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Hongqi Liu

Principles and Applications of Well Logging



Hongqi Liu
School of Geoscience and Technology
Southwest Petroleum University
Chengdu, Sichuan
China

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Preface 1

Well logging plays an increasingly important role in the petroleum industry, many engineers need knowledge of this technology. This book, including nine chapters, introduces conventional logging technology, imaging logging, and logging while drilling.

From Chaps. 1 to 3, we mainly present conventional logging method, i.e., normal resistivity logging, sonic velocity and amplitude logging, and natural radioactivity and induced radioactivity (neutron-gamma) logging. These three chapters are basic and are therefore very important. Chapter 4 focuses on nuclear magnetic resonance (NMR), which can provide pore's structural analysis. In Chap. 5, we emphasize about the production logging technology, which plays a prominent role in healthy, safety and environmental (HSE) production is gradually becoming a standard for Chinese oil companies. As a milestone for the development of well logging and drilling technology, logging while drilling (LWD) and geosteering are the latest high technology, and these contents are introduced in Chap. 6. Besides LWD, imaging logging is another important phase in the history of well logging, Chap. 7 mainly explain Eclipse-5700, Excell 2000, and Sondex logging series technology. The new generation instruments can provide much higher vertical resolution and much deeper depth horizontal investigation images of well wall rather than curves. Sonic logging can provide information of compressional and shear compressional travel time, based on which rock mechanical properties can be evaluated. The basic concepts, methods, and a lot of empirical formula are included in Chap. 8. Chapter 9 presents a comprehensive interpretation, which integrates almost all the contents introduced in Chaps. 1–8. In Chap. 9, one can learn how to delineate upper depth and lower depth of permeable zone, how to identify the fluid types, and how to calculate porosity, permeability, saturation of oil, and etc.

Obviously, there are some errors and deficiencies in this version, the author do welcome suggestions and sincere advice from the readers.

Chengdu, China

Hongqi Liu

Preface 2

Although there are many excellent and famous technical books about well logging, it is still difficult to find a very suitable book for Chinese students. In twenty-first century, a lot of Chinese colleges have opened bilingual courses, and they are eager to find textbooks from the available science and technical books. Here this book meets the needs of the students who major in well logging.

A very classical Chinese novel of Qing dynasty, “A Dream of Red Mansions”, has another name, i.e. “The Story of Stone”. Although “Well Logging” concerns science and technology, in fact, it is also a record of a stone’s story. The only difference between the famous novel and well logging lies in the former record stories of Jia Baoyu, Lin Daiyu, and other several hundreds of persons, but the latter is about the geophysical and petrophysical properties of rocks, especially the formation of water, oil, and gas.

How to find a hydrocarbon? Where to locate a hydrocarbon? And how much of the hydrocarbon can we extract from the formation? All these questions are frequently encountered during the exploration phase. As for the second phase, exploitation stage, there also many technological problems, such as evaluation of the cementation quality, safety window of drilling density, predication and calculation of the magnitude and direction of formation stress, flow quantity in the pipe, etc. All these questions can be solved completely in some degree.

Therefore, this book will tell large amount of stories about different stones, such as sandstone, shale, clay, limestone, and dolomite

This book includes conventional well logging methods, production logging, and new generation logging technology, such as imaging logging, logging while drilling (LWD).

The author would like to acknowledge the help received from a number of individuals, without which this book would not have been possible.

Hence, we owe thanks to the editors Tong He, Wei Li of Petroleum Industry Press. We also acknowledge Prof. Hongquan Xia for his advice, and graduate students Jie Tian, Bo Li, Ying Chen; they made a lot of maps and curves for this book.

Of course, the deficiencies, errors, and omissions, both in the text and in this acknowledgment, and the blames rest with us.

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Hongqi Liu

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