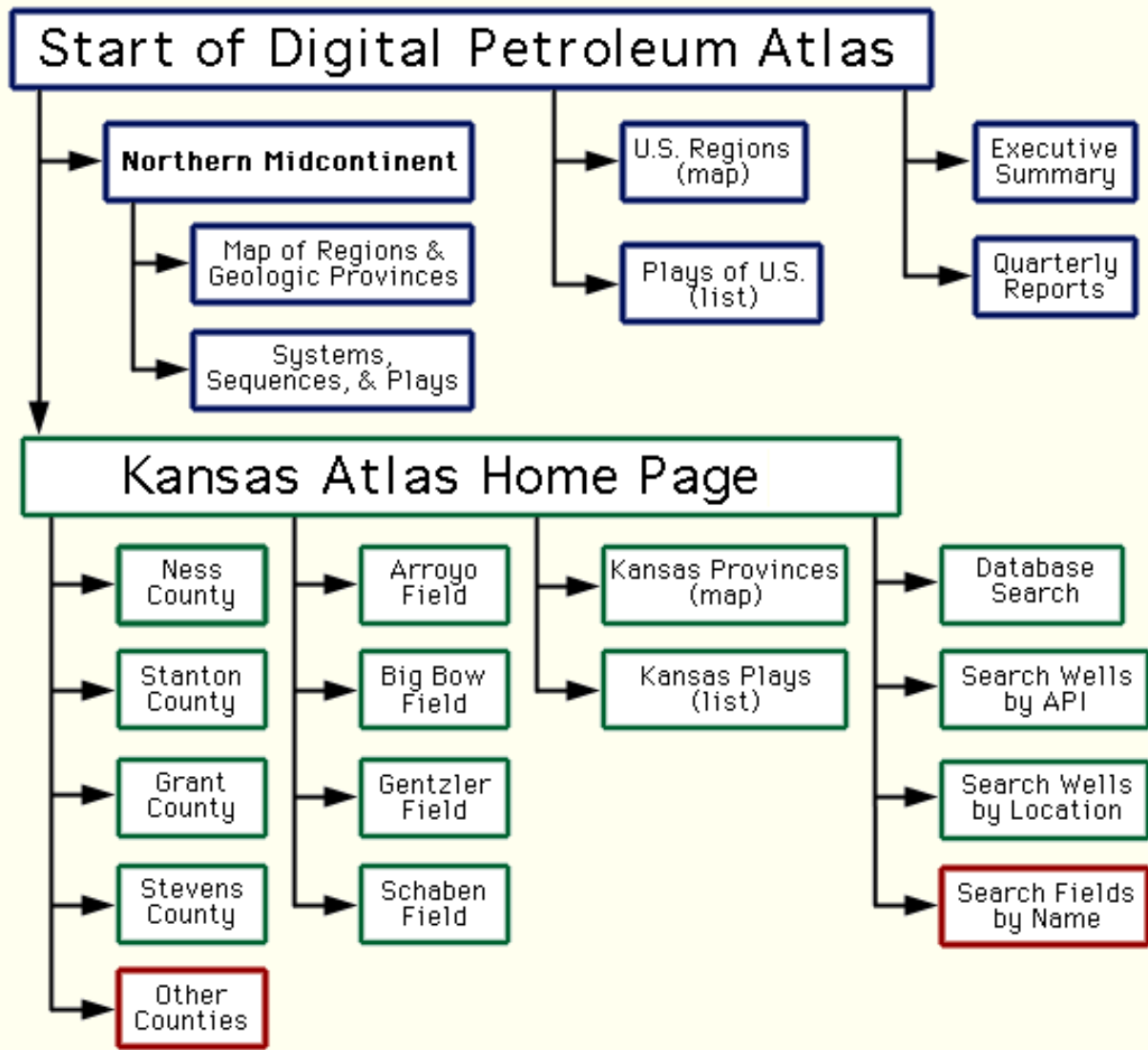


Figure 4. Digital Petroleum Atlas Site Map shows the overall DPA structure and status. The site map also provides an user way navigate to specific areas of the atlas (<http://www.kgs.ukans.edu/DPA/dpaMap.html>).

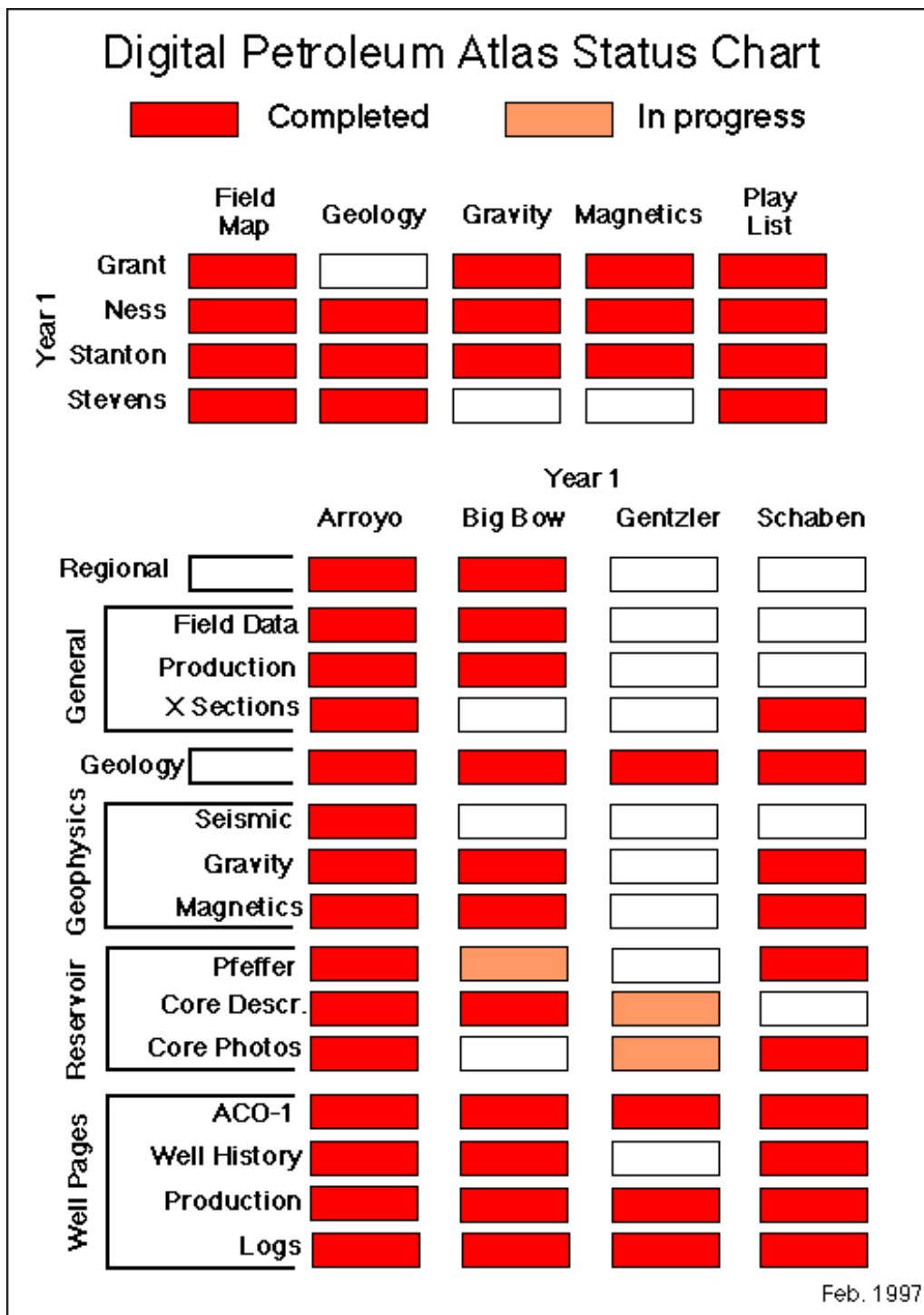


Figure 5. Status chart for the prototype Digital Petroleum Atlas showing the status of individual atlas components down to the field level (<http://www.kgs.ukans.edu/DPA/Reports/statusChart.html>).

