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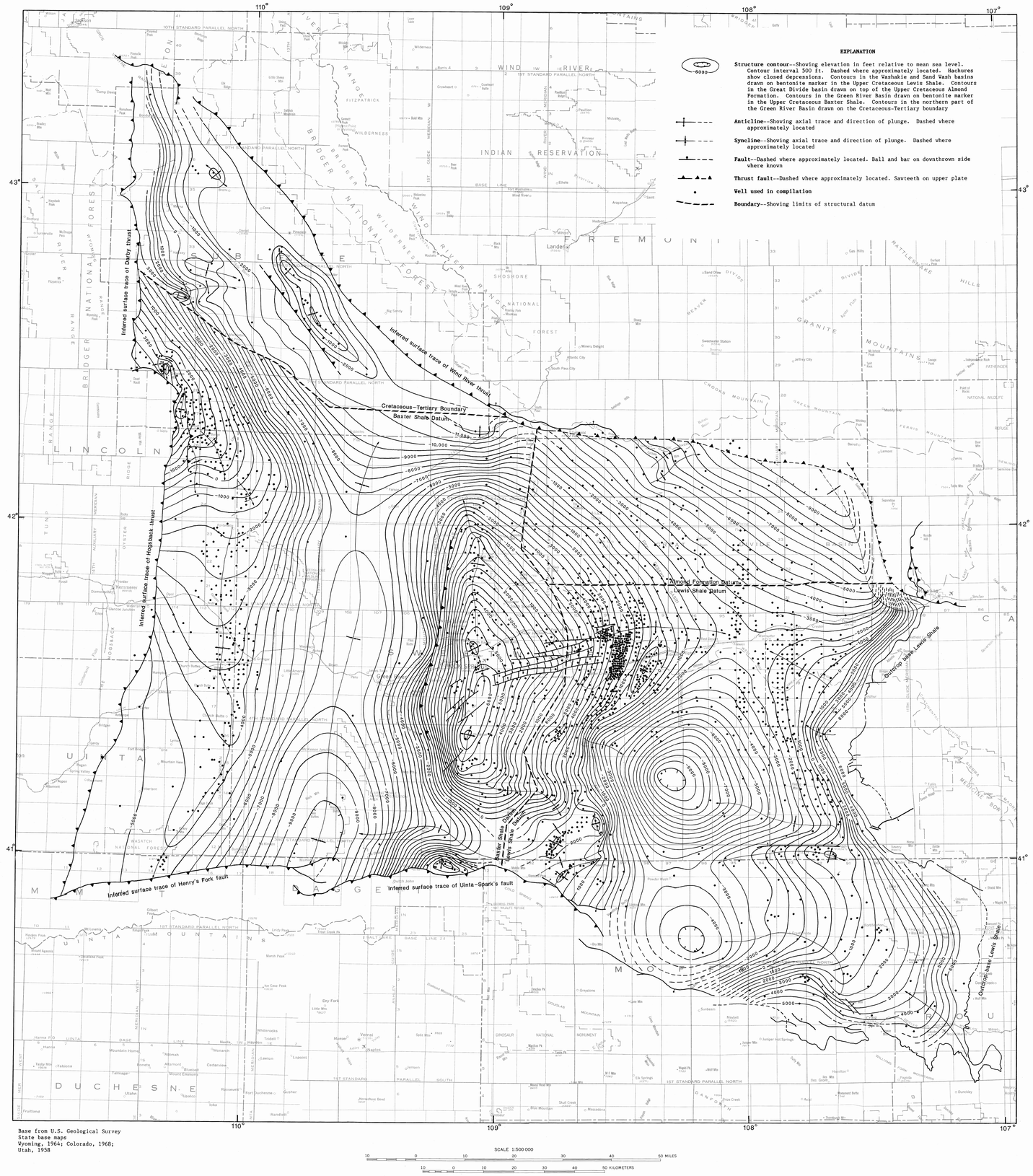
MISCELLANEOUS FIELD STUDIES
MAP MF-2031



Base from U.S. Geological Survey
State base maps
Wyoming, 1964; Colorado, 1968;
Utah, 1958

STRUCTURE CONTOUR MAP OF THE GREATER GREEN RIVER BASIN, WYOMING, COLORADO, AND UTAH

By

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INTRODUCTION

The Greater Green River basin of Wyoming, Colorado, and Utah contains five basins and associated major uplifts (fig. 1). Published structure maps of the region have commonly used the top of the Lower Cretaceous Dakota Sandstone as a structural datum (Petroleum Ownership Map Company (POMCO), 1984; Rocky Mountain Association of Geologists, 1972). However, because relatively few wells in this area penetrate the Dakota, the Dakota structural datum has to be constructed by projecting down from shallower wells. Extrapolating in this manner may produce errors in the map. The primary purpose of this report is to present a more reliable structure contour map of the Greater Green River basin based on datums that are penetrated by many wells.

