Australian Government
Geoscience Australia

Government of Western Australia
Department of Mines and Petroleum

ROYALTIES FOR REGIONS

ACQUISITION & PROCESSING OF THE 2013 ALBANY-FRASER SEISMIC SURVEY

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Onshore Seismic and Magnetotelluric Section

Minerals and Natural Hazards Division

Geoscience Australia

Independence Group

ANGLOGOLD ASHANTI

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Acquisition and Processing

Acquisition

- Logistics
- Recording Parameters
- Field QC and data management

Processing

- Hardware and Software
- Processing Overview

Testing Program

Data availability

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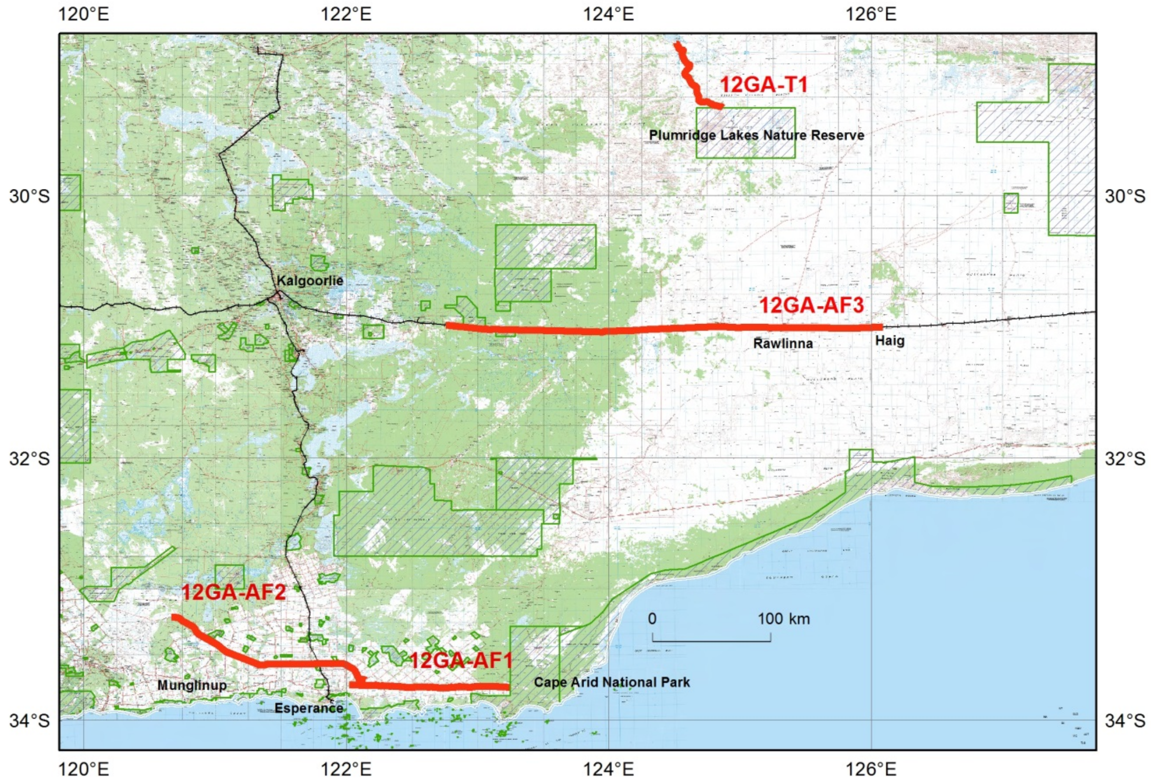
Acquisition

