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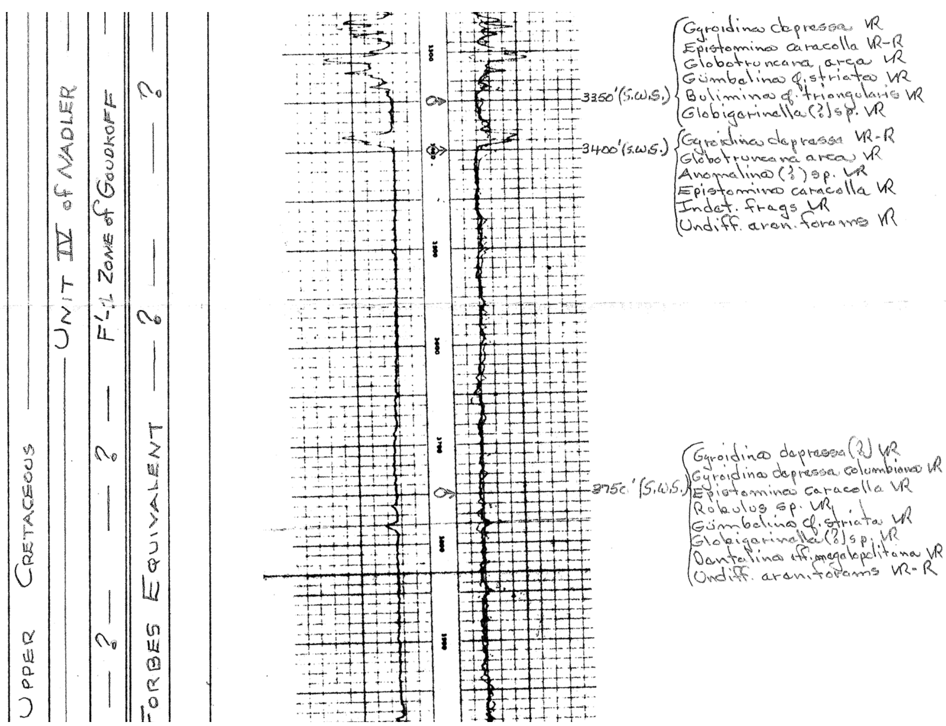
Location and Age of Foraminifer Samples Examined by Chevron Petroleum Company Paleontologists from More Than 2,500 Oil Test Wells in California

By Earl E. Brabb



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For more information concerning this publication, contact:
Earl E. Brabb, USGS Western Geology and Geophysics Team,
345 Middlefield Road, Mail Stop 975, Menlo Park, CA 94025
916-315-8811, *ebrabb@usgs.gov*.

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Cover: An example of one of the hand-annotated logs (1-A-1)

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Introduction and Background

Chevron Petroleum Company in 2001 donated an estimated 50,000 foraminifer slides, 5,000 well logs, geologic and surface locality maps, and paleontologic reports to the California Academy of Sciences and Stanford University for safekeeping, because they stopped or cut back exploration for petroleum deposits in California. The material was loaned to Earl Brabb temporarily so that information useful to the U.S. Geological Survey could be extracted. Among the estimated 5,000 well logs, more than 2,500 were printed on fragile Ozalid paper that had deteriorated by turning brown and hardening so that they could be easily damaged. These 2,516 well logs were scanned to provide a digital copy of the information (data set 1, posted separately at *http://pubs.usgs.gov/of/2011/1262/of2011-1262_data_set1_filecabinets/*).

The 2,516 wells extend over an area from Eureka in Humboldt County south to the Imperial Valley and from the Pacific Ocean east to the eastern side of the Great Valley and the Los Angeles Basin (fig. 1). The wells are located in 410 7.5-minute quadrangle maps in 42 counties. The digital information herein preserves the data, makes the logs easily distributed to others interested in subsurface geology, and makes previously proprietary information widely available to the public for the first time.