The final map shows the large- to small-scale structures present in the Greater Green River basin. The availability of subsurface control and the map scale determined whether or not a structural feature was included on the map. In general, large structures such as the Moxa arch, Pinedale anticline, and other large folds were placed on the map based solely on the structure contours. In comparison, smaller folds and some faults were placed on the map based on structure contours and other reports (Bader, 1987; Bradley, 1961; Love and Christiansen, 1985; McDonald, 1975; Roehler, 1979; Wyoming Geological Association Oil and Gas Symposium Committee, 1979). State geologic maps and other reports were used to position basin margin faults (Bryant, 1985; Gries, 1983a, b; Hansen, 1986; Hintze, 1980; Love and Christiansen, 1985; Tweto, 1979, 1983). In addition, an interpreted east-west-trending regional seismic line by Garing and Tainter (1985), which shows the basin configuration in cross-section, was helpful in locating buried faults, such as the high-angle reverse or thrust fault along the west flank of the Rock Springs uplift.

The following sections describe the four structural datums.

Lewis Shale datum

In the Washakie and Sand Wash basins, a distinctive, easily recognizable bentonite marker from the lower part of the Upper Cretaceous Lewis Shale was chosen as the structural datum (fig. 4). The marker we used is typical of bentonite zones in that it produces a high conductivity (or, conversely, low resistivity) peak on well logs. Many published stratigraphic cross sections were used to trace the Lewis marker in the Washakie basin (Tyler, 1978a, b, 1979a, b, c, 1980a, b, c; and Tyler and others, 1981, 1982). A stratigraphic cross section by Bader (1983) was used to identify the Lewis marker south of the Cherokee Ridge into the Sand Wash basin.

Almond Formation datum

North of the Wamsutter Arch, in the Great Divide basin, the Lewis Shale contains a higher proportion of sand, making it difficult to recognize the Lewis marker. Therefore, in the Great Divide basin, the top of the Upper Cretaceous Almond Formation was used as the structural datum (fig. 5). The top of the Almond Formation is not isochronous; it rises stratigraphically from east to west across the basin. Several stratigraphic cross sections were used to identify the top of the Almond Formation in the Great Divide basin (Bucurel, 1981, 1982; and Bucurel-White, 1983).

Baxter Shale datum

The Lewis Shale is generally not present west of the Rock Springs uplift, in the Green River Basin, due to both nondeposition and erosion. Therefore, structure contours in the Green River Basin are drawn on a bentonite marker selected from the next marine shale stratigraphically below the Lewis--the Baxter Shale. The marker is isochronous and produces a high conductivity peak on well logs (fig. 6). Several published cross sections of the Green River Basin were used to identify the Baxter Shale marker (Bader and others, 1982; Law and others, 1979; Markochick and others, 1982).

DISCUSSION

Among the Upper Cretaceous stratigraphic units penetrated by wells, no single structural datum is recognizable throughout the Greater Green River basin; therefore, four different structural datums were used in constructing the structure contour map (figs. 2 and 3). Datums were chosen from Upper Cretaceous units because of U.S. Geological Survey interest in gas-bearing Upper Cretaceous and Lower Tertiary low-permeability reservoir rocks and because of the availability of large numbers of logs from wells that penetrate at least part of the Upper Cretaceous section. The stratigraphic markers were selected from more than 2,000 electrical logs and were correlated using the spontaneous potential (SP), resistivity (RES), and conductivity (CON) traces. If available, bentonite marker beds such as those in the Upper Cretaceous Baxter, Hilliard, and Lewis Shales were used preferentially over other markers because they represent volcanic ash falls that were deposited in a relatively short period of time, whereas the other datums used are time transgressive. In general, as an aid to correlation, individual wells were compared to a cross-sectional framework composed of both published and unpublished stratigraphic cross sections.

