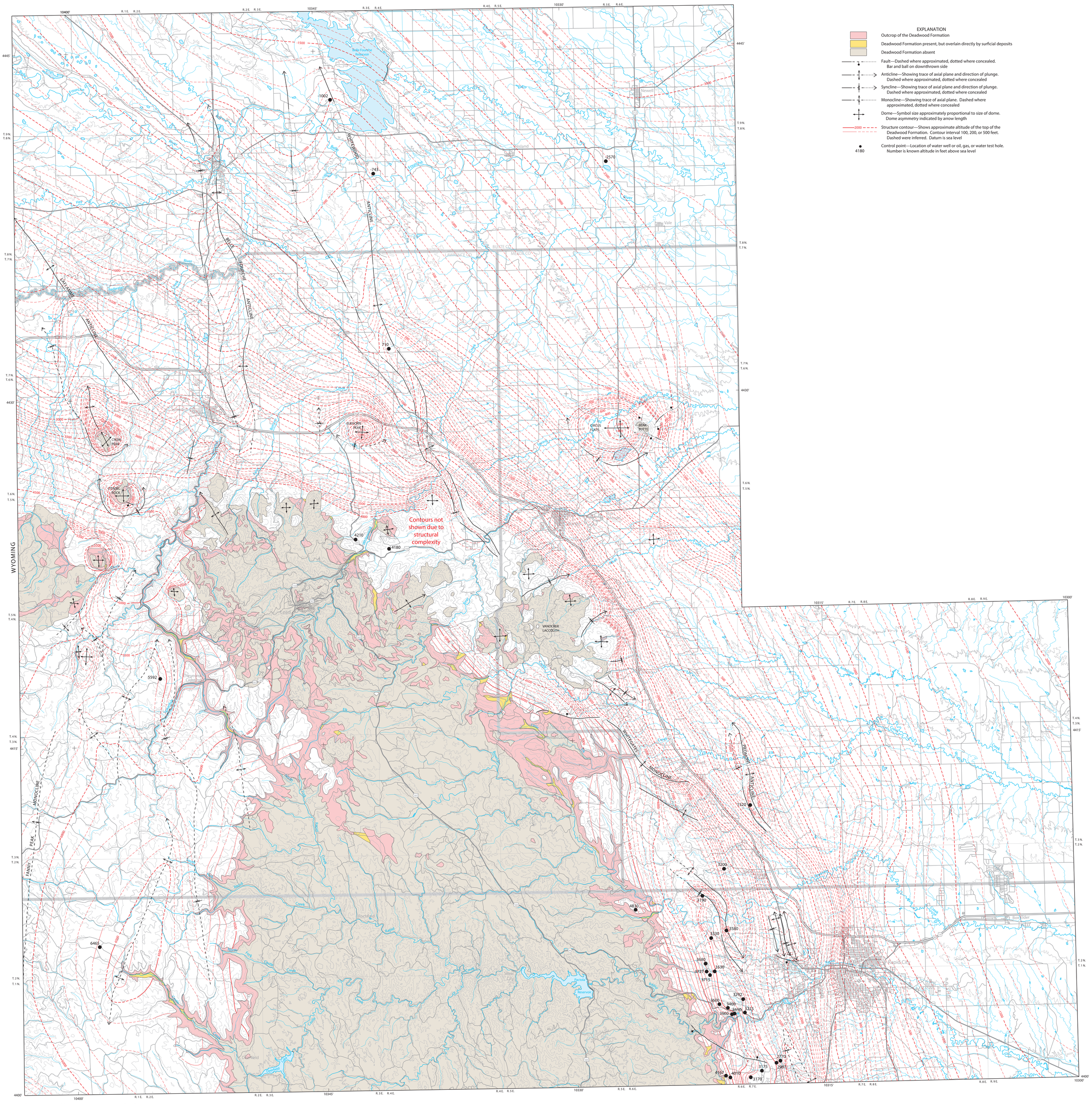
U.S. DEPARTMENT OF THE INTERIOR
U.S. GEOLOGICAL SURVEY

PREPARED IN COOPERATION WITH THE
SOUTH DAKOTA DEPARTMENT OF ENVIRONMENT AND NATURAL RESOURCES
AND THE WEST DAKOTA WATER DEVELOPMENT DISTRICT

HYDROLOGIC INVESTIGATIONS ATLAS HA-744-E
Northern part of area —SHEET 1 OF 2
Carter, J.M., and Redden, J.A., 1999, Altitude of the Top of the Deadwood Formation in the Black Hills Area, South Dakota



Planimetric base from U.S. Geological Survey digital data, 1:100,000: Devils Tower and Sundance, 1979; Belle Fourche, 1983; Rapid City, 1977
Topographic base modified from U.S. Geological Survey digital data, 1:24,000, from maps dated 1950-84
Universal Transverse Mercator projection
Zone 13
North American Horizontal Datum 1927

INTRODUCTION

This map is a product of the Black Hills Hydrology Study, which was initiated in 1990 to assess the quantity, quality, and distribution of surface water and ground water in the Black Hills area of South Dakota (Driscoll, 1992). This long-term study is a cooperative effort between the U.S. Geological Survey (USGS), the South Dakota Department of Environment and Natural Resources, and the West Dakota Water Development District, which represents various local and county cooperators. This map is part of a series of 1:100,000-scale maps for the study. The maps include a hydrogeologic map, structure-contour maps (altitudes of the tops of formations) for five formations that contain major aquifers in the study area, and potentiometric maps for these five major aquifers (the Inyan Kara, Minnekahta, Minnelusa, Madison, and Deadwood aquifers).

