VIDEO REVIEW

by

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The East Greenland Rift - A film and Workbook Training Package

Modern earth sciences integrate geology with geochemistry and geophysics. Thus, we compare and contrast the surface geology of any given area with its subsurface geology and also with the geology of other areas. Traditional geology was based mostly on outcroup observations that were supplemented by geophysical measurements and particularly by reflection seismic profiles. The East Greenland Rift Training Package allows students to share in the excitement of field work in remote areas whilst exploring the linkage between surface geology and the geophysical exploration for hydrocarbons.

The training package consists of four programmes on two video tapes, a workbook and tutor notes, all packaged in two loose leafring binders. The programmes are each about 30 minutes long, and they are closely integrated with a substantial, well illustrated workbook. Several practical exercises based on seismic profiles are included :

Programme 1 of the series introduces the plate tectonic and regional setting of the East Greenland Rift. In a graduate level course, one could digress from this introduction with a study of the Evolution of the Arctic-North Atlantic and the Western Tethys.

Programme 2 looks at the development of carbonate plays associated with rifts. Novices, as well as those that need a refresher, will find the quintessence of carbonate geology summed up in the workbook.

Programme 3 is a very substantial study of rift controlled clastic sedimentation. The main exercise here consists of the preparation of a chronostratigraphic diagram. This enables the student to gain an overview of structural deformation and its influence on stratigraphy.

Programme 4 looks at the relationship of the faults and their formation to the sedimentary fill of half grabens. The two seismic profiles across the North Viking Graben and the Jeanne d'Arc Basin are most informative and their interpretation could lead to an in-depth discussion of hydrocarbon plays in the North Sea and of the setting of the Hibernia field offshore Newfoundland (Tankard & Balkwill, 1989).

Students responded with a great deal of interest. They were particularly impressed by the combination of videos showing spectacular field geology with the interpretation of some very fine reflection seismic profiles. The East Greenland Rift series demonstrates the lively integration of geology and geophysics as a way to overcome excessive specialisation.

Analogue Modelling of Extensional Fault Structures

Hydrocarbon exploration has revealed that asymmetrical half grabens are the most important expression of extensional tectonics. Seismic reflection profiles that reveal these structures are of varying quality and, in all cases, the interpretation of these profiles is an unfamiliar task for explorers trained as surface geologists. Even under the most favourable circumstances outcrop studies of extensional areas do not permit the study of fault geometries at depth. Thus with little or no outcrop control and seismic profiles that often do not clearly reveal all the details, structural geologists often depend on analogue models to inspire their interpretation. This videotape is a particularly successful presentation of one of many analogue modelling approaches.

All analogue models have strengths and weaknesses. The strength of the modelling approach shown in this video is the lucidity of presentation and the sound use of materials that properly mimic the rheology of rocks. The limitation of the method is given by a

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variety of fixed footwall configurations. Of course, there is good reason to believe that, in nature, the footwalls may not be fixed. On the other hand, even given a fixed footwall configuration for the master fault, the video admirably shows how all other fault shapes change as the deformation advances. Thus within any experiment we can actually observe faults with changing footwall configurations even though the listric master fault remains fixed.

Perhaps the greatest appeal of the videotape is its "mind-opening" capacity. We are taught to accept what we often reluctantly observe on seismic reflection profiles ! Of particular interest are planar faults within an overall listric fault context, the importance of crestal collapse grabens, the occurrence of forced folding, and the changing dips along fault planes. The video clearly shows how some normal faults are decoupled at depth. In one case, reverse faulting is produced within a normal faulting context.

The models are designed and presented by Ken McClay, and the user is encouraged to refer to his relevant papers (eg McClay & Ellis, 1987 ; Ellis & McClay, 1988).

Petroleum geologists will find this videotape as an aid to the interpretation of complex extensional structures, and to define trapping configurations in extensional provinces. The videotape may also be used for an undergraduate introduction to tectonics and for graduate courses that focus on extensional tectonics in different settings or else for courses dedicated to the structural interpretation of reflection seismic profiles.

In conclusion, "Analogue Modelling of Extensional Fault Structure" is a spectacular and most welcome contribution to structural geology. The videotape wil be useful to students, instructors, seismologists and petroleum geologists.

References

McClay, K.R. & Ellis, P.G., 1987 - Geometrics of extensional fault systems developed in model experiments. *Geology*, ***15***: 341-344.

Ellis, P.G. & McClay, K.R., 1988 - Listric extensional fault systems - results of analogue model experiments. *Basin Res.*, ***1***: 55-70.

This videotape has been offered to the Society.

Analogue Modelling of Inversion Fault Structures

During the last decade Inversion Tectonics have been discovered and defined much more tightly. Seismic reflection profiles obtained by the petroleum industry revealed that extensional half graben systems frequently got re-activated by subsequent compression leading to the formation of very characteristic structures that displayed downdip convergence of strata in the core of anticlines and opposite updip convergence on the crest of anticlines. Unfortunately, modern textbooks in structural geology pay little, if any, attention to inversion structures and it is, therefore, most opportune to have a splendid film available that attempts to replicate inversion structures in "sandbox-type" experiments.

Older inversion concepts were rather vague and often involved the inversion of sedimentary basins in their totality. The recently deceased Russian tectonician, V.V. Beloussov, made the inversion of geosynclines a cornerstone of his mountain-building models by invoking essentially vertical forces to explain the process. Today a more restricted definition would limit the term inversion specifically to the reactivation of extensional half graben systems by subsequent compression (positive inversion) and the re-activation of compressional structures by subsequent extension (negative inversion). The petroleum industry tends to limit the term inversion exclusively to "positive" inversion.

The analogue models that were created by Ken McClay vividly illustrate the details of inversion tectonics by re-activating normal faults, planar normal faults and normal faults characterized by ramp flat segments. The experiments clearly point out that both the hanging wall and the footwall get involved in the inversion process. The models are intended as a guide to the interpretation of

seismic profiles, but it is obvious that both the models and the profiles together also help to guide the interpretation of surface geological maps.

"Analogue Modelling of Inversion Fault Structures" is a short and superb film not only for petroleum explorers, but it will be useful at an introductory level because of its clear exposition that will make a complex topic more easily understood. It also will fulfil a very useful role in the more advanced instruction of structural geology, simply because the concept is not adequately treated in modern text books of structural geology. Finally, the film is particularly helpful in any course devoted to the structural interpretation of reflection seismic profiles.

Distributed by GEOFILMS, 12 Thame Lane - Culham - Oxford - OX14 3DS - United Kingdom.

Price :

Analogue Modelling of Extensional Fault Structures :
£ 150 + £ 6 p&p/US$275 + $20 p & p.
Analogue Modelling of Inversion Fault Structures :
£ 150 + £ 6 p&p/US$275 + $20 p & p.
The East Greenland Rift Training package :
The Set - Workbook + Films and Tutor Notes
£ 380 + £ 14 p&p/Non-UK : $750 + $46 p&p.
Additional Workbooks : £60 (Excl. VAT) + £6 p&p/Non-UK : $115 + $20 p&p
Academic orders only : £28 (Excl. VAT) + £6 p&p/Non-UK : $60 + $20 p&p
The above prices are for VHS cassettes in either PAL, NTSC or SECAM systems. Other formats, U-matic or Beta, are also available on request.