United States Regions and Geologic Provinces HomePage

United States Regions HomePage provides links to maps of regions and geologic provinces, overview discussions, historical data and Quick Time movies of the exploration history at national, province, basin, and play levels. All information is linked through graphical user interfaces

(<http://www.kgs.ukans.edu/DPA/frontEnd/regions1.html>).

Information at the national and province level is from the US Geological Survey 1995 National Assessment of United States Oil and Gas Resources (available on CD-ROM from the U.S.G.S. as Digital Data Series DDS-30, Release 2). The U. S. G. S. material has been supplemented and in some cases replaced by regional and play material covering the Kansas basins. All regional information is linked through graphical user interfaces.

Northern Mid-continent Digital Petroleum Atlas HomePage

The Northern Mid-continent HomePage provides interactive maps and expanding lists that outline the region and its geologic provinces

(<http://www.kgs.ukans.edu:80/DPA/NMC/nmc.html>). The long-term goal of the DPA project remains to expand beyond the prototype atlas in Kansas in order to include all significant reservoirs representing the major plays in the Northern Mid-continent (Figure 1a). The Northern Midcontinent as defined for the DPA includes all of Kansas, Nebraska, South Dakota, North Dakota, the Williston basin portion of Montana, and the Denver-Julesburg basin of eastern Colorado (Figure 1b). From the Northern Mid-continent HomePage one can access similar regional information as is found on the US Regions HomePage. Included on the Northern Mid-continent HomePage are links to

- Maps showing the area , landforms, tectonics, and basins of the Northern Mid-continent region (<http://www.kgs.ukans.edu/DPA/NMC/nmc.html>);
- Interactive maps of regions, provinces, and plays within the Northern Mid-continent region (<http://www.kgs.ukans.edu/DPA/NMC/nmcProv.html>); and
- Expanding hypertext lists of geologic systems, sequences, and plays that occur within the region (<http://www.kgs.ukans.edu/DPA/NMC/Seq/sys1.html>).

The system, sequence and play lists expand to provide more detail. As an example the Pennsylvanian, Lower Absaroka Sequence will provide access to a set of regional maps (paleogeography and accumulation rates) and a list of plays associated with this sequence throughout the region (<http://www.kgs.ukans.edu/DPA/NMC/Seq/penn.html>). Selecting the Morrow Sandstone Gas and Oil Stratigraphic Play in the Anadarko Basin provides the regional detail on the this particular play with summary, estimate of resources, accumulation versus size graphs, etc.

(<http://www.kgs.ukans.edu/DPA/frontEnd/Anadarko/Morrow/morrow.html>). Detailed discussion is restricted to the Mississippian and Morrow plays of Kansas that were part of the one year prototype. However this architecture provides a methodology for covering similar plays across different basins and states.

Netscape: DPA--Kansas

Back Forward Home Reload Images Open Print Find Stop

Location: <http://crude2.kgs.ukans.edu/DPA/dpaKansas.html>

DPA Home **Kansas** **KGS Home** **PTTC Home** **Help ?** **Site Map**

Digital Petroleum Atlas--Kansas Home Page



Search for Wells and Fields

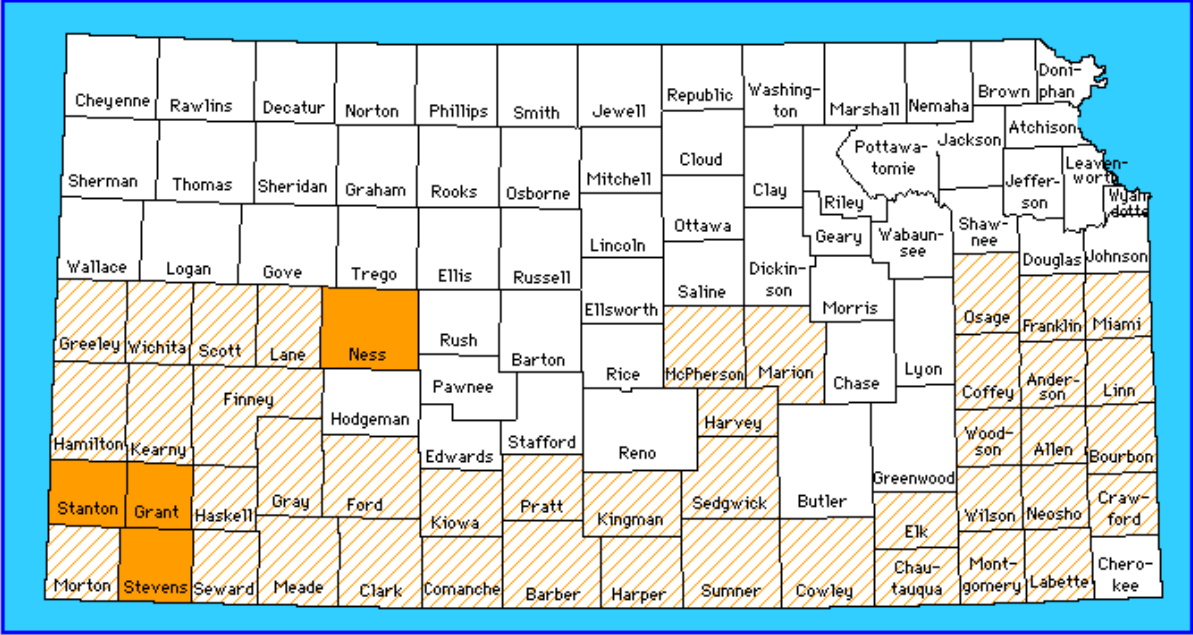
Search Wells by API Search Wells by T-R Search Fields by Name General Field Search

[Regional Geological Setting of Kansas](#)

[List of Oil and Gas Plays in Kansas](#)

Map linked to fields and counties

Only counties colored in  have been added to the atlas at this time. Clicking on the other counties will take you to annual oil and gas production files (those colored in  include oil and gas field maps).



Kansas Geological Survey, Digital Petroleum Atlas
Send comments and/or suggestions to webadmin@crude2.kgs.ukans.edu
Updated July 1, 1996

Figure 6. Kansas DPA HomePage provides access to petroleum information and technology for Kansas plays, fields, reservoirs and wells (<http://www.kgs.ukans.edu/DPA/dpaKansas.html>).

