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Data Article

Data extraction from vintage well sonic log graphs in the ViDEPI project (offshore the Apulia, southern Italy): A multi-useful dataset

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ABSTRACT

Twelve files have been obtained after the extraction of data from raster PDF images of sonic log graphs. These files data regard exploration wells placed in the Adriatic Sea pertaining the Apulia (Branzino-1, Chiara-1, Cristina-1, Famoso-1, Giove-1, Giove-2, Grazia-1, Grifone-1, Medusa-1, Sabrina-1, Simona-1, and Sparviero-1bis), and the related raster sonic log graphs are free accessible at the ViDEPI Project (www.videpi.com) of the Ministry for the Economic Development of the Italian Government. Two columns A and B of data, i.e., interval transit time Δt [μs/ft] and depth [m], respectively, characterise each file. Hence, 18,396 pairs of Δt-depth values have been obtained.

The picking of the data occurred by the use of WebPlotDigitizer© free software. These data are relevant for the interpretation of reflection seismic lines throughout the Adriatic Sea, mainly in the offshore the Apulia. Moreover, the interpretation of those reflection seismic lines located in the adjacent offshore zones, such as the Ionian Sea, can benefit from these data; the values can be important for seismological goals around the Apulia, as well. From these data, Δt-depth diagrams can be originated by the use of software capable of building 2D graphs from values in CSV files (e.g. Matlab©).

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Specifications Table

Subject	Earth and Planetary Sciences
Specific subject area	Geology
Type of data	Tables (essentially) Graphs Figure
How the data were acquired	The data were acquired by extracting interval transit time Δt vs depth values from public exploration well sonic logs as raster images in PDF files; the unit of measurement of Δt is μs/ft, where μs is microseconds and ft is feet, and the unit of measurement of depth is m, i.e., meters. The data were manually picked using the free software WebPlotDigitizer©. The pairs of Δt-depth values resulted in files data, each for the sonic logs of twelve exploration wells in the offshore the Apulia.
Data format	Raw data in CSV format.
Description of data collection	Each PDF file, representing the sonic log, has been loaded. Consequently, the default format 2D (X-Y) Plot has been selected. X-Y axes have been aligned to Δt-depth axes of the sonic log, fixing for X1 the minimum value of Δt, for X2 the maximum value of Δt, for Y1 the depth of the sea floor and for Y2 the depth of the exploration well bottom. Therefore, the digitization of the peaks of each sonic log sawtooth function manually occurred. Finally, the pair of Δt-depth values resulted in CSV file format for the sonic logs of each of the exploration wells.
Data source location	ViDEPI Project, at the website www.videpi.com, of the Ministry for the Economic Development of the Italian Government.
Data accessibility	Repository name: Mendeley Data Data identification number: DOI: 10.17632/xncfj4mrmp.1 Direct URL to data: https://data.mendeley.com/datasets/xncfj4mrmp
Related research article	*M. Cicala, D. Chiarella, F. De Giosa, V. Festa, Basic data visualization in vintage seismic profiles: Indications for the interpretation of the ViDEPI database (offshore Puglia, southern Italy), Rend. Online Soc. Geol. Ital.* 59 (2023), doi:10.3301/ROL.2023.09.

Value of the Data

- These data are indispensable for the construction of the sonic log diagrams, hence for the calculation of the seismic P-waves average velocity regarding the seismostratigraphic units within the bedrock of the Adriatic Sea, especially offshore the Apulia.
- The data are important for geologists who interpret the reflection seismic profiles located in the Adriatic Sea, chiefly offshore the Apulia; the interpreters of the seismic profiles placed in the adjacent offshore areas, i.e., the Ionian Sea, can benefit from the data making appropriate correlations. Furthermore, the data can be helpful also for seismological purposes around the Apulia.
- The data can be used in the procedures for the reprocessing of available seismic dataset or processing of new seismic acquisitions aimed to obtain higher quality reflection seismic profiles in the offshore the Apulia.

