UNITED STATES
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Technical Letter
Dribble-20
August 13, 1962

Federal Center, Denver 25, Colorado

Mr. James E. Reeves, Manager
Nevada Operations Office
U. S. Atomic Energy Commission
P. O. Box 1676
Las Vegas, Nevada

Dear Mr. Reeves:

Transmitted herewith are two copies of:

TECHNICAL LETTER: DRIBBLE-20

VELOCITY CROSS SECTION 3, EXTENDING WEST
FROM TATUM DOME,
LAMAR COUNTY, MISSISSIPPI

By

R. A. Black, D. H. Eargle, B. Davis,
and J. Stanford

August 13, 1962

USGS-474-283

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Sincerely yours,

W. S. Twenhofel

W. S. Twenhofel
Program Supervisor
Special Projects Branch

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VELOCITY CROSS SECTION 3, EXTENDING WEST FROM
TATUM DOME, LAMAR COUNTY, MISSISSIPPI

By

R. A. Black, D. H. Eargle, B. Davis, and J. Stanford

Velocity cross section 3 extends about 26 miles slightly south of west from Tatum salt dome, south-central Lamar County, Mississippi, to the southeastern part of Walthall County. The line of section passes just north of the Baxterville and Sandy Hook oil fields and ends near the Dexter oil and gas fields in Walthall County. Cross section 3 is the third of a series of seven such cross-sections (fig. 1) that will be prepared to show major sonic velocity zones (and lateral variation of sonic velocity within these zones) for a region within a radius of about 25 miles of Tatum salt dome. Tatum dome is the site proposed for a series of seismic experiments for improving the detection of underground nuclear explosions. These experiments have the code name "Dribble" and are part of the Vela Uniform program of the Atomic Energy Commission.

Data on sonic velocities of the sedimentary rocks surrounding Tatum dome are required for planning of instrumentation for recording the proposed seismic events and in the interpretation of the recorded seismograms. As shown in figure 1, all of the velocity sections will radiate outward from the Humble Oil and Refining Company's No. 1

EXPLANATION

•EL-3

Well, with key number, for which an electrical log is available, on or projected to velocity cross section

●CVL-21

Well, with key number, for which a continuous-velocity log is available, on or projected to velocity cross section

Key numbers correspond to those in Technical letter Dribble-2

— Velocity cross section —

0 5 10 Miles
Scale

FIGURE 1.—MAP OF PARTS OF MISSISSIPPI AND LOUISIANA SHOWING LOCATION OF VELOCITY CROSS SECTIONS

Hibernia Bank and Trust Co. well, about a mile southeast of the center of Tatum dome, and will include one or more additional wells in which sonic logs were taken. Velocity cross sections 1 and 2 have been published as Technical Letters: Dribble-5 and Dribble-18, respectively.

The method used in preparing the velocity cross sections was described in Technical Letter: Dribble-5, page 4, as follows:

"All of the continuous-velocity logs were first examined to determine vertical velocity layering. Interval-velocity logs were then prepared from the continuous-velocity logs, using intervals of 100 feet or more in thickness for which reasonably constant velocities were indicated on the continuous-velocity logs; some units of less than 100 feet in thickness have been included where they represent persistent stratigraphic units. The interval-velocity logs were then compared with the electrical logs of the respective wells to determine which of the velocity units could be identified on the electrical logs. Units or layers of both high and low velocity, which could be correlated on both the interval-velocity and electrical logs, were selected for use in preparing velocity cross sections to show vertical and lateral changes in velocity and thickness of the rock units surrounding Tatum dome. No attempt was made to force the velocity intervals to coincide with stratigraphic contacts, although in many instances they do coincide."

Velocity cross section 3 (fig. 2) begins with the Humble No. 1 Hibernia well on the southwest flank of the dome and ends with the Gulf Coast No. 1 McGhee well to the west. Velocity control was obtained from continuous velocity logs from the Humble No. 1 Hibernia,

Humble No. C-4 Ball, and Humble No. 1 Dexter wells. The velocity zones were traced between these wells by means of electric logs from 7 additional wells along the line of section.

The Cretaceous structures responsible for the Baxterville, Sandy Hook, and Hub oil fields are readily apparent in figure 2. Well EL-20 (Stekoll No. 1 Gex) is on the north flank of the Baxterville field; well EL-19 (Amerada No. 1 Rawls) is on the edges of a syncline northeast of the Sandy Hook field; well EL-18 (Mobile Drilling No. 1 Martin) is on the north edge of the Sandy Hook structure; and well CVL-11 (Humble No. C-4 Ball) is on the Hub oil field structure. The structural features that are conspicuous in the Cretaceous section are generally smoothed out in the Tertiary section, except for a slight reflection of the Hub structure in the rocks of Tertiary age. The upper Cretaceous section is fairly uniform in thickness except over the Baxterville structure where it thins slightly. The Tertiary formations thicken appreciably to the west, towards the Mississippi embayment. The Salt Mountain Limestone, near the base of the Wilcox Group, is not definitely traceable westward beyond the Baxterville field.

The interval-velocity logs of the Humble No. 1 Hibernia, Humble No. C-4 Ball, and Humble No. 1 Dexter wells are shown in figure 3. The numbers beside the velocity zones are the average interval-velocities in feet per second. The stratigraphic contacts were determined from the electric logs of the various wells, and are the same as the stratigraphic units on Stratigraphic table 1 in

Technical Letter Dribble-4. The two deepest wells in which velocity logs were obtained bottomed in Pre-Dantzler rocks of Washita and Fredericksburg age, for which unit velocities have previously been reported in Technical Letter Dribble-18.

The velocity cross section, utilizing data from the interval-velocity logs, and traced through the other wells by means of electrical logs, is shown in figure 4. The high velocity zones are shown on this section, and also on figure 2, by cross hatching, and the low velocity zones are shown by stippling. The numbers along the wells in which continuous-velocity logs were run indicate the interval-velocity in feet per second.

Only one of the continuous-velocity logs (the Humble No. 1 Hibernia) begins in the Pascagoula-Hattiesburg Clay. No velocity zones were found in the Pascagoula-Hattiesburg Clay undifferentiated that could be correlated over the area for which velocity logs were available. In general the clays and sands of this stratigraphic interval are low in average velocity with the sands, which are loose and incohesive, being generally of lower velocity than are the clays.

The stratigraphic sequence beginning at the top of the Heterostegina zone of the Catahoula Sandstone and ending at the top of the Wilcox Group is composed of a sequence of limestones of relatively high seismic velocity separated by clays and sands of relatively low seismic velocity. The unit comprising the Wilcox Group and the upper part of the Midway Group has many distinct velocity zones, but these zones could not be correlated from well

to well along velocity section 3. The Salt Mountain Limestone, near the base of the Wilcox Group, was traceable across the entire area traversed by velocity cross section 1, and could be traced to the southern flank of Midway Dome on velocity cross section 2. This same stratigraphic unit could only be traced as far as well EL-20 on velocity cross section 3 (fig. 4). Although the stratigraphic contact between the Wilcox-Upper Midway and the Porters Creek Clay is not marked by a velocity discontinuity that can be correlated from well to well, the basal part of the Porters Creek clay contains a zone of low seismic velocity that can be correlated on all logs.

As on velocity cross sections 1 and 2, the chalk sequence shows a generally high seismic velocity. The interval-velocity logs for the Humble No. 1 Dexter and the Humble No. C-4 Ball wells (fig. 3) show velocity zones within the chalk sequence which are similar to velocity zones described for the chalk sequence on velocity cross sections 1 and 2. These zones, however, cannot be correlated on the electric logs. The base of the chalk is readily identified by the top of the low velocity zone, identical with the McShan Formation, as shown on the interval velocity logs and in figure 4.