The location of each well and the elevation of the structural datum at each well were calculated and plotted on the map by computer. Structure contours were computer generated and then modified by hand to produce the final map.

Cretaceous-Tertiary boundary

The Baxter marker cannot be traced into the northern part of the Green River Basin because an insufficient number of wells penetrate the Baxter Shale. Consequently, structure contours in the northern part of the Green River Basin are drawn on the Cretaceous-Tertiary boundary (fig. 7). The choice of correlatable stratigraphic markers in this area is limited due to the lack of sufficient stratigraphically deep wells, the discontinuous nature of the lithologic units, and the lack of sufficient biostratigraphic information (Law, 1984). The identification of the Cretaceous-Tertiary boundary is based on work by Law (1979) and Law and Nichols (1982).

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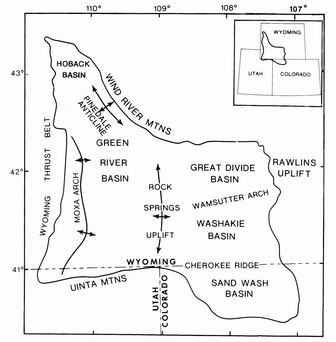

Figure 1.--Index map showing location of Greater Green River basin and associated major structural features.

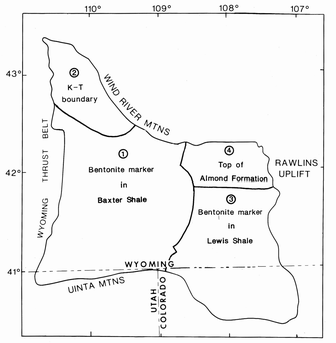

Figure 2.--Map showing structural datums used in different parts of basin. Circled numbers refer to stratigraphic position of structural datums shown in figure 3.

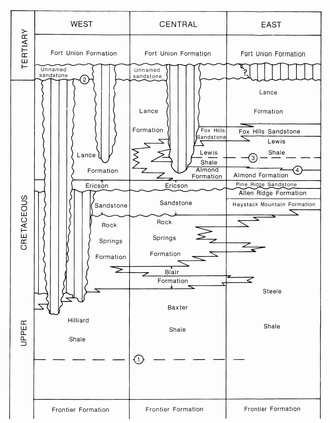

Figure 3.--Generalized geologic column showing correlations of Upper Cretaceous and lower Tertiary rocks in the west, central, and east Greater Green River basin. Circled numbers refer to the structural datums used in the basin and shown in figure 2.

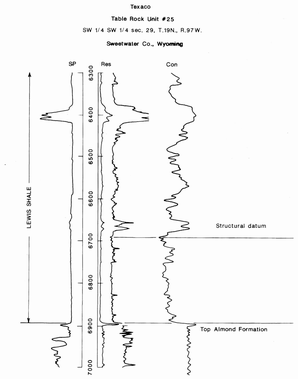

Figure 4.--Type log for the Washakie and Sand Wash basins showing the structural datum in the Upper Cretaceous Lewis Shale.

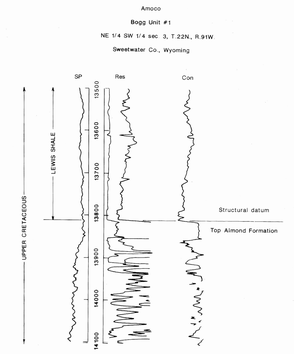

Figure 5.--Type log for the Great Divide basin showing the structural datum at the top of the Upper Cretaceous Almond Formation.

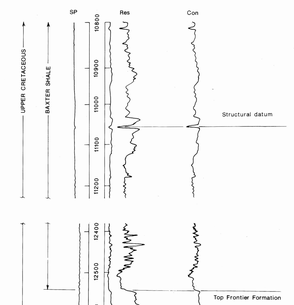

Figure 6.--Type log for the Green River Basin showing the structural datum in the Upper Cretaceous Baxter Shale.

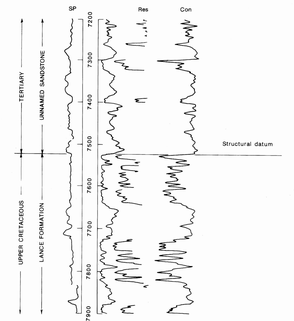

Figure 7.--Type log for the northern part of the Green River Basin showing the structural datum at the Cretaceous-Tertiary boundary.

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