GEOPHYSICAL TRANSACTIONS 1988
Vol. 34. No. 1. pp. 5—6

FOREWORD FOR THE SPECIAL ISSUE 'ANISOTROPY, SHEAR WAVES AND POLARIZATION MEASUREMENTS'

Hans A. K. EDELMANN*

The immediate reaction of my colleagues and I after looking at shear-wave recordings some fifteen years ago was emphatic. As predicted, a new artificially generated wave type could be used to produce a subsurface image. The reaction of the Establishment, however, was less encouraging and we all soon became aware that a long way lay ahead of us during which the method had to be improved and the sceptics convinced. There were many proposals at that time suggesting how the new tool should be used — one of the most conservative theories being to determine Poissons's ratio from *P*- and *S*-wave velocities. Many misunderstandings, too, had to be cleared out of the way, for example shear-wave records were not suitable for replacing *P*-wave records. Neither velocities nor reflection coefficients could be assumed to be equal for both types of waves so that the differences in appearance of *P*- and *S*-wave records, that embarrassed most of the seismologists, proved to be the real potential of the method. We had to learn to interpret these differences with respect to subsurface lithology because we knew too little about the relationship between lithology and *P*- and *S*-wave appearance.

Obtaining good shear-wave sections was not simple at that time because of the predominant ground roll and the strong but obscure local influence of near-surface layers. It was therefore a relief to discover that the quality of data proved to be strongly dependent upon anisotropy, which explained many of the phenomena previously not readily understood. But as always it had to be decided which physical effects were to be used and which were to be eliminated. Theoretically, the influence of polarization, meaning the dependence of propagation velocity on propagation direction, can have a high diagnostic value. The German engineer Otto von Guericke said in 1672: "...therefore scientists who merely rely upon ideas and deductions and do not accept practical experience will never make conclusive statements about the constitution of this Universe. Because if human thinking is not based upon experiments, it will deviate from truth farther than the sun is separated from the earth". It was obvious from the beginning that experience could only be gained from practical application. Among the first geophysicists who successfully applied shear waves in reflection seismic work was Kenneth Waters from CONOCO. He showed

* PRAKLA-SEISMOS AG, POB 510530, D 3000 Hannover 51
Manuscript received: 18 January, 1988

convincingly that the cross-sectional view of the earth need no longer be based on the sole method of compressional wave reflection seismics. He proposed a means of generating shear-wave cross-sections which had all the features necessary for becoming a routine method using the VIBROSEIS® technique. No other method tested since that time has ever achieved the same quality of data acquisition and degree of professionalism.

It can be said today that the theory of shear waves exists and the tools necessary for proving this theory are also available. Even so, the exploration geophysicist must realize he will be asked questions if he highlights an important subject. It is not sufficient to discover things in nature, then isolate and describe them. That is equivalent to discovering a new geophysical effect in test-tube experiments. A new geophysical method must first of all prove its usefulness under the critical eyes of those who are responsible for the success of exploration and production drilling. Little by little it is becoming evident that there is a great deal known about shear waves. But this information has been given very reluctantly by the bright people in the oil industry who have held back good ideas for refinement and finishing, instead of aggressively selling their methods to the decision makers who urgently need more reliable information. This is what I call the tolerated information gap in a company.

Ludger Mintrop, the inventor of the refraction seismic technique did one thing. He offered purely and simply to delineate salt domes, which at that time were known to be the centres of oil accumulation. Neither he nor anyone else could exhaustively explain the physical process of refraction seismics, but notwithstanding that, many people succeeded in finding oil by his technique. When we offer the shear-wave technique today as an aid to finding and developing specific oil and gas fields we must ensure it gets into the hands of those who are ready and able to use it to achieve higher success rates, i.e. production and petroleum engineers.

The purpose of the E. A. E. G. workshop held at the Belgrade Convention in 1987 was to present an opportunity to learn more about the theoretical background and to improve our practical knowledge. In addition, it was intended to give an impetus to think about a more efficient application of shear waves.

Acknowledgement is due to the Eötvös Loránd Geophysical Institute, who kindly undertook to publish the work. I would like to thank all participants for their contributions and my co-chairman Robert Garotta for his help in making the workshop a success.

Hannover, January 1988