1. Objective

The main objective of the present article is to build a database useful for quantitative analyses in the interpretation of reflection seismic profiles in the Adriatic Sea offshore the Apulia. As

a matter of fact, only semi-quantitative considerations for the seismic P-waves average velocity are possible on the basis of the available images of the sonic logs. Hence, the related obtained interval transit time-depth values will be indispensable to calculate the interval seismic P-waves velocities, and, consequently, the average ones.

2. Data Description

Twelve files have been obtained after the extraction of data from raster images of the same number of sonic logs. The files refer to the exploration wells shown in Fig. 1a, whose geographic coordinates are reported in Table 1. Each file is composed of two columns of data A and B, representing interval transit time Δt [μs/ft] and depth [m], respectively. Therefore, a total of 18,396 pairs of Δt-depth data have been extracted.

Concerning the exploration well Branzino-1, the obtained data file is BRANZINO_1.csv. In particular, the depth includes the sea water column and the heigh of the rotary table (18.1 m). As in the original sonic log graph, the depth column of the file starts with the value 400.10 m; the depth column ends with the value 2017.25 m, which practically corresponds to the exploration well bottom. 2158 pairs of Δt/depth values have been picked from the original sonic log.

Concerning the exploration well Chiara-1, the related data file is CHIARA_1.csv. The depth includes the sea water column and the heigh of the rotary table (27.00 m). As in the original sonic log, the depth column of the file starts with the value 437.02 m; the depth column ends with the value 1269.64 m, which practically corresponds to the exploration well bottom. 895 pairs of Δt/depth values have been picked from the original sonic log.

The file data connected to the exploration well Cristina-1 is CRISTINA_1.csv. The depth includes the sea water column and the heigh of the rotary table (27.00 m). As in the original sonic log, the depth column of the file starts with the value 350.02 m; the depth column ends with the value 1487.66 m, which approaches the exploration well bottom. 1191 pairs of Δt/depth values have been picked from the original sonic log.

In relation to the exploration well Famoso-1, the resulting data file is FAMOSO_1.csv. The depth includes the sea water column and the heigh of the rotary table (33 m). As in the original sonic log, the depth column of the file starts with the value 453.29 m; the depth column ends with the value 4464.21 m, which practically corresponds to the exploration well bottom. 4083 pairs of Δt/depth values have been picked from the original sonic log.

The file data concerning the exploration well Giove-1 is GIOVE_1.csv. The depth includes the sea water column and the heigh of the rotary table (22.4 m). As in the original sonic log, the depth column of the file starts with the value 874.69 m; the depth column ends with the value 1000.62 m, which approaches the exploration well bottom. 167 pairs of Δt/depth values have been picked from the original sonic log.

Table 1
Details of the analysed exploration wells.

Exploration well name	Source	Year of drilling	Geographic coordinates	
Branzino-1	ViDEPI project	1976	42° 06′ 42.30′′ N	15° 15′ 37.20′′ E
Chiara-1	ViDEPI project	1988	41° 56′ 03.10′′ N	15° 16′ 01.59′′ E
Cristina–1	ViDEPI project	1981	42° 01′ 35.94′′ N	15° 11′ 56.80′′ E
Famoso-1	ViDEPI project	1969	42° 31′ 33.40′′ N	15° 23′ 10.80′′ E
Giove-1	ViDEPI project	1998	40° 49′ 55.84′′ N	18° 16′ 42.36′′ E
Giove-2	ViDEPI project	1998	40° 49 '48.25′′ N	18° 16′ 42.73′′ E
Grazia-1	ViDEPI project	1970	41° 32′ 23.00′′ N	16° 53′ 42.00′′ E
Grifone-1	ViDEPI project	1982	41° 37′ 30.51′′ N	17° 42′ 51.92′′ E
Medusa-1	ViDEPI project	1986	40° 54′ 41.00′′ N	18° 09′ 14.00′′ E
Sabrina-1	ViDEPI project	1980	42° 08′ 28.30′′ N	15° 04′ 58.78′′ E
Simona-1	ViDEPI project	1981	42° 06′ 27.59′′ N	15° 08′ 11.25′′ E
Sparviero-1 bis	ViDEPI project	2000	41° 42′ 16.30′′ N	17° 48′ 52.31′′ E