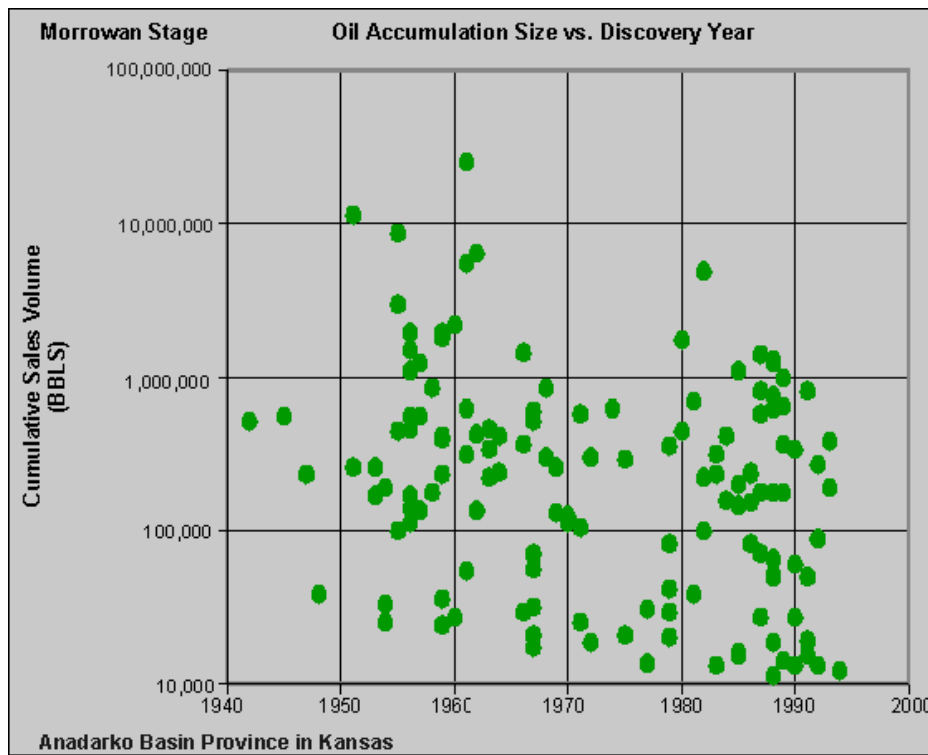
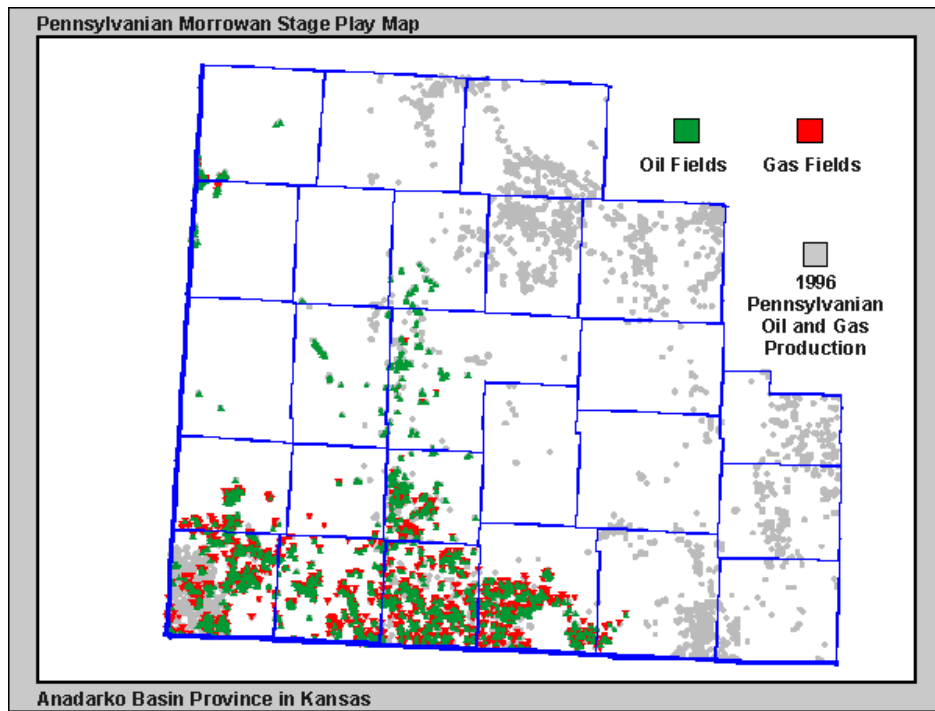


Figure 8. a) Map of distribution of Morrowan oil and gas production in the Anadarko Basin Province of Kansas. b) Plot of oil accumulation size versus discovery date for Morrowan oil gas production in the Anadarko Basin Province of Kansas. (<http://www.kgs.ukans.edu/DPA/Plays/Anadarko/morrow.html>).

Kansas Digital Petroleum Atlas HomePage

The Kansas DPA HomePage provides numerous paths and tools to access Kansas petroleum information and technology at the play, field, reservoir and well levels (<http://www.kgs.ukans.edu/DPA/dpaKansas.html>). Access is provided to reviews of the regional geological setting, overviews of oil and gas plays and to information and technology at the county, field and well levels. All the Kansas information and technology that is included was assembled as part of the first year prototype of the digital petroleum atlas.

Kansas Regional Geologic Setting.--A regional geological setting page provides access to statewide gravity and magnetic maps and to a map of the oil and gas provinces in Kansas (<http://www.kgs.ukans.edu/DPA/regional.html>). The gravity and magnetic maps were constructed using data maintained by the Kansas Geological Survey. The gravity and magnetic maps are available to the user on-line with a number of statewide overlays: outlines of the oil and gas fields, post-Mississippian structure, Precambrian structure and county lines. The user simply toggles among the various overlays. Resolution is limited by screen size, but more detailed gravity and magnetic maps can be downloaded at different scales and in a variety of formats (<http://www.kgs.ukans.edu/PRS/PotenFld/potential.html>). The geologic province map of Kansas (<http://www.kgs.ukans.edu/DPA/Plays/ksProv.html>) displays the main oil and gas provinces of Kansas (Figure 7). The oil and gas provinces are displayed as defined by the Kansas Geological Survey and the US Geological Survey (1995). The geologic province map functions as a graphical user interface to provide access to more detailed geologic and petroleum information for each geologic province.

As an example, a click on the Anadarko Basin Province (<http://www.kgs.ukans.edu/DPA/Plays/Anadarko/anadarko.html>) produces a map of the oil and gas fields and to links to regional geologic and play information. The Anadarko Basin Province map is another active GUI that in turn provides further access to county maps and through the county maps to field, reservoir and well information. Included on the Anadarko Basin Province page are movies that show Permian and Pre-Permian exploration histories in Kansas. The movies require Quick-Time (a commonly available World-Wide-Web helper application). Also available is access to a general discussion of the regional Mid-continent geology and exploration history (again with animation), and to play level information for each of the seventeen individual plays recognized in the Anadarko Basin Province. To illustrate, clicking on the Morrowan Sandstone Oil and Gas play (<http://www.kgs.ukans.edu/DPA/Plays/Anadarko/morrow.html>) yields a map showing the distribution of leases that have produced oil or gas from the Morrowan (Figure 8a). Again, this map is another active GUI that provides access to additional information at the county level. Located below the map for Morrowan oil and gas reservoirs in the Anadarko Basin Province are plots for accumulation size versus discovery date (Figure 8b). In addition to GUI access based on a map of geologic provinces the user can access the same Kansas play information through a series of expanding play lists (http://www.kgs.ukans.edu/DPA/Plays/regionList1_6.html). Basic information for each Kansas oil and gas play is available on-line and can be downloaded to a visitor's computer with a click of the mouse.

Kansas County Information.-- On the Kansas Digital Petroleum Atlas HomePage, a map of Kansas counties provides a graphical user interface and active links to annual oil and gas production data, maps of oil and gas fields, and geologic and geophysical information at the county scale (Figure 6, <http://www.kgs.ukans.edu/DPA/dpaKansas.html>). Clicking on a county highlighted in solid gold provides access to a county-wide map of the oil and gas fields and a generalized geologic column (Figure 9, <http://www.kgs.ukans.edu/DPA/County/stanton.html>). In turn, the county map and geologic column are graphical user interfaces that provide access to additional information and interpretative products. Clicking on any of the highlighted horizons on the geologic column produces the same county-wide oil and gas field map overlain with the selected mapped horizon (structure or isopach). As an option the user can click on the “next page-previous page” buttons below the county map to drill down through the column. In addition, buttons are provided to access county-wide gravity and magnetic maps, and expanding lists of plays and fields located in the county. Clicking on a field’s name on the county map provides access to individual field information. If the field has not been included in the DPA, the user will obtain basic geologic information and historical production. If the field is included in the DPA, the user will see the field level homepage (ex. Arroyo or Big Bow fields in Stanton County). Cross-hatched counties contain only oil and gas maps and access to annual oil and gas production files. Counties that are not highlighted are limited to annual oil and gas production.