Information Provided

The information in the accompanying spreadsheet database for nearly all of the wells was taken, in part, from one of the six California Division of Oil, Gas and Geothermal Resources (DOGGR, formerly called the Division of Oil and Gas) District databases. District 6 is divided into two parts (6a and 6b) so that the total number of Districts in this report is regarded as seven. The rest of the information came from the original well logs. Identification data for the wells is somewhat complicated. Many of the Chevron well logs did not have the American Petroleum Institute (API) number, which hardly ever changes and is the most useful parameter in searching DOGGR databases. A search of other information on the well log was needed. Both the operator and lease names change over time as the well is sold or transferred to another owner, so these names in the DOGGR database may not even faintly resemble the original name on the well log. Similarly, the well number may change as wells are transferred or sold. The latitude and longitude are not consistently provided in most of the seven DOGGR databases, nor are the total depths. Finding a particular well in the DOGGR database, therefore, requires persistence and some luck in tracking down several factors related to the well description. Some errors in the spreadsheet database are likely.

All of the 2,516 wells in the spreadsheet database included with this report are accompanied by a scanned image of the original well record. This image can be located using a code in column A that indicates where the image is stored. The scanned images are divided into 10 parts or boxes (1, 2, 3, 4, 5, 6, 7, 19, 20, and 21). Each box is divided into at least 2 drawers (A through E for some boxes) that correspond to the file cabinet drawers where the hard copies of the wells were originally stored. The drawers may be further divided into parts or folders if the number of images in a drawer is large. An image with a code of 1A17, for example, is stored in box 1, drawer A, within a folder with numbers 1 to 69, image 17. An image with a code of 19A23 is stored in Box 19, drawer A, folder 1 to 48, item 23. The search process is started by clicking on the box number that corresponds to the first number of the code in the spreadsheet database and then successively on the drawer letter (A, B, C D, or E), on the folder with the range of numbers that includes the image number wanted, and then on the specific image wanted. The spreadsheet database (data set 2) is posted separately at *http://pubs.usgs.gov/of/2011/1262/of2011-1262_data_set2_database/* in several file formats.

This spreadsheet database provides information about well locations (columns E, F, G, H J, K and L), total depth of the well (column R), date when the Chevron paleontologist completed the age analysis (column M), name of the operator who drilled the well (column B), name of the land-owner or lease-holder (column C), lithology age, and depth of various geologic units in the well (column Q), the American Petroleum Institute (API) file number (column I), and the number of the DOGGR District digital file (column O). District 4 is divided into part 1 and part 2 because the files are so large.

Logs showing the distribution of heavy minerals, electrical logs with no paleontologic information, reports about the petrography of sandstones, and reports by paleontologists about fossils in the well are not provided here but are in many of the well files. These can be accessed at the Branner Library, Stanford University. Other companies drilled many of these wells but their slides with foraminifers were examined and dated by Chevron paleontologists. Most of the wells were drilled in the 1950s and 1960s but some of the wells were drilled in the 1930s and 1940s and some as late as the 1980s.

Ages of Foraminifers

Foraminifers were the principal fossil group used to date the rocks in the 1950's and 1960's when most of the wells were drilled. The zones defined by Goudkoff (1945) were used for the Cretaceous and those by Kleinpell (1938) and Laiming (1940) for the Tertiary. Cretaceous zones were extended and modified by Berry (1974) who used these new definitions to revise the ages for many of the wells.

Correlation of Tertiary foraminifers has changed substantially in the last 50 years. Poore (1980) pointed out that many of the zones and stages are time-transgressive when compared with zonations of calcareous plankton used in international standards. Kleinpell (1980) provided a new correlation of California stages that extensively modifies his 1936 correlations. His new classification was used to change Zemorrian ages from the early Miocene used by Chevron paleontologists to Oligocene. McDougall (2007) has restudied the type sections used by Laiming (1940) and refined the taxonomy of the foraminifers to establish better correlations between the California benthic stages and zones and the standards for nannoplankton and planktic foraminifers. Her scheme for correlating Paleogene foraminifers is substantially different from that of Kleinpell (1980) and is used in this report to change some of the Chevron ages. Some information from the report by Almgren and others (1988) was also used. These changes are only a temporary and arbitrary age assignment until the Chevron faunas are restudied. The scanned images of each well can always be checked to determine what age was originally used by Chevron paleontologists.

Acknowledgments

I am most grateful to the paleontologists, geologists, and managers with Chevron Petroleum Company who provided the materials for this report. I am also greatly indebted to Carl Wentworth and Joel Robinson who worked with the well database in GIS format to determine if the quadrangle names were correct. Carl also kindly pointed out a reference for the Sun Lepori well near Point Arena. Lew Rosenberg was helpful in providing simplified copies of digital well data from the seven DOGGR Districts. Century Graphics in North Highlands and El Dorado Hills scanned the well logs, some of them exceeding 10 ft in length, and provided the images used in this report.