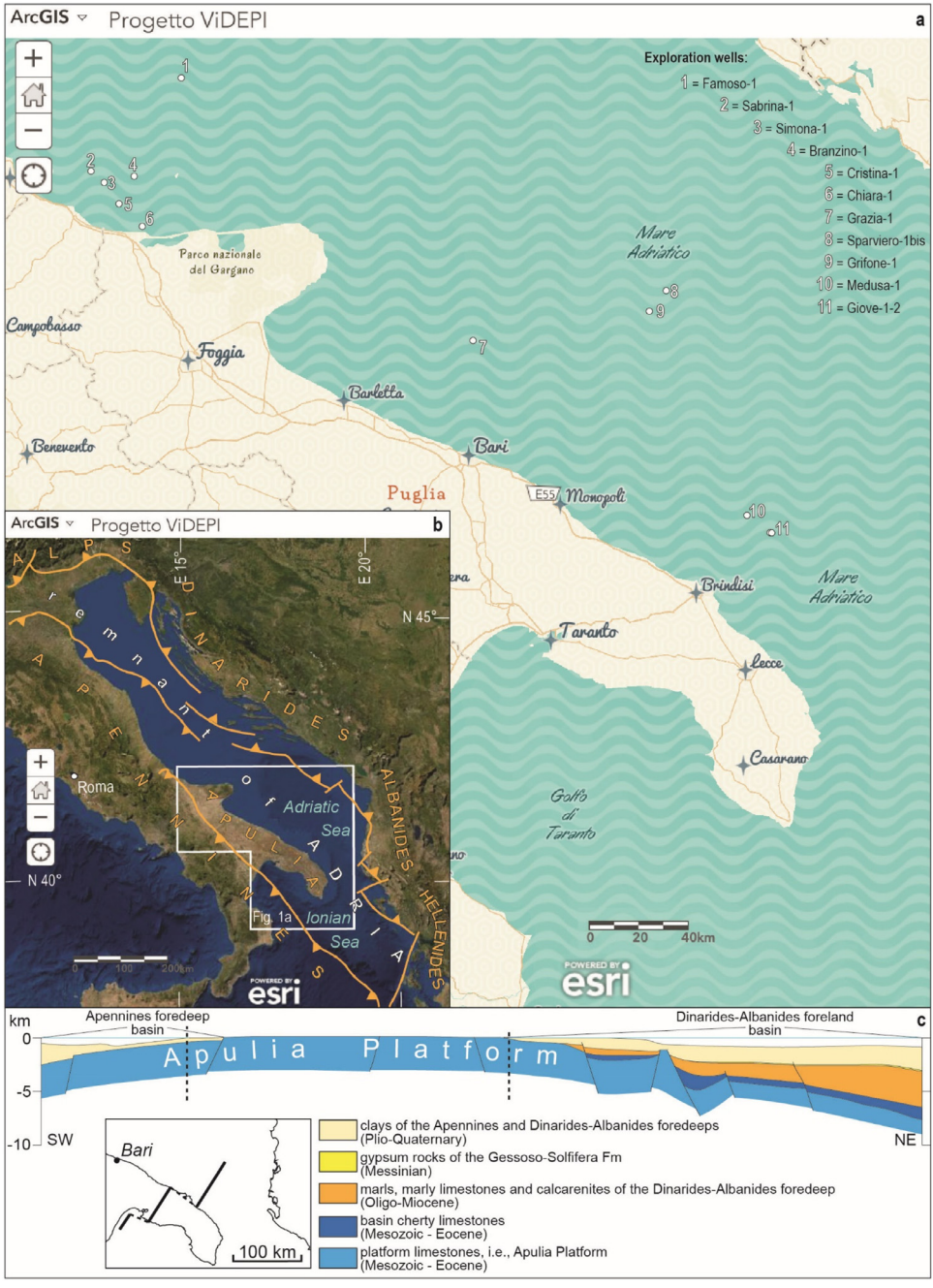

Fig. 1. (a) Map of the Apulia (i.e., Puglia) and surroundings (see Fig. 1b for the location) showing the location of exploration wells provided of sonic logs, and falling within Adriatic Sea (i.e., Mare Adriatico) offshore the Apulia (modified after the ViDEPI Project). (b) Structural sketch map illustrating the remnant of Adria surrounded by Alps, Apennines and Dinarides-Albanides-Hellenides orogenic belts (modified after [13]); basemap modified after the ViDEPI Project. (c) Schematic regional geological cross section from the Apennines foredeep to the Dinarides-Albanides foreland basin (redrawn and simplified after [19]).

The file data linked to the exploration well Giove-2 is GIOVE_2.csv. The depth includes the sea water column and the heigh of the rotary table (22.2 m). As in the original sonic log, the depth column of the file starts with the value 875.22 m; the depth column ends with the value 1249.91 m, which approaches the exploration well bottom. 485 pairs of Δt/depth values have been picked from the original sonic log.

As regards the exploration well Grazia-1, the related data file is GRAZIA_1.csv. The depth includes the sea water column and the heigh of the rotary table (33 m). As in the original sonic log, the depth column of the file starts with the value 441.39 m; the depth column ends with the value 2044.64 m, which practically corresponds to the exploration well bottom. 1811 pairs of Δt/depth values have been picked from the original sonic log.

The file data associated to the exploration well Grifone-1 is GRIFONE_1.csv. The depth includes the sea water column and the heigh of the rotary table (15 m). As in the original sonic log, the depth column of the file starts with the value 1551.64 m; the depth column ends with the value 3134.41 m, which practically corresponds to the exploration well bottom. 1647 pairs of Δt/depth values have been picked from the original sonic log.

About the exploration well Medusa-1, the obtained data file is MEDUSA_1.csv. The depth includes the sea water column and the heigh of the rotary table (15 m). As in the original sonic log, the depth column of the file starts with the value 720.08 m; the depth column ends with the value 1440.05 m, which practically corresponds to the exploration well bottom. 1332 pairs of Δt/depth values have been picked from the original sonic log.