Kansas Oil and Gas Fields.--As part of first year of the prototype DPA project, studies were undertaken at three Kansas fields. The three fields are:

- Arroyo Field (Morrowan Sandstone) in Stanton County (<http://www.kgs.ukans.edu/DPA/Arroyo/arroyoMain.html>);
- Big Bow Field (Mississippian, St. Louis Limestone) in Stanton and Grant counties (<http://www.kgs.ukans.edu/DPA/BigBow/bigbowMain.html>); and
- Gentzler Field (Morrowan Sandstone) in Stevens County (<http://www.kgs.ukans.edu/DPA/Gentzler/gentzlerMain.html>).

In addition, as part of a technology transfer effort the Class 2 field study and demonstration project funded by the US Department of Energy at Schaben Field (Mississippian, Osagian carbonates) in Ness County was added to the DPA (<http://www.kgs.ukans.edu/DPA/Schaben/schabenMain.html>, DE-FC22-93BC14987). New data and research products are added to each field study as they become available. Publication in the DPA is an ongoing process that continuously updates the data and technology associated with each field study.

Each field study homepage provides a map of the field area, basic field and discovery information, and a standardized set of links to additional geologic, geophysical, engineering and production data (Figure 10, <http://www.kgs.ukans.edu/DPA/Arroyo/arroyoMain.html>).

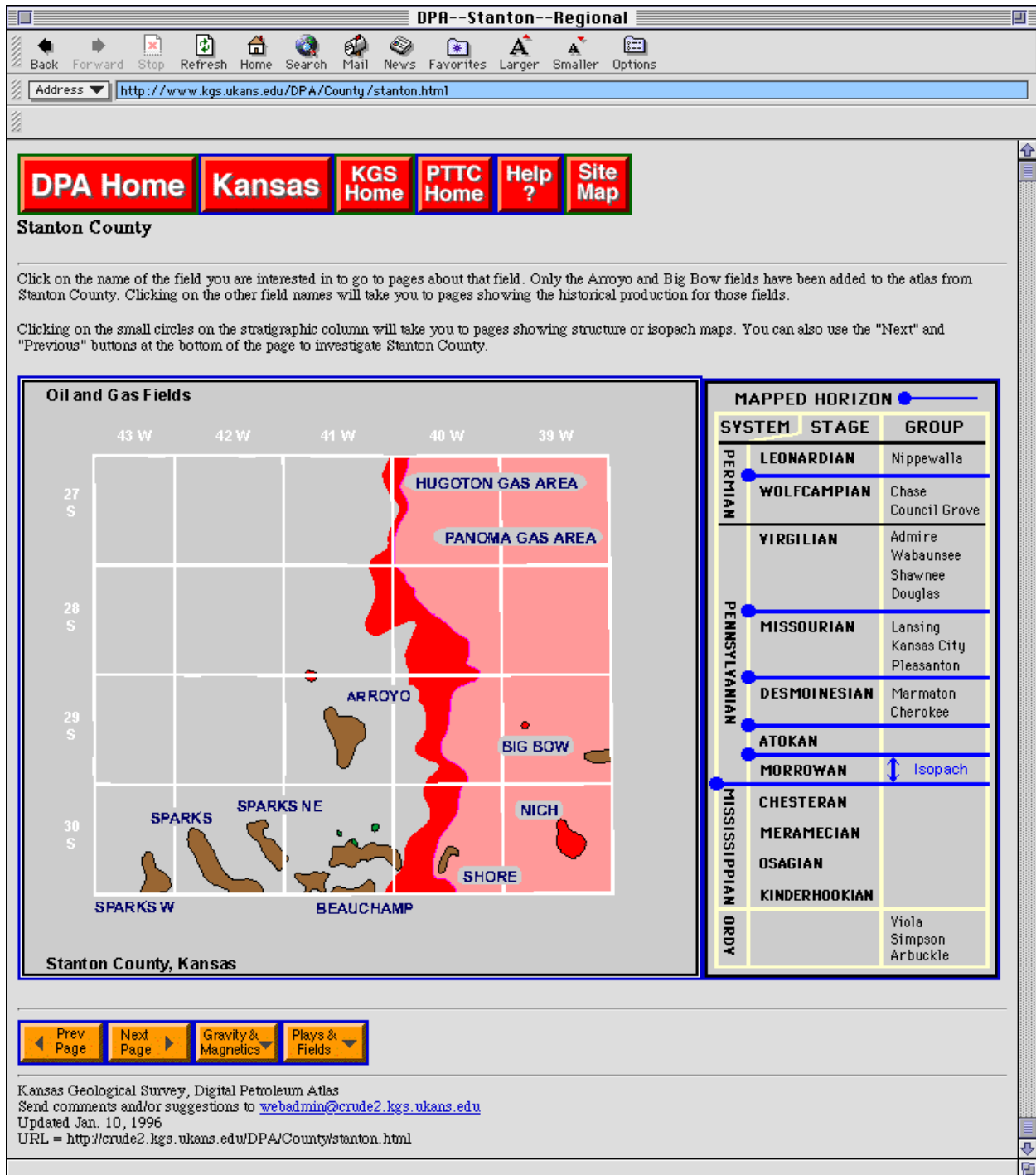


Figure 9. County map and geologic column for Stanton County, Kansas (<http://www.kgs.ukans.edu/DPA/County/stanton.html>). Both the geologic column and the county map are graphical user interfaces that can access additional geologic and petroleum information. In addition buttons below map can be used to access additional information.

Arroyo Field

Back Forward Stop Refresh Home Search Mail News Favorites Larger Smaller Options

Address <http://www.kgs.ukans.edu/DPA/Arroyo/arroyoMain.html>

[DPA Home](#)
[Kansas](#)
[PRS Home](#)
[PTTC Home](#)
[Help ?](#)
[Site Map](#)

Stanton County--Arroyo Field-- Title Page

Field Boundary

Stanton County, Kansas **Twp 29 S / Rge 41 W**

Discovery Well
 J.M. Huber, #27-1 Pro Farms
 20'S NW NE SW, 27-T29S-R41W
 04/12/90, Morrow Oil & Gas, 5900' RTD

J. M. Huber, #23-1 Kendrick
 30'E NW NE NW, 23-T29S-R41W
 06/23/92, St. Louis Oil, 5650' RTD

Field Size: 6,240 acres
Productive Wells: 24
Abandoned Wells: None

Cumulative Oil: 651,409 bbls as of 7/1/95
Cumulative Gas: 21,072,705 mcf as 7/1/95

[Annual Field Production Data](#)

[Regional Setting](#)
[General Information](#)
[Geological Information](#)
[Geophysical Information](#)
[Reservoir Information](#)
[Well Information](#)

Kansas Geological Survey, Digital Petroleum Atlas
 Send comments and/or suggestions to webadmin@crude2.kgs.ukans.edu
 Updated Oct. 26, 1995
 URL = <http://crude2.kgs.ukans.edu/DPA/Arroyo/arroyoMain.html>

Figure 10. Field homepage for Arroyo Field in Stanton County, Kansas (<http://www.kgs.ukans.edu/DPA/Arroyo/arroyoMain.html>). Page can be accessed directly using the DPA site map, by searching on field parameters or by clicking on the Arroyo Field name on the Stanton County HomePage (Figure 9) The links on the field homepage provide access to pages containing geologic, geophysical, engineering, production and well information.