The study area consists of the topographically defined Black Hills and adjacent areas located in western South Dakota. The Black Hills area is an elongated, dome-shaped feature, about 125 miles long and 60 miles wide, which was uplifted during the Laramide orogeny (Feldman and Heimlich, 1980). The oldest geologic units in the study area are Precambrian metamorphic and igneous rocks, which are exposed in the central core of the Black Hills. Surrounding the Precambrian core is a layered series of sedimentary rocks including limestones, sandstones, and shales that are exposed in roughly concentric rings around the uplifted flanks of the Black Hills. The bedrock sedimentary units typically dip away from the uplifted Black Hills at angles that approach or exceed 10 degrees near the outcrops, and decrease with distance from the uplift. Many of the sedimentary units contain aquifers, both within and beyond the study area. Recharge to these aquifers occurs from infiltration of precipitation upon the outcrops and, in some cases, from infiltration of streamflow (Hortness and Driscoll, 1998). Artesian conditions generally exist within these aquifers where an upper confining layer is present. Flowing wells and artesian springs that originate from confined aquifers are common around the periphery of the Black Hills.

The purpose of this map is to show the altitude of the top (structure contours) of the Deadwood Formation within the area of the Black Hills Hydrology Study. The depth to the top of the Deadwood Formation can be estimated at a specific site by subtracting the altitude of the top of the formation from the topographic elevation. However, caution is urged in determining the depth to the top of the formation in areas on the map

SOURCES OF DATA

The outcrops shown on the map are from Strobel and others (1999), and the structural features are modified from Redden (1994) and Strobel and others (1999). The data points shown on this map were compiled from interpretation of drillers' logs and geophysical logs of numerous oil, water, and gas wells and test holes, and from information stored in the ground-water database of the USGS National Water Information System. Many of the site locations were field verified during the study. The altitudes of subsurface contacts were compiled from data obtained from J. Paul Gries (South Dakota School of Mines and Technology), the South Dakota Geological Survey, and the USGS. Additional information for the wells and test holes used for this map are presented in Carter (1999). In areas where no wells penetrated the Deadwood Formation, the altitude of the top of the formation was estimated based on the structure contours of the shallower Inyan Kara Group (Carter and Redden, 1999a), Minnekahta Limestone (Carter and Redden, 1999b), Minnelusa Formation (Carter and Redden, 1999c), and Madison Limestone (Carter and Redden, 1999d). The structure contours in these areas probably are less accurate than in areas nearer the outcrop of the Deadwood Formation.

DESCRIPTION OF THE DEADWOOD FORMATION

The Cambrian- and Ordovician-age Deadwood Formation is composed primarily of brown to light-gray glauconitic sandsone, shale, limestone, and local basal conglomerate (Strobel and others, 1999). The thickness of the Deadwood Formation increases from south to north in the study area and ranges from 0 to 500 feet; the Deadwood Formation is absent in the southern part of the study area (Gries, 1975). In the northern and north-central Black Hills, the Deadwood Formation is conformably overlain by the Whitewood Dolomite and Winnipeg Formation. The Winnipeg Formation is not present south of the approximate latitude of 44 degrees, and the Whitewood Dolomite is not present south of the approximate latitude of Nemo (DeWitt and others, 1986). South of the approximate latitude of 44 degrees, the Deadwood Formation is overlain by the Devonian- and Mississippian-age Englewood Formation. The Deadwood Formation is underlain by Precambrian-age igneous and metamorphic rocks throughout the study area.

ALTITUDE OF THE TOP OF THE DEADWOOD FORMATION

The Deadwood Formation generally dips away from the core of the Black Hills. The dip of the top of the Deadwood Formation generally is steepest near the outcrop, where it can exceed 20 degrees, and gradually decreases with increasing distance from the outcrop to less than 1 degree near the study area boundary. The altitude of the top ranges from 7,000 feet above sea level (based on the National Geodetic Vertical Datum of 1929) in the west-central part of the study area to 3,200 feet below sea level in the northeastern part. Structure contours were not drawn in part of the northeastern part of the study area because of lack of data points and structural complexity.

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———1999b, Altitude of the top of the Minnekahta Limestone in the Black Hills area, South Dakota: U.S. Geological Survey Hydrologic Investigations Atlas HA-744-B, 2 sheets, scale 1:100,000.
———1999c, Altitude of the top of the Minnelusa Formation in the Black Hills area, South Dakota: U.S. Geological Survey Hydrologic Investigations Atlas HA-744-C, 2 sheets, scale 1:100,000.
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INDEX TO STRUCTURE MAPPING

Structure contours modified from:
1. Redden (1994)

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Altitude of the Top of the Deadwood Formation in the Black Hills Area, South Dakota

By
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1999