The file data concerning the exploration well Sabrina-1 is SABRINA_1.csv. The depth includes the sea water column and the heigh of the rotary table (33 m). As in the original sonic log, the depth column of the file starts with the value 355.52 m; the depth column ends with the value 1428.72 m, which practically corresponds to the exploration well bottom. 1225 pairs of Δt/depth values have been picked from the original sonic log.

In relation to the exploration well Simona-1, the related data file is SIMONA_1.csv. The depth includes the sea water column and the heigh of the rotary table (23 m). As in the original sonic log, the depth column of the file starts with the value 407.21 m; the depth column ends with the value 1500 m, which practically corresponds to the exploration well bottom. 1264 pairs of Δt/depth values have been picked from the original sonic log.

Finally, as regards the exploration well Sparviero-1bis, the connected data file is SPARVIERO_1BIS.csv. The depth includes the sea water column and the heigh of the rotary table (24.5 m). As in the original sonic log, the depth column of the file starts with the value 1973.21 m; the depth column ends with the value 3889.89 m, which practically corresponds to the exploration well bottom. 2138 pairs of Δt/depth values have been picked from the original sonic log.

3. Experimental Design, Materials and Methods

The Visibility of Petroleum Exploration Data in Italy (ViDEPI) project, related to hydrocarbon exploration in Italy, is the largest and public database in the Mediterranean area including seismic profiles and exploration well logs. The project contains data surveyed since 1957, made available by the Ministry for the Economic Development of the Italian Government. In particular, the exploration wells within the marine zones pertaining the Apulia were drilled from the 1970s to beginning of 2000s. The contents of the project is accessible since 2007 on the website www.videpi.com, where analogic scanned documents, in PDF format, can be freely downloaded.