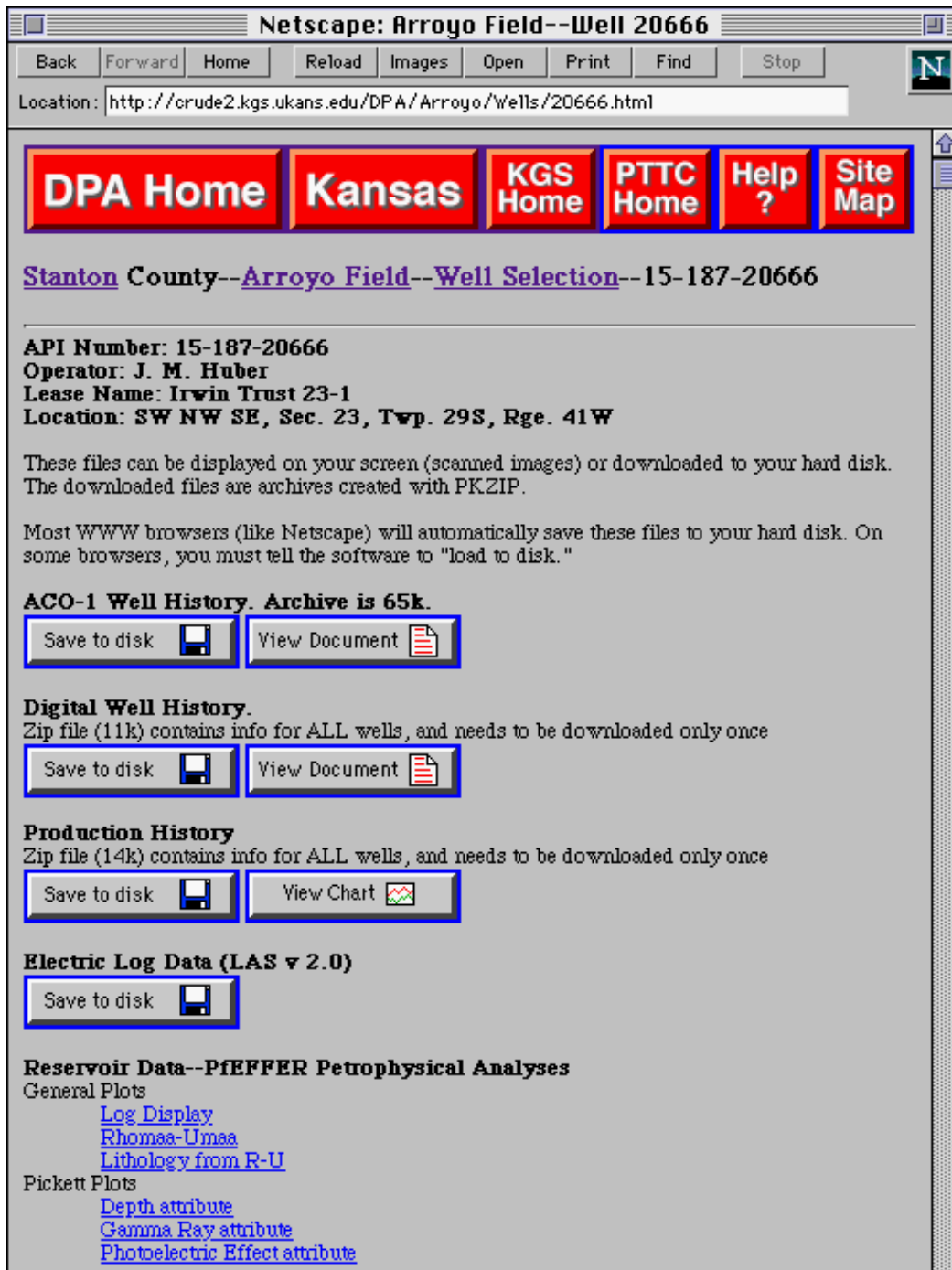


Figure 11. Individual well data page for a selected well in the Arroyo Field, Stanton County, Kansas (<http://www.kgs.ukans.edu/DPA/Arroyo/Wells/20666.html>). Data includes a raster image of the original completion report (ACO-1), digital well data (including geologic mapping horizons), production data, electric log data (LAS format), and other reservoir data associated with the individual well. Well data can be accessed by clicking on the well spot on the field map, by searching on API number, or through a township-range-section search.

Using the Arroyo Field in Stanton County Kansas as an example, the links for each homepage are:

- Annual Field Production Page provides annual and cumulative field production as data and plots (<http://www.kgs.ukans.edu/Field/A/arroyo.html>).
- Regional Setting Page contains regional geologic maps and cross-sections. Figures are small scale to speed loading, but can be expanded to a larger scale by clicking on the figure. (<http://www.kgs.ukans.edu/DPA/Arroyo/Regional/arroyoRgnlM.html>)
- General Field Information Page contains general geologic, engineering, drilling and production parameters and practices (<http://www.kgs.ukans.edu/DPA/Arroyo/General/arroyoGnr1.html>). Examples include average reservoir porosity, initial reservoir pressure, and typical drilling and logging practices
- Geologic Information Page provides access to a field map and type log. Both the map and type log are graphical user interfaces (<http://www.kgs.ukans.edu/DPA/Arroyo/Geology/arroyoGeol2.html>). Clicking on the different horizons displays structural and isopach maps for the field. Selected cross-sections for the field can be accessed in the same manner. The user can also step through all the maps and cross-sections by using the “Next Page” and “Previous Page” buttons below the field map.
- Geophysical Information Page in Arroyo Field contains synthetic seismic cross sections that were generated from sonic and density well logs (<http://www.kgs.ukans.edu/DPA/Arroyo/Geophysics/arroyoGeop1.html>). Models show the seismic signature for the reservoir sand at selected frequencies.
- Reservoir Information Page provides access to core pictures and core analyses, and petrophysical analysis of each well using the PFEFFER Petrophysical Log Analysis package (<http://www.kgs.ukans.edu/DPA/Arroyo/Reservoir/arroyoRese1.html>). PFEFFER was used to generate “Pickett Plots” and to determine water saturation, bulk volume water and other petrophysical parameters.
- Well Information Page contains a field map similar to the map on the field homepage (<http://www.kgs.ukans.edu/DPA/Arroyo/Wells/arroyoWell1.html>). However the map is a graphical user interface, and clicking on a well spot produces an individual well page that provides access to all available information (Figure 11, <http://www.kgs.ukans.edu:80/DPA/Arroyo/Wells/20666.html>). Access is also provided using searches on the well API number or location (Section, Township and Range). Information for each well in the field includes a scanned image of the original completion report (ACO-1), digital well history including geologic tops, production history, digital electric log data (LAS format), and other data associated with the individual well (e.g., core and

petrophysical analyses). All data can be viewed on-line or downloaded to the visitors computer for additional analysis.

ATLAS NAVIGATION

Navigation among the Digital Petroleum Atlas web pages is provided by a suite of standardized buttons that provide hypertext links or through search engines. The navigational tools permit the user to move through the DPA in a more or less linear path, similar to a traditional book, or to skip rapidly among related subjects and scales.

Navigational Buttons

As with all World-Wide-Web pages, text that is blue and underlined provides links to other pages. Some links are to other pages in the DPA, some are to other pages on the world-wide-web server at the Kansas Geological Survey, and a few may lead to servers outside the Kansas Geological Survey. At the top and bottom of DPA web pages is a standardized suite of navigational buttons that provide hypertext links to various critical DPA web pages. The top navigation bar should appear in red (Figure 12). It contains the following set of navigation buttons to move the user among the major DPA components and to other petroleum related research units at the University of Kansas.

