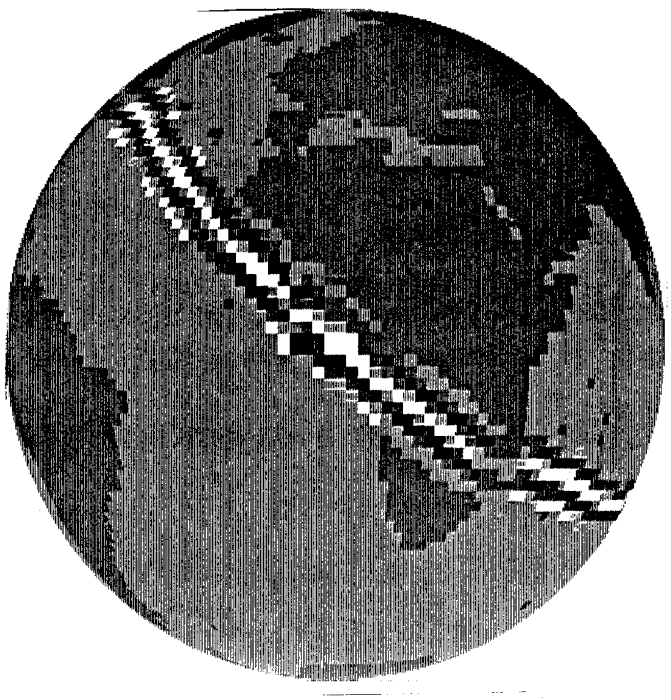
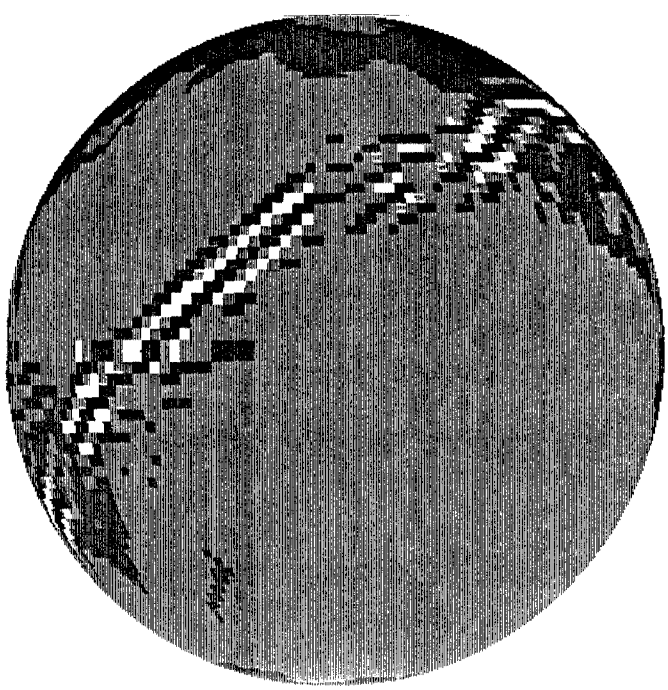


STANFORD EXPLORATION PROJECT

Report Number 50, November 1986

Kamal Al-Yahya, Biondo Biondi, Jon Claerbout, Joe Dellinger, John Etgen, Paul Fowler,
Clement Kostov, Pete Mora, Francis Muir, Rick Ottolini, Chuck Sword,
Jos van Trier and Marta Woodward



Copyright © 1986

by the Board of Trustees of the Leland Stanford Junior University

Stanford, California 94305

Copying permitted for all internal purposes of the Sponsors of
the Stanford Exploration Project

SEP-50 --- TABLE OF CONTENTS

Preface

SEP Golden Volume v

Deconvolution

Kostov, C. and Rocca, F., Estimation of residual wavelets 1

Al-Yahya, K. and Mora, P., Water bottom multiple deconvolution 23

Ottolini, R. and Rocca, F., Movies of data-lag histograms with application to deconvolution research 35

Wave Propagation

Sword, C., Claerbout, J., and Sleep, N., Finite-element propagation of acoustic waves on a spherical shell 43

