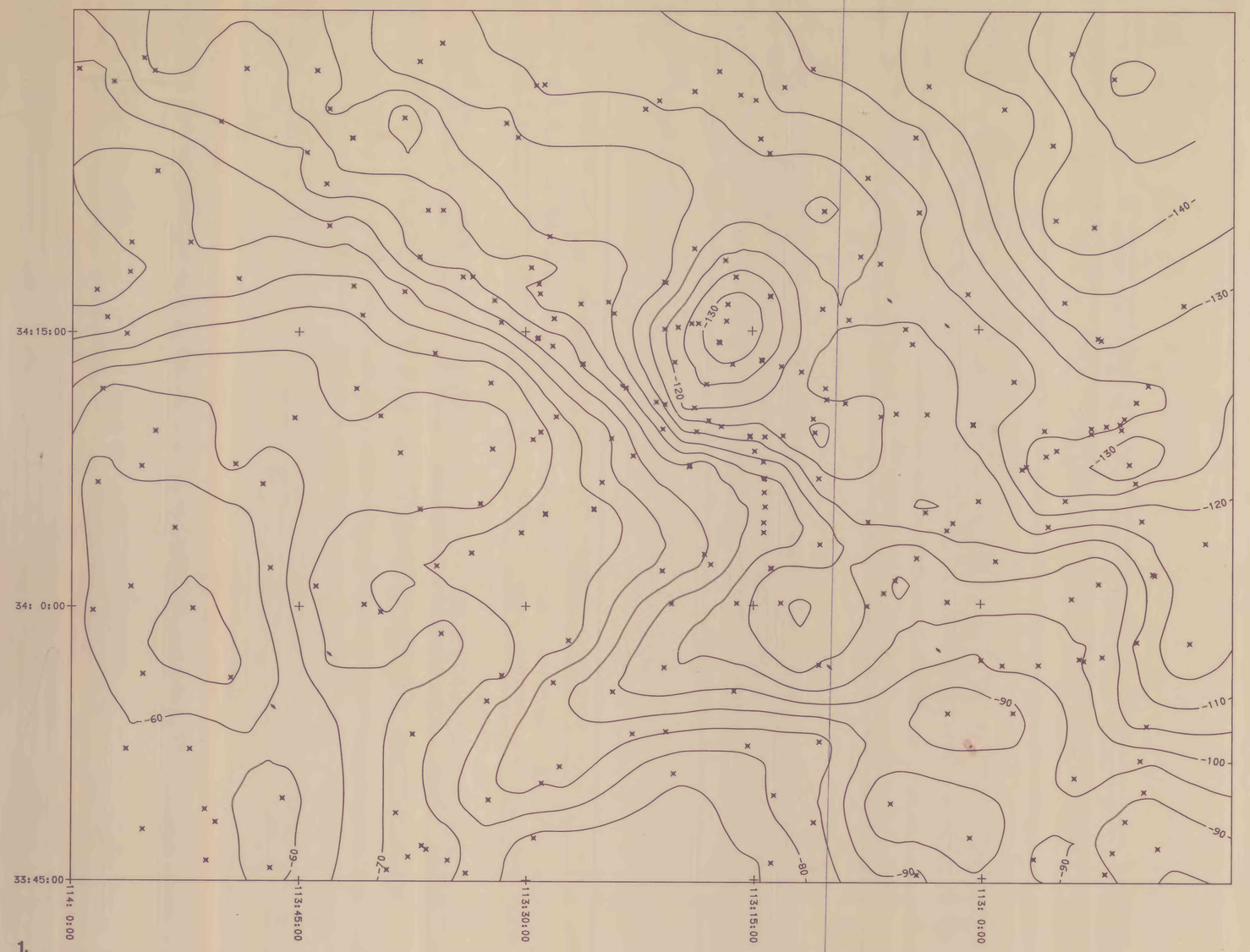
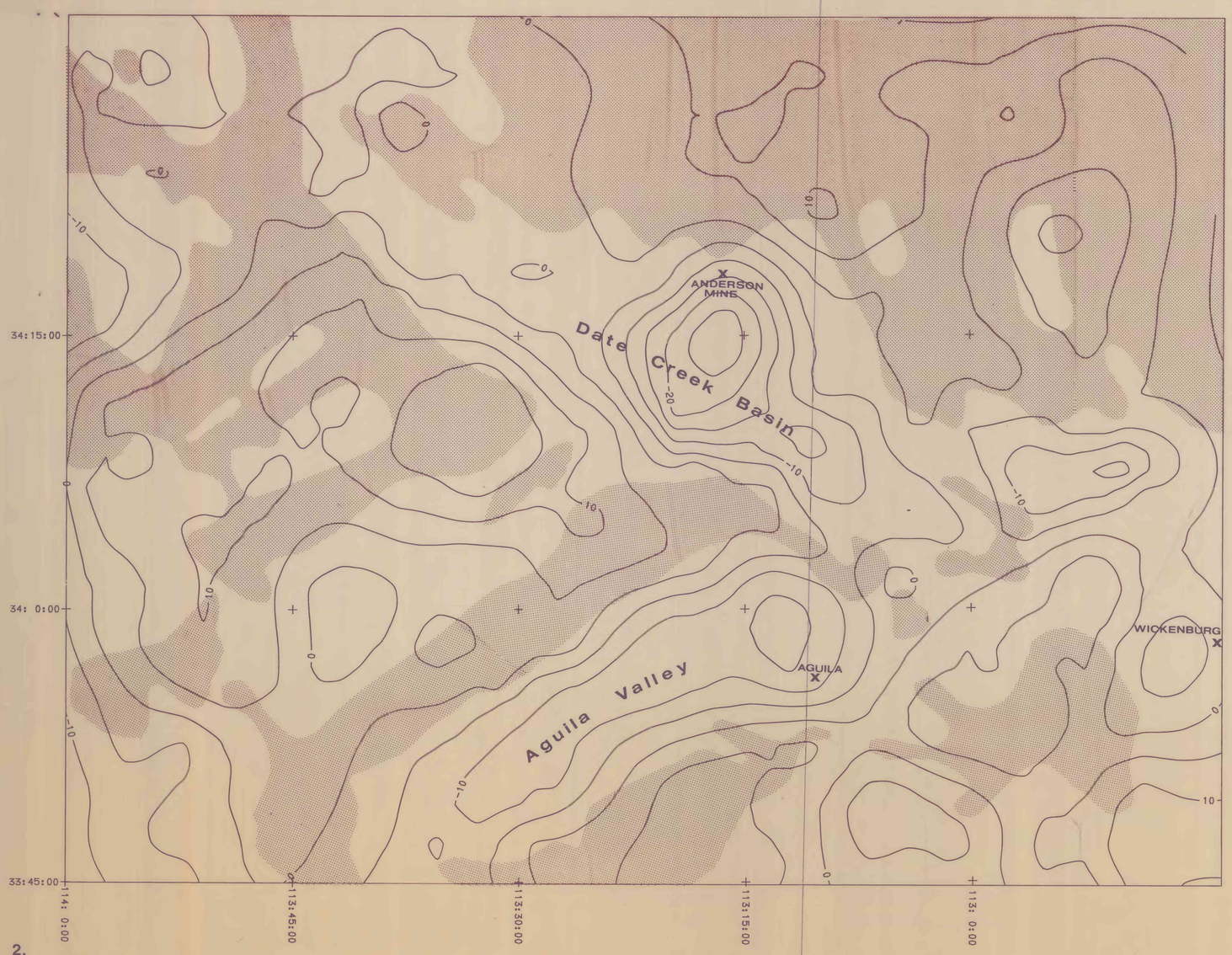
DEPARTMENT OF THE INTERIOR
UNITED STATES GEOLOGICAL SURVEY

OPEN-FILE REPORT
78-362
SHEET 1 OF 2



1.
Date Creek Basin & vicinity complete Bouguer gravity
Scale 1:250,000

Asterisks show station locations



2.
Date Creek Basin & vicinity 2nd order residual gravity
Scale 1:250,000

Stippled areas underlain largely by Precambrian through Mesozoic igneous and metamorphic rock

3.
Anderson Mine anomaly 2nd order residual gravity
Scale 1:125,000

COMPLETE BOUGUER GRAVITY MAPS AND GRAVITY MODELS OF THE DATE CREEK BASIN AND VICINITY, MARICOPA, MOJAVE, YAVAPAI, AND YUMA COUNTIES, ARIZONA

By
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1978

Introduction

A gravity survey was made in parts of Maricopa, Mohave, Yavapai and Yuma Counties, Arizona, to provide information on basin-fill and basement structural relationships of the Date Creek Basin and surrounding areas as part of on-going studies of the uranium geology of western Arizona by the U.S. Geological Survey. The principal facts of the gravity stations have been reported in Wynn, Otton, and Stawicki (1978); this report includes maps and models derived from these data.

The gravity models in this report were calculated using the three-dimensional gravity modeling program of Cordell and Henderson (1968), modeling the basins as an aggregate of three dimensional prisms extending from the reference surface of the Date Creek Basin. This reference surface is taken to be at an elevation of 670 meters above sea level, and is used as the reference datum for the gravity models in maps 4 and 7. The prisms are two kilometers on a side and extend from the datum surface downward, their bottom edges being the contact with the crystalline basement. The depth extent of each prism is varied through several iterations, each time calculating the gravity field of all the prisms taken together, comparing this calculated field with the observed field, and adjusting the lengths of each prism accordingly until an optimum fit is obtained between calculated and observed fields.

A drill hole intersected crystalline basement at 1.71 kilometers below the 670 meter datum in the center of the Anderson Mine gravity anomaly. This depth control was used in model No. 4 to derive a density contrast between basin-fill and crystalline rocks of -0.72 gm/cm^3. This value was then used to calculate the model of map 6, but a limitation of the computer program required the use of a different reference surface. The result of map 6 was then shifted upwards by 412 meters to conform to the known depth-to-basement of -1.71 kilometers at the Anderson Mine anomaly. This process in effect uses the -0.72 gm/cm^3 density contrast to model the nearby basins. A test of the accuracy of this assumption can be made by checking the elevations in map 7 that are above the 670 meter datum (zero elevation in map 7), and comparing them to two kilometer averages for elevations of the outcropping non-basin-fill rocks in the surrounding mountains. A preliminary check by the authors has found that the comparison is quite good, adding confidence to the model for the basement depths in map 7.

Description of the generation of the maps

Seven maps accompany report, and the description of their derivation is as follows:

Map No.	Title of map	Description of its derivation
1	Date Creek Basin and vicinity complete Bouguer gravity	Complete Bouguer gravity map of the area bounded by 33°45' and 34°33' north latitude, and by 112°45' and 114°00' west longitude, derived by contouring the data from Wynn, Otton, and Stawicki, 1978. A two kilometer grid was used, and the data are plotted with a 5.0 milligal contour interval. Explanation of the data reduction is given in Wynn, Otton, and Stawicki, 1978. Asterisks show station locations.
2	Date Creek Basin and vicinity second-order residual gravity	The residual that remains after a second-order surface is removed from map 1. Equation of the second-order surface: -97.0876 -2.030097 X -2.12002 Y + 0.007307 XY -0.033985 X^2 -0.026703 Y^2 where the grid unit is 2.0 kilometers, X_0 = -30 km, Y_0 = -22 km. Contour interval = 5.0 milligals, and stippling shows non-basin-fill rocks.
3	Anderson Mine anomaly second-order residual gravity	Segment blocked out from map 2 in the vicinity of the Anderson Mine, chosen for modeling purposes. It is bounded by 34°03' and 34°22' north latitude, and by 113°00' and 113° 25' west longitude. Contour interval = 2.5 milligals
4	Anderson Mine gravity model in km (drho = .72)	Contours in kilometers of the best fit model surface for the data of map 3. DRHO is the density contrast of -0.72 gm/cm^3, chosen to give results that were consistent with drill-hole information. Three-dimensional gravity-modeling program of Cordell and Henderson, 1968 was used, with 670 meters above sea level used as the reference datum. Contour interval = 0.2 km.
5	Two-Basins second-order residual gravity	Segment blocked out from map 2 in the SW three-fourths of the map area, chosen for modeling of the combined Date Creek and Aguila Valley Basins. It is bounded by 33°45' and 34°23' north latitude, and by 113°00' and 114°00' west longitude. Contour interval = 5.0 milligals.
6	Two-Basins gravity model in km (drho = -.72)	Contours in kilometers of the best fit model surface for the data of map 5. DRHO is the density contrast of =0.72 gm/cm^3 that was used, and all other parameters chosen to be the same as the model in map 4. Contour interval = 0.2 km.
7	Two-Basins gravity model, datum shifted 412 meters	Map 6, shifted by +412 meters to give depth to the bottom of the Anderson Mine anomaly consistent with drill-hole data (The bottom of the drill hole is 1.71 km below the 670 meter datum). Thus, the density contrast obtained from the Anderson Mine anomaly was extended to model the surrounding basins. Values above the datum roughly approximate the elevations of the outcropping rocks, indicating that the -0.72 gm/cm^3 density contrast is a good approximation of the density difference between sedimentary basin-fill and crystalline rocks throughout the map area. Contour interval = 0.2 km.

References Cited

Cordell, L., and Henderson, R. G., 1968, Iterative three-dimensional solution of gravity anomaly data using a digital computer: Geophysics, v. 33, no. 4, p. 596-601.

Wynn, J. C., Otton, J. K., and Stawicki, R. A., 1978, Principal facts for gravity stations in Maricopa, Mojave, Yavapai, and Yuma Counties, Arizona: U.S. Geological Survey Open-File Rept. 78-207.