The Gordo Formation and the upper part of the Coker Formation form distinct velocity zones and the top of the lower Tuscaloosa is marked on all of the continuous-velocity logs that penetrate these rocks by a distinct velocity discontinuity. The Massive Sand is generally indicated by a zone of somewhat higher seismic

velocity compared with the velocity of the rocks above and below this unit. The Pre-Dantzler rocks of Washita and Fredericksburg age show considerably higher velocities than do the rocks of the overlying Dantzler Formation. This is believed to be the result of the marine nature of the Washita-Fredericksburg sequence which contains a number of limestones and calcareous sandstones.

The name and location of each well used in velocity cross section 3, and other pertinent data for each well, are given on table 1.

Table 1.--Well data for cross section 3

Explanation of data	
Well Number:	Well Name (company, well number, lease name)
	Location: section, township, range, location in section
	County
	Elevation Datum: KB-Kelly bushing, in feet above sea level
	Total Depth of Well: TD, in feet below elevation datum

EL-15:	Gulf Coast Drilling & Exploration Co. No. 1 S. F. McGhee sec. 35, T. 2 N., R. 12 E.; center SW $\frac{1}{4}$ SW $\frac{1}{4}$ Walthall County KB 384	TD 10,316
EL-16:	Union Producing Co. No. 1 Prisk sec. 11, T. 1 N., R. 12 E.; center SE $\frac{1}{4}$ NE $\frac{1}{4}$ NE $\frac{1}{4}$ Walthall County KB 342	TD 9667
CVL-24:	Humble Oil & Refining Co. No. 1 Dexter Gas Unit #2 sec. 8, T. 1 N., R. 13 E.; 1650' S., 660' W. of NE cor sec. Walthall County KB 351	TD 11,200
EL-17:	Seaboard Oil Co. No. 1 F. E. Sellers sec. 24, T. 2 N., R. 13 E.; center of SE $\frac{1}{4}$ SW $\frac{1}{4}$ Marion County KB 185	TD 9520
CVL-11	Humble Oil & Refining Co. No. C-4 E. A. Ball sec. 20, T. 2 N., R. 14 E.; 330' S. & E. of NW cor. of SE $\frac{1}{4}$ SE $\frac{1}{4}$ Marion County KB 140	TD 13,013
EL-18:	Mobile Drilling Co. No. 1 M. H. Martin sec. 26, T. 2 N., R. 18 W.; 330' S. & W. of NE cor. SW $\frac{1}{4}$ SE $\frac{1}{4}$ Marion County KB-128	TD 9484
EL-19:	Amerada Petroleum Co. No. 1 Rawls sec. 32, T. 2 N., R. 17 W.; 660' N. & E. of SW cor. sec. Marion County KB 190	TD 9691

- EL-20: Stekoll Petroleum Co. No. 1 Ethel H. Gex et al.
sec. 25, T. 2 N., R. 17 W.; 330' N. & W. of SE cor. $SE\frac{1}{4}$ $SE\frac{1}{4}$
Marion County
KB 357 TD 12,451
- EL-21: Viking Oil Co. et al. No. A-1 Hibernia Bank
sec. 9, T. 2 N., R. 16 W.; 660' N., 611' W. of SE cor $SW\frac{1}{4}$ $SW\frac{1}{4}$
Lamar County
KB 306 TD 12,210
- CVL-7: Humble Oil & Refining Co. No. 1 Hibernia Bank & Trust Co.
sec. 13, T. 2 N., R. 16 W., 1646.2' N., 2307' W. of SE
cor sec.
Lamar County
KB 345 TD 6013

FIGURE 2.— CROSS SECTION 3, SHOWING CORRELATION OF STRATA BY MEANS OF ELECTRICAL AND CONTINUOUS-VELOCITY LOGS

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