Muir, F., An automaton for propagating waves through heterogeneous media 79

Dellinger, J., and Mora, P., Accurate finite-difference derivative operators by inversion 85

Claerbout, J., Mass-spring networks to simulate the 4-th order Laplacian 95

Claerbout, J., and Dellinger, J., Eisner's reciprocity paradox and its resolution: Part I, the paradox 99

Claerbout, J., Slippery edges 103

Claerbout, J., and Dellinger, J., Eisner's reciprocity paradox and its resolution: Part II, the resolution 107

Migration Velocity Analysis

van Trier, J., and Rocca, F., Autofocusing of migrated data 113

Al-Yahya, K., Migration velocity analysis of field data: preliminary results 129

Fowler, P., Migration velocity analysis: preliminary data tests 139

Migration

Etgen, J., Prestack reverse time migration of shot profiles....151

Biondi, B., Migration using short-time Fourier transforms....171

Woodward, M.J., Three-pass 3-d migration on a hexagonal grid....195

Levin, S., Parallel finite-difference migration in practice....207

Al-Yahya, K. and Fowler, P. Prestack residual migration....219

Inversion

Mora, P., Elastic wavefield inversion of reflection and transmission data....231

Woodward, M.J., Iterative tomography: addendum....261

Interactive Interpretation

Claerbout, J., Hyperbola overlay program development: a personal engagement....269

Ottolini, R., Comments on "Hyperbola overlay program development"....279

Computers

Claerbout, J., A canonical program library....281

Ottolini, R., Signal processing with stochastic memories....291

Ottolini, R., Update on workstation raster speed....297

Phone Directory....298

Research Personnel....300

Sponsors of the Stanford Exploration Project....304

SEP Golden Volume

This volume marks the fiftieth report of the Stanford Exploration Project. These reports now cover thirteen years, and include 26 semi-annual reports, 23 Ph.D. theses, and one textbook. Students trained at SEP have enjoyed considerable success as geophysicists, six as faculty members in leading U.S. and foreign universities, and fourteen as researchers in the petroleum industry. Twelve more students are now working on Ph.D. degrees at SEP.

Perhaps now is a good time to ask where we have been, where we are now, and where we are headed. SEP was initially chartered for the purpose of pursuing "fundamental research in reflection seismology." Through the years we have explored many areas both directly and indirectly related to this central goal, as perusal of the table of contents of this or most any other report will show. At first, finite-difference migration was the raison d'etre of SEP, and we are proud of having pioneered the application of wave propagation physics to exploration geophysics. SEP-1 came out in September, 1973. In all of 1973, there were no papers whatsoever in Geophysics on the subject of migration. In 1974 there were but two papers, and there were only four migration talks at the SEG annual meeting in October 1973. Now, of course, every SEG or EAEG meeting has many sessions on migration, and there are so many papers on the topic that SEG has published a collection of key reprints.

We are also proud to note (Leading Edge, October, 1986) that of the seven papers considered for the SEG's "Outstanding Paper in Geophysics" award this year, two were SEP contributions. These papers reflect current trends in SEP research. In the early days, geophysicists analyzed signals and noises for one-dimensional deconvolution problems. Now we know that classic migration is the first step of an optimization process. We are learning the subsequent steps towards uniting physics and statistics in the

broader context of velocity analysis. We are excited about the directions this has led us, and expect this viewpoint to receive more attention by our profession.

SEP began with 23 sponsoring organizations in 1973, and has grown in support to 41 sponsors in 1986. (And 16 of the 23 charter members are with us still!) Without the generosity of our sponsors, of course, we could not maintain such a large and active research program, nor obtain the state-of-the-art computing facilities which make testing of our ideas possible. But more than just the financial support and the donations of field data sets, we have benefited from the many suggestions and discussions with sponsor representatives, at the SEP meetings, during visits to Stanford, and through countless telephone and mail conversations. On this, the occasion of our fiftieth volume of SEP reports, we want to thank all of you who have supported our work and made it all possible.

P.J.F., R.O., and J.F.C.