- DPA Home: Link to the homepage for the Digital Petroleum Atlas Project (<http://www.kgs.ukans.edu/DPA/dpaHome.html>). The Homepage for the Digital Petroleum Atlas Project contains an additional navigation button in blue that provides a direct link to the US Department of Energy homepage (<http://apollo.osti.gov/html/home.html>).
- Kansas: Link to the homepage for the Kansas section for the Digital Petroleum Atlas (<http://www.kgs.ukans.edu/DPA/dpaKansas.html>).
- KGS: Link to the homepage for the Kansas Geological Survey (<http://www.kgs.ukans.edu/kgs.html>).
- PTTC: Link to the homepage for the Northern Mid-continent Resource Center of the Petroleum Technology Transfer Council (<http://www.kgs.ukans.edu/ERC/pttcHome.html>).
- Help ? : Link to a help page that provides an explanation of the structure and navigation tools used by the DPA project (<http://www.kgs.ukans.edu/DPA/Help/dpaHelp.html>).
- Site Map: Link to an interactive map of the structure of the DPA project (<http://www.kgs.ukans.edu/DPA/dpaMap.html>).

A navigation bar located on each field-level homepage provide links to standardized topical areas (figures 10, and 13a). The topical areas covered include:

- Regional Setting: Provides regional-scale maps covering the geology and production.
- General Information: Basic geologic, geophysical, fluid, engineering, completion, and production data and techniques at the field-scale.
- Geological Information: Access to geologic field maps and cross-sections through a type log graphical user interface. Clicking on selected horizon provides access to multiple maps at different stratigraphic levels. Access is also provided to structural and stratigraphic cross-sections.
- Geophysical Information: Access reflection seismic and other geophysical data (e.g., gravity and magnetics).
- Reservoir Information: Contains reservoir engineering, petrophysical and geologic information.
- Well Information: Provides access to information on a single wellbore (Figure 11). Access is through an interactive map (click on a well symbol) or search criteria (Figure 13C, API number or location). Data includes raster image of original completion report (ACO-1 in Kansas), digital "scout ticket" data, production data in graphical and digital formats, and digital log data. Digital log data is in LAS format and can be read by various log readers. Also include are any core analyses or interpreted material associated with that particular well.

In addition to the navigation bar for topical areas, buttons on the bottom of selected regional, county and field homepages provide the user the ability to move stepwise through the material. A set of "next page / previous page" buttons provides a more-or-less linear book-like approach to navigating through DPA material (Figure 13b).

Interactive Image Maps

Clickable interactive image maps and figures occur throughout the DPA (Figure 14). These graphical user interfaces are surrounded by a blue box and provide active links to custom maps and plots and to access additional DPA pages. Examples include the interactive map on the Well Information Page under each field study (Figure 14a). Clicking on a well spot on this image map provides access to the well page for that particular well (e.g., Figure 11). Another example is the interactive stratigraphic column on each County Page (figures 9, and 14b). By clicking on each active stratigraphic horizon, the column provides access to geologic and geophysical maps. Similar interactive image maps and figures occur throughout the DPA and provide links to maps, cross-sections, production plots, figures, and a wide variety of information and interpretative material.

Search Engines

Fields and wells in the DPA can be searched by geographic location (Section-Township-Range), name (API number or field name) and in the case of fields by a flexible search routine that incorporates production and geologic parameters. The search for wells and fields can be accessed through a navigation bar that appears on the Kansas DPA Homepage (figures 13c and 6, <http://www.kgs.ukans.edu/DPA/dpaKansas.html>). Similar buttons to access search programs are available on the county and field pages.

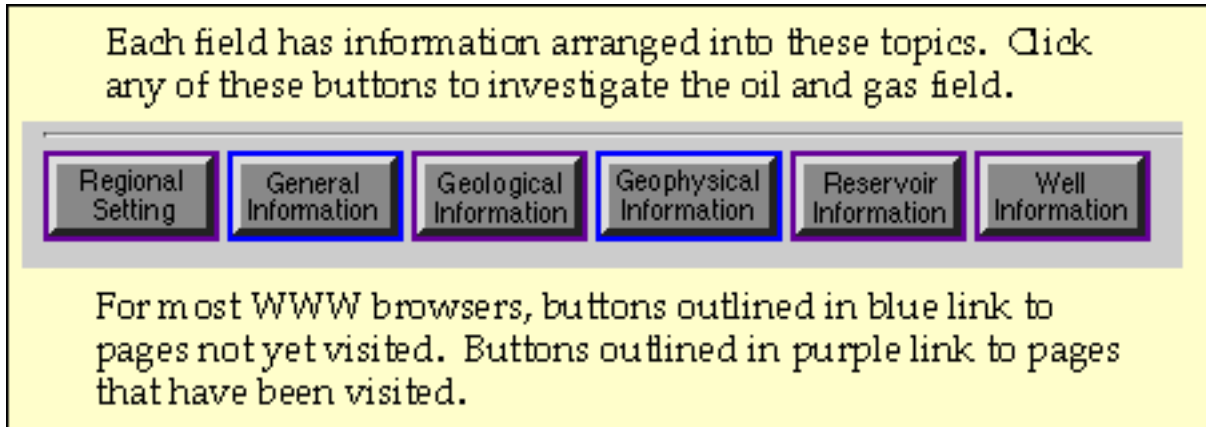
Several search routines written in C permit search by county, section-township-range, or API number of individual well data (e.g., logs, completion reports, production, etc.). All wells used in the DPA are accessible through on-line search routines. Fields in Kansas can be retrieved using a similar set of input panels and C programs (Figure 15, <http://www.kgs.ukans.edu/DPA/Forms/GeneralInfo.html>). Parameters such as geographic location, producing horizon, discovery date, cumulative production, reservoir lithology, trap type, etc., can be used to sort and search the 6,000+/- Kansas oil and gas fields. Field studies that are part of the DPA are returned as active links that can be used to access additional information.

The search panel and programs are the basis of searches at the play, field, reservoir and well levels, and provides the engine for flexible searching based on user selected geologic and production criteria through the thousands of fields, reservoirs or wells.

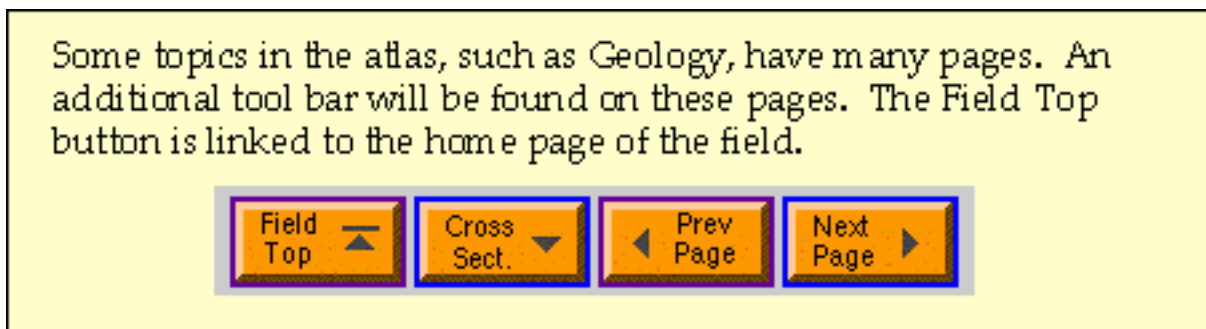
While a researcher new to Kansas may find the maps and charts are the most efficient way to become familiar with the data available on-line, the experienced user can use the search engines to locate answers to specific production and exploration questions. Work in progress will replace the existing C programs with powerful database software (ORACLE). Replacing the custom-written programs will provide greater flexibility to the user and reduce maintenance of the DPA.



Figure 12. Navigation bar located at the top of most pages in the DPA. The bar provides hypertext links to the major components of the digital atlas.



a.



b.



c.

Figure 13. a.) Navigation bar located at bottom of field pages in the DPA. Buttons lead to the topical areas covered for each field study (e.g. Geological Information). b.) Additional navigation bar located at bottom provides additional links among multiple web pages within a topical area. c.) Navigation bar that appears on selected regional, county and field homepages that provides links to search engines for locating wells and fields (See Figure 15 for an example).

Well Select map

Stevens County, Kansas Top 20 E / Rgn 41 W

Some pages have maps that are clickable imagemaps. Clicking on a well on this map, for example, brings up a page that allows downloading of well logs, ACO forms and so on.

Not all maps are linked to other pages. If a map is surrounded by a blue box, then clicking should show you a new page.

a.

MAPPED HORIZON		
SYSTEM	STAGE	GROUP
NEW ENGLAND	FORBES F.M.	Hicksville
	WILLIAMS F.M.	Green Council Grove
MISSOURIAN	VERMILION	Adrian Webb Alton Douglas
	MISSOURIAN	Lansing Kansas City Pleasanton
	OSAGEAN	Wharton Cherokee
APPALACHIAN	JORDAN	Bopech
	OSAGEAN	
	MEMPHISAN	
	OSAGEAN	
PALEOZOIC	MISSOURIAN	Vin Grapes Arlington

Stratigraphic or well log columns are found on many pages. These are usually clickable imagemaps.

Clicking on a rock name or stratigraphic unit will take you to a page about that topic.

Not all units will link to other pages, but a Help page will assist in finding out what parts of the graphic are linked.

b.

Figure 14. a.) Interactive image map provides access to pages by clicking on objects such as well spots. Clicking on well spot will lead to well information and downloadable data about that well. b.) Clicking on an interactive image such as a stratigraphic column will provide a new image (e.g., a structure map).

Search Fields by Parameters

Please enter the information about the Fields and the select the **Submit Query**
The option **ALL** stands for "no constraints to that parameter".

Field Name:	<input type="text"/>	Cum. Oil (Barek):	<input type="text" value=">"/>	<input type="text"/>
Cum. Gas (MCF):	<input type="text" value=">"/>	<input type="text" value="10,000,000"/>	Total Active Well:	<input type="text" value=">"/>
Trap Type:	<input type="text" value="ALL"/>	Field Acres:	<input type="text" value=">"/>	<input type="text"/>
Recorded Total Depth (RTD):	<input type="text" value=">"/>	<input type="text"/>	Discovery Date(19xx):	StartDate: <input type="text" value="1985"/> EndDate: <input type="text"/>
Township:	<input type="text"/>	<input type="text"/>	Range:	<input type="text"/>
Reservoir Name:	<input type="text" value="ALL"/> <ul style="list-style-type: none"> UNKNOWN Admire Arbuckle Atokan Bandera quarry Bartlesville Basal Penn Bevier coal Burgess 	Lithology:	<input type="text" value="ALL"/>	
Geology Age:	<input type="text" value="ALL"/>			
County:	<input type="text" value="ALL"/> <ul style="list-style-type: none"> ALLEN ANDERSON ATCHISON BARBER BARTON BOURBON BROWN BUTLER CHASE 	State:	<input type="text" value="KANSAS"/>	

Figure 15. Input panel for searching for oil and gas fields by selected parameters (<http://www.kgs.ukans.edu/DPA/Forms/GeneralInfo.html>). This example searches for gas fields discovered in Kansas after 1985 that have cumulative production of more than 10 Bcf. The search returned basic information about four fields including Arroyo Field in Stanton County, Kansas. Arroyo Field, which is part of the prototype DPA, is an active link that provides access to the detailed DPA field study. Searches can be conducted by a number of other geologic and geographic parameters. Also algebraic operators can be modified. Similar panels can be used for single well searches.

TECHNOLOGY TRANSFER ACTIVITIES

The world-wide-web and the publish as-you-go design of the prototype Digital Petroleum Atlas Project provided immediate and ongoing technology transfer activities. The DPA model appears to provide an efficient method of technology transfer to the geographically dispersed high technology petroleum industry. The pages that comprise the DPA are among the most visited on the Kansas Geological Survey web site and usage continues to grow (Figure 2, http://www.kgs.ukans.edu/PRS/usage/past_stats.html). Periodic email updates provided to interested operators and individuals have been well received. The distribution of the email update continues to grow and currently reaches 40 companies, organizations and individuals. As part of technology transfer efforts, seven formal talks and papers were presented to local and national meetings (Table 2). A paper to be published in COMPUTERS AND GEOSCIENCE uses the Digital Petroleum Atlas as a primary example of new forms of on-line publication (Carr and others, in press). A copy of this manuscript is available on-line as DPA topical report (http://www.kgs.ukans.edu/PRS/publication/OFR96_37/abstract.html). A paper on the application of the Internet for providing natural resource information and technology is to be published in the PROCEEDINGS OF THE GEOSCIENCE INFORMATION SOCIETY (Carr and others, in press)

Table 2.-- Formal presentations that resulted from the first year of the Prototype Digital Petroleum Atlas Project. Selected abstracts are included in Appendix A.

- Society of Independent Petroleum Earth Scientists (SIPES), Dallas, Texas, 3/21/96
- Kansas Independent Oil and Gas Association (KIOGA), Wichita, Kansas, 8/26/96
- Kansas Petroleum Council (KPC), Wichita, Kansas, 9/18/96
- The Geological Society of America, Denver, Colorado, 10/28/96
- Interstate Oil and Gas Compact Commission (IOGCC) Annual Meeting, Las Vegas, Nevada, 12/9/96
- American Association of Petroleum Geologist (AAPG) Annual Meeting, Dallas, Texas, 4/9/97
- Powder River Basin Section of Society of Petroleum Engineers, Gillette, Wyoming, 5/14/97

In addition to verbal feedback, a number of email comments were received from oil and gas operators that indicate that the product is meeting a need. Included are selected email comments from operators (names and affiliations removed).

“The digital petroleum atlas is one of the few worthwhile petroleum sites on the internet. You are demonstrating what can be done with the Web. We need more states to start doing what you are doing. Until we see more products like this the small independent will not be on the internet.”

“I think the Kansas O&G database is great and wish the project much success. I wanted to know when monthly well and field data would be available. Also will injection data also reside in the database eventually? Have you thought about writing Java applets that would plot data various ways and do decline analysis.”

“I really like the direction you're taking with the Digital Petroleum Atlas. This is the kind of information I've been hoping for from KGS and PTTC. Can't wait for you to start on other counties (like Lane and Ness for example hint, hint). Keep up the great work.”

“This service is very useful and saves a great deal of time.”

“You have done an excellent job! Love the feature, keep up the good work.”

PROBLEMS ENCOUNTERED

The Digital Petroleum Atlas was designed to be a dynamic product with the constant addition of new information and ideas. Within this changing environment all defined tasks of the one-year prototype DPA were completed. The only significant modification is elimination of a widely distributed CD-ROM version of the DPA. The growth of the Internet and the power and dynamic nature of the web format does not justify a published CD-ROM version. However, a modified CD-ROM version can be easily produced on request. In using the DPA, oil and gas operators and the interested public propose many of the ongoing changes and additions. The prototype DPA project was completed within budget and cost sharing was in excess of 20%.

RECOMMENDATIONS FOR FUTURE WORK

Results from the one-year prototype Digital Petroleum Atlas Project have significantly exceeded expectations. A follow-up project was proposed to expand the breath of plays, fields and reservoirs covered, enhance the included petroleum technology, expand the geographic coverage beyond Kansas, and improve the navigation and search technology for access to DPA technology and information.

CONCLUSIONS

As the first year of a longer-term effort, the prototype Digital Petroleum Atlas (DPA) has developed a new methodology to provide efficient and timely access to the latest petroleum data and technology for the domestic oil and gas industry, public sector research organizations and local governmental units. The DPA provides real-time and cost-effective electronic publication of materials typically found in published paper oil and gas atlases. The latest technologies and information are continuously “published” electronically when individual project components are completed, removing the lag and expense of transferring technology using traditional paper publication. Additional information and technology are constantly being added to the DPA to increase the scope and detail. Active links, graphical user interfaces and database search mechanisms provide a published product with which the operator can interact in ways that are impossible in a paper publication. Contained in the DPA are forms of publication that can only be displayed in an electronic environment (for example, animated exploration histories through time). Improvement in data and technology access for the domestic petroleum industry represents one of the best and cost-effective options that is available for mitigating the continued decline in domestic production.

The one-year prototype DPA Project developed methodologies and computerized procedures to study, compile and “publish” a limited set of field and play studies concentrated in Kansas and to a lesser extent the Northern Mid-continent Region. As part of the one year DPA project, three Kansas field studies were completed (Arroyo, Gentzler and Big Bow).

Through complete and flexible user access to technology, interpretative products and the underlying geologic and petroleum data, the DPA changes the relationship between interpretative result and data, between technology generation and application.

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APPENDIX

APPENDIX A: Selected Abstracts

Paper presented at the Society of Independent Petroleum Earth Scientists (SIPES),
Dallas, Texas, 3/21/96

The Role of the Public Sector in Providing Cost-Effective Technology to the Petroleum Independent: A Kansas Example

CARR, TIMOTHY R., Kansas Geological Survey, University of Kansas, Lawrence, KS

To remain competitive, independent oil operators require the highest level of appropriate technology, and the highest quality data. Major technical challenges to independent operators are; geologic and engineering uncertainty, lack of knowledge of existing technology, lack of high quality data, and the lack of confidence that existing technologies can improve operations. In the last few years, the University of Kansas and the Kansas Geological Survey have attempted to address these technical challenges by a renewed commitment to improve technology and data transfer. Improvements include changes both in organizational structure, research directions, and in the process of technology transfer.

Research efforts in Kansas have focused on developing tools that leverage existing data through cost-effective application of technology. Examples include: use of well logs within interpretation systems designed for analysis of 3D seismic data ("Pseudoseismic"); a spreadsheet computer program to implement traditional and innovative log analysis (PfEFFER); and techniques for acquisition of high-resolution seismic data.

Changes in the technology transfer process are moving away from the one-on-one consultations, paper publications and dusty files, and toward providing high-speed large-volume conduits for digital data and technology among operating companies, service companies, consultants and public sector entities. The Internet has provided just-in-time accessibility to fundamental well, reservoir, and geographic data (such as e-logs, production volumes, and digital map data), to petroleum related data compilations (such as field studies, regional maps and bibliographies), and to the latest research ideas. The virtual resource center provides a flexible and efficient method to disseminate data and technology to a geographically dispersed high technology industry.

Paper presented at Kansas Independent Oil and Gas Association (KIOGA), Wichita, Kansas, 8/26/96

The Internet: A Tool to Access Information and Technology for the Petroleum Independent in Kansas

CARR, TIMOTHY R., Kansas Geological Survey, University of Kansas, Lawrence, KS

The exchange of information and research results in the petroleum industry is moving away from the one-on-one consultations, paper publications and dusty files. Budget constraints and changes in communications have opened high-speed, large-volume conduits for digital data and technology among operating companies, service companies, consultants and public sector entities. The Internet provides the petroleum independent with just-in-time accessibility to real-time data (such as oil and gas prices), and basic exploration and development data (such as e-logs, production volumes, and digital map data). In addition the independent can search and access petroleum related data compilations (such as field studies, regional maps and bibliographies), and the latest research ideas.

The Kansas Geological Survey and the KU Energy Research Center are working with Kansas operators and organizations to construct a virtual resource center that provides a flexible and efficient method to communicate data and technology to a geographically dispersed high technology industry.

Paper presented at the Geological Society of America, Denver, Colorado, 10/28/96

The Impact of the Internet on the Public Sector: Providing Natural Resource Information and Technology to Kansas

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The Kansas Geological Survey uses the Internet as an important communication channel. The Internet provides rapid, cost-effective access to natural resource data, informational sources, publications, and technology. Usage of the Survey's web server has grown dramatically. Today, the Survey is weaving the Internet into all of its ongoing and future research and public service operations.

Technology and information transfer processes are moving away from individual consultations, paper publications, and dusty files, and toward high-speed large-volume conduits for digital data and technology that better fit the wide audience of academic organizations, private and public sector entities, and individual citizens. The Internet provides flexible just-in-time accessibility to fundamental geologic and geographic data, to data compilations, and to the latest research and technical studies. Products are available on-line as they are completed, at a fraction of the time and cost of paper publication. Publications with relational links and search engines allow users to modify the scale and focus to their particular requirements, and permit access to data in a

compatible format for validation and risk analysis. The Survey is designing research and technical products that go beyond traditional publications and take advantage of the Internet capabilities (examples include the Digital Petroleum Atlas and the Kansas GIS Core Database).

The Survey's virtual resource center provides a flexible and efficient method to disseminate data and technology, and provide geologic research to a geographically dispersed population. The Internet better enables the Survey's information and research results to serve as the framework upon which individual and public policy decisions are built.

To be presented at the American Association of Petroleum Geologist (AAPG) Annual Meeting, Dallas, Texas, 4/9/97

Scientific Communication in the Earth Sciences: The Impact of the Electronic Publication

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Traditional paper media, such as books, monographs, journals, and maps, have been a recognizable aspect of geologic work for several centuries. They remain the primary medium for communicating research results, transferring technology, and archiving knowledge. However, continued growth in volume of earth-science literature, increased unit costs of producing and archiving paper publications, and rapidly increasing power and availability of electronic technology are creating pressures on traditional scientific communication, and rapidly altering the role of traditional publication as a means of scientific communication. Electronic publication provides broad access and alters the relationship between interpretative result and the data. Electronic technology improves the quality and accessibility of "non-traditional" research products, (e.g., digital geographic information and unpublished archival material), and provides the means to create dynamic forms of scientific communication that can only be displayed in an electronic environment. New forms of communication use hypertext and relational database functions to provide text and graphics with which readers can interact. Electronic publication improves research reproducibility and facilitates use and continued enhancement of research products. Earth science institutions, including the Kansas Geological Survey, are experimenting with new forms of on-line publication that assure broad access to research and data, and improve application of research to societal problems.

To be presented at Powder River Basin Section of Society of Petroleum Engineers, Gillette, Wyoming, 5/14/97

The Internet: A Tool to Access Information and Technology for the Petroleum Independent

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The exchange of information and research results in the petroleum industry is moving away from the one-on-one consultations, paper publications and dusty files. Budget constraints and changes in communications have opened high-speed, large-volume conduits for digital data and technology among operating companies, service companies, consultants and public sector entities. The Internet provides the petroleum independent with just-in-time accessibility to real-time data (such as oil and gas prices), basic exploration, development and production information (such as e-logs, production volumes, and digital map data). In addition, the independent can search and access petroleum related compilations (such as field studies, regional maps and bibliographies), and the latest research ideas.

The Kansas Geological Survey and the University of Kansas Energy Research Center are working to construct a working national model of a virtual resource center. An on-line resource that provides flexible and efficient communication of data and technology to a geographically dispersed high technology industry.