Logistics

672 km deep seismic reflection data – 4 lines

Acquired 23 April – 6 June 2012. Other data acquired: MT, Gravity



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Acquisition

Logistics - Camp

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Acquisition

Recording – IVI Hemi-50 Vibes on AF2

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Acquisition

Recording - Dogbox

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Acquisition

Logistics - Traffic Control

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Acquisition

Logistics - Traffic Control

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Acquisition

Recording - Planting geophones

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Acquisition

Recording - Picking up geophones

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Acquisition

Recording - Pulling in cable

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Acquisition

Recording - Vibes on AF3

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Acquisition

Recording – Loading cables and geophones at end of survey

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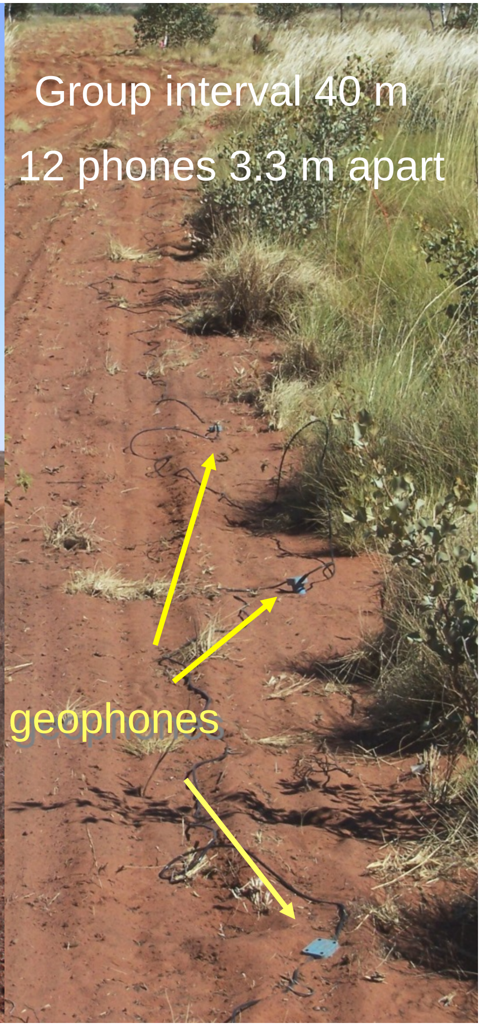
Acquisition Parameters



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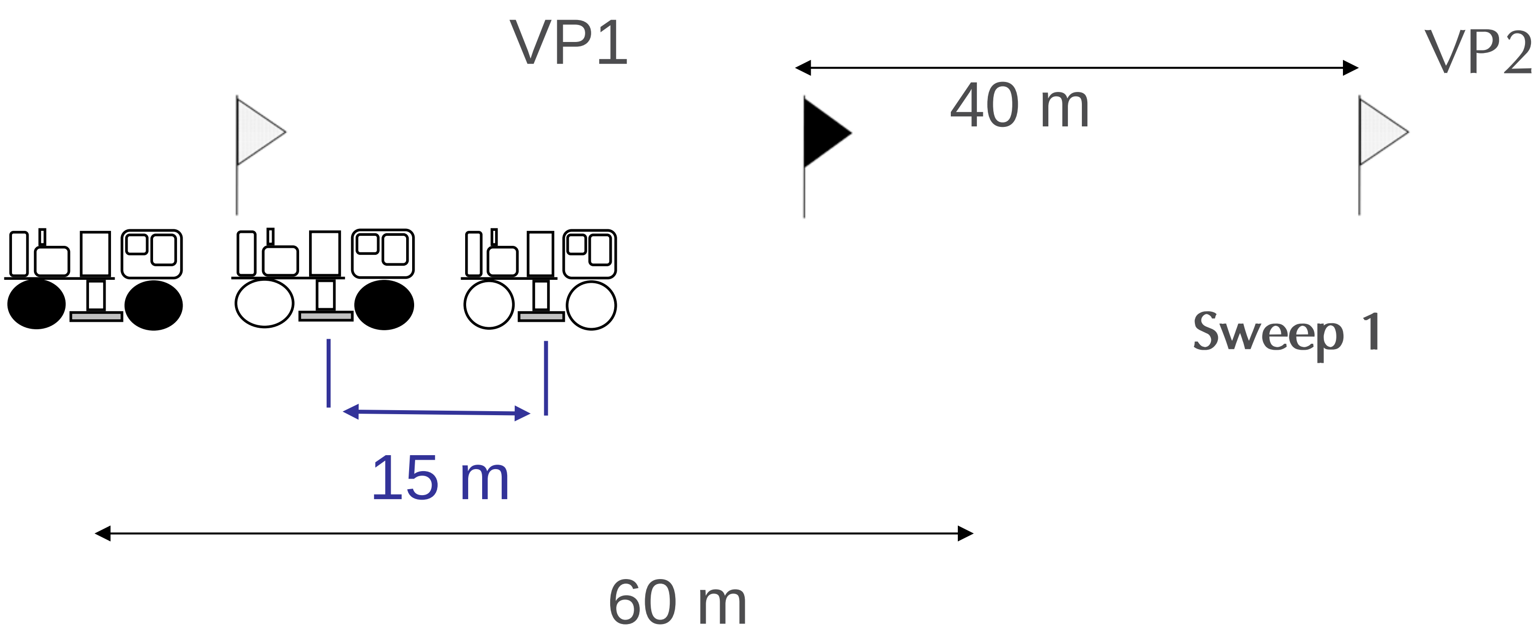
Acquisition