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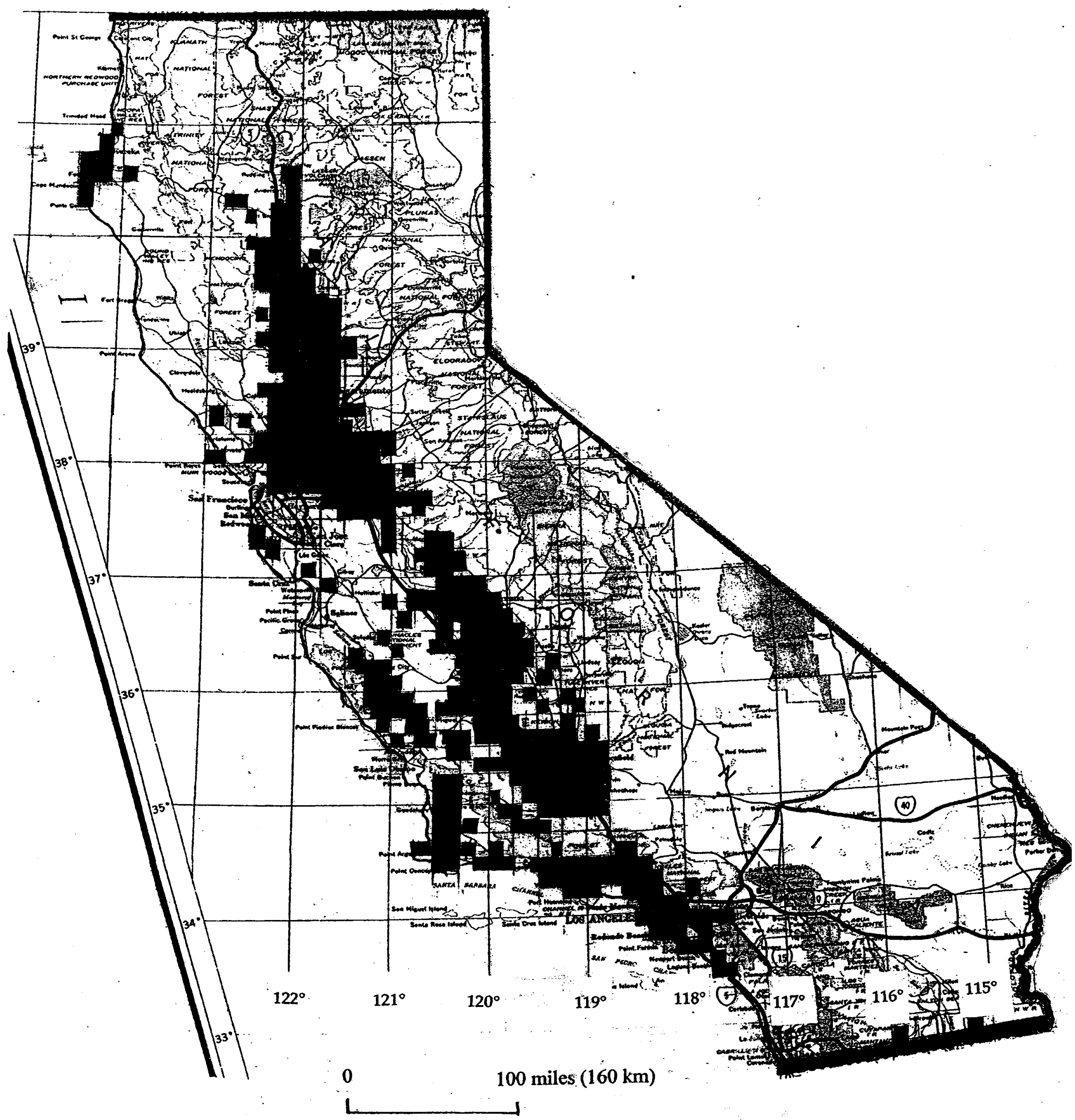

Figure 1. Map of California showing the approximate location of the 410 U.S. Geological Survey 7.5-minute quadrangles that contain the 2,516 well logs in this report.