The releasing of these subsurface data gave a notable impulse on the study of the tectono-sedimentary evolution of the Mesozoic Apulia Platform and its adjacent basins on a portion of the Adria plate, and of this latter sector during its Cenozoic involvement in the Dinarides-Hellenides (to the East) and Apennines (to the West) orogenic systems (Figs. 1b,c) [1–17,20].

However, the representation as images of the sonic logs graphs of the exploration wells is a limitation in their use. As it is well known, the sonic log is a Δt-depth diagram, where Δt is the interval transit time; the unit of measurement of Δt is μs/ft (μs = microseconds, ft = feet),

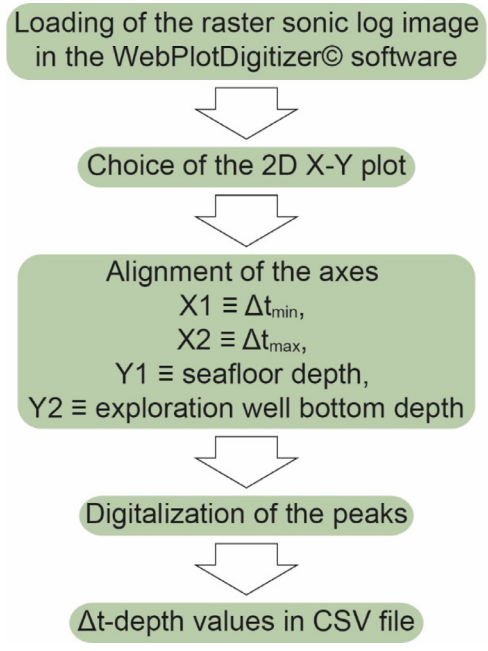

Fig. 2. Flow diagram showing the steps of the data extraction process for each sonic log (see the text for further explanations).

and that of the depth is m (m = meters). For the interpretation of the seismic profiles, it is important to distinguish the net variations of Δt, that are related to sudden change of acoustic impedance, which in turn depends on lithostratigraphic features. It is worth mentioning that for each lithostratigraphic succession the calculation of the average interval transit time, i.e., Δt_{av}, easily allows to obtain the seismic P-waves average velocity, i.e., $v_{av} = 1/\Delta t_{av}$; the unit of measurement of v_{av}, which is thus ft/μs, can be converted in m/s (m = meters, s = seconds), taking into account that μs = 10^{-6} s, and ft = 0.3048 m [18].

Therefore, only those exploration wells showing the sonic logs have been considered for the construction of the database in the present work (Table 1). In particular, the bedrock of the Adriatic Sea pertaining the Apulia is characterised by the following seismostratigraphic units, that practically corresponds to nearly homogenous lithostratigraphic ones: (i) the Plio-Pleistocene (clay-dominated), (ii) the Messinian Gessoso-Solfifera (gypsum rocks), (iii) the Oligo-Miocene (mainly marls, marly limestones and calcarenites), and (iv) the Mesozoic-Eocene (platform limestones or basin cherty limestones) (Fig. 1c).

The data were acquired by extracting interval transit time Δt vs depth values from the public exploration well sonic logs as raster images in PDF files; for each sonic log, the steps of the data extraction process, described below, are summarised in the flow diagram of Fig. 2.

The data were picked using the free software WebPlotDigitizer© (Author: Ankit Rohatgi, Website: https://automeris.io/WebPlotDigitizer, Version: 4.6, Date: September 2022, E-Mail: ankitrohatgi@hotmail.com, Location: Pacifica, California, USA). Each PDF file, representing the sonic log, has been loaded (Fig. 3a). Consequently, the default format 2D (X-Y) Plot has been selected. X-Y axes have been aligned to Δt-depth axes of the sonic log, fixing for X1 the minimum value of Δt, for X2 the maximum value of Δt, for Y1 the depth of the sea floor and for Y2 the depth of the exploration well bottom. Therefore, the digitization of the peaks of each sonic log sawtooth function manually occurred (Fig. 3a). Finally, the pair of Δt-depth values resulted in CSV file format for each sonic log (Fig. 2) of the following exploration wells: Branzino-1, Chiara-1,