Recording – Acquisition Parameters – Source array

3 Vibes - 60 m centred between pegs **:** 15 m pad/pad **:**15 m move up

Vibe Point (VP) Interval: 80 m



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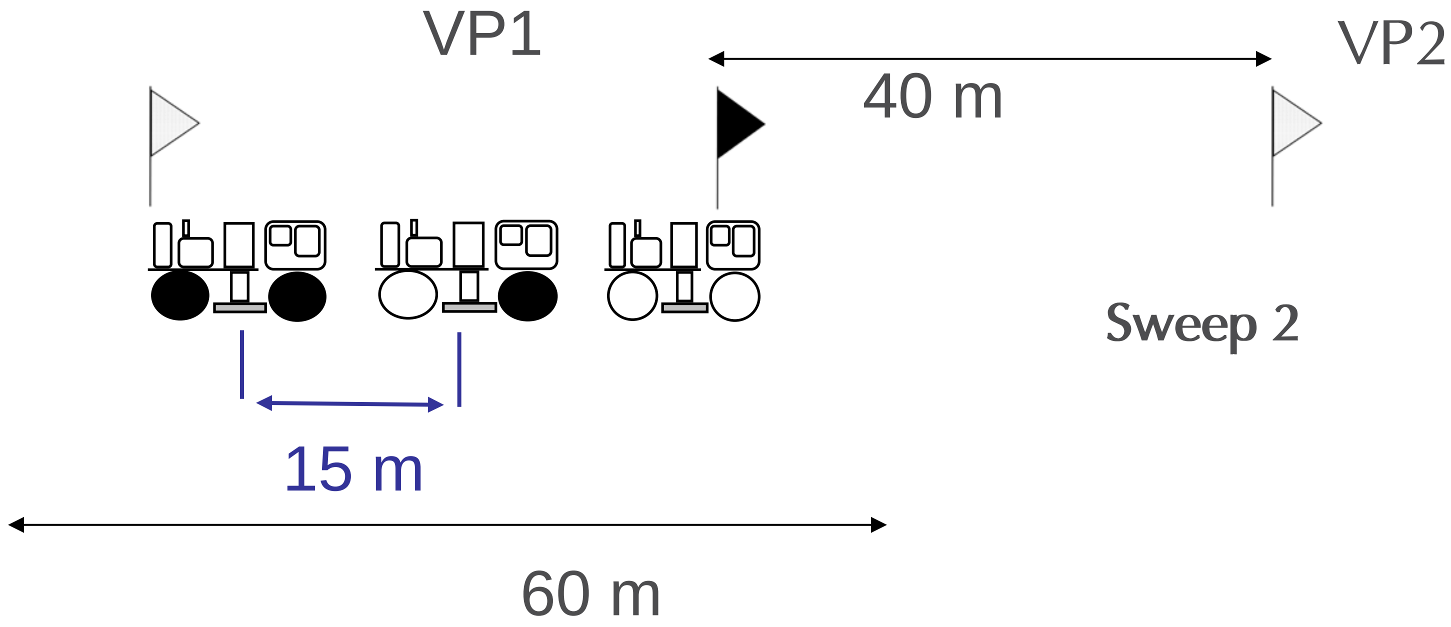
Acquisition

Recording – Acquisition Parameters – Source array

3 Vibes - 60 m centred between pegs **:** 15 m pad/pad **:**15 m move up

Vibe Point (VP) Interval: 80 m



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