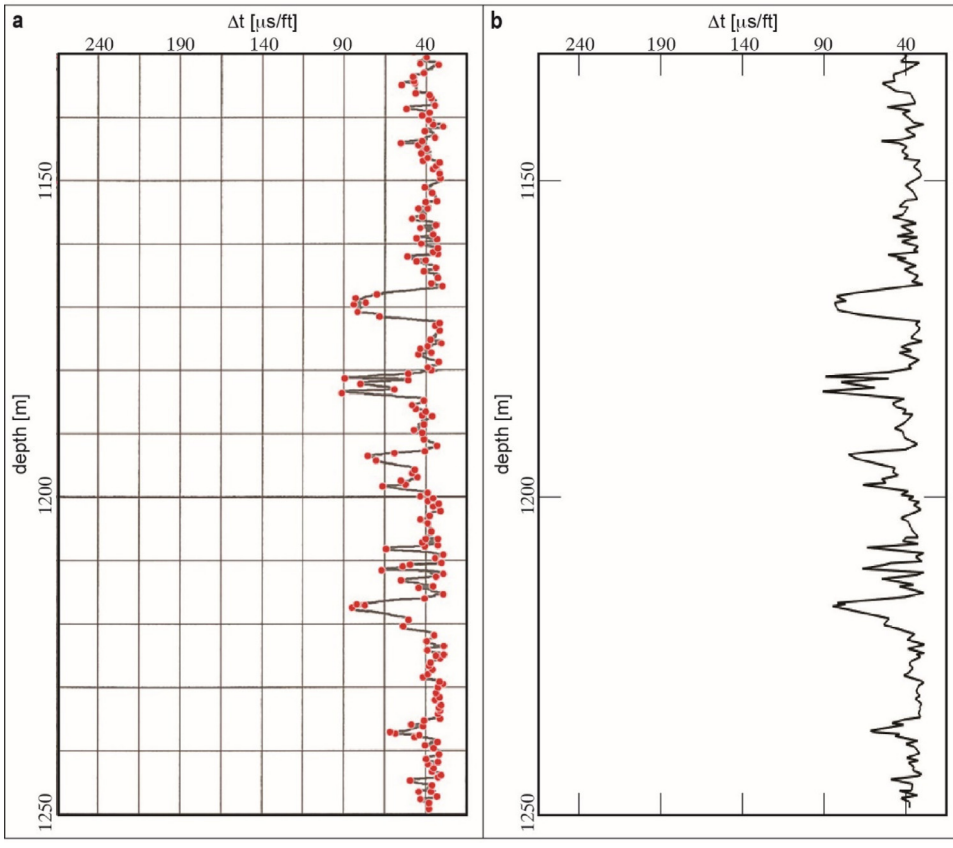

Fig. 3. (a) Portion of the original sonic log graph from the Giove-2 exploration well; the red dots indicate the manually picked values using WebPlotDigitizer© software. (b) Reconstruction of the sonic log diagram, in Matlab© ambient, plotting the values picked from the graph in Fig. 3a.

Cristina-1, Famoso-1, Giove-1, Giove-2, Grazia-1, Grifone-1, Medusa-1, Sabrina-1, Simona-1, and Sparviero-1bis (Fig. 1a, for the location; Table 1, for the geographic coordinates). As an example, the same portion of the sonic log represented in Fig. 3a has been reconstructed by plotting in Matlab© ambient the related picked Δt-depth data.

Ethics Statements

This work does not involve the use of human subject, does not involve animal experiment and does not involve data collected from social media platforms.

Declaration of Competing Interest

The authors declare that they have no known competing financial interests or personal relationships that could have appeared to influence the work reported in this paper.

Data Availability

Data extraction from vintage well sonic log graphs from the ViDEPI project (offshore the Apulia, southern Italy): A multi-useful dataset (Original data) (Mendeley Data).

CRediT Author Statement

Marianna Cicala: Methodology, Data curation, Writing – original draft, Validation; **Vincenzo Festa:** Conceptualization, Writing – original draft; **Antonio Marrone:** Conceptualization, Writing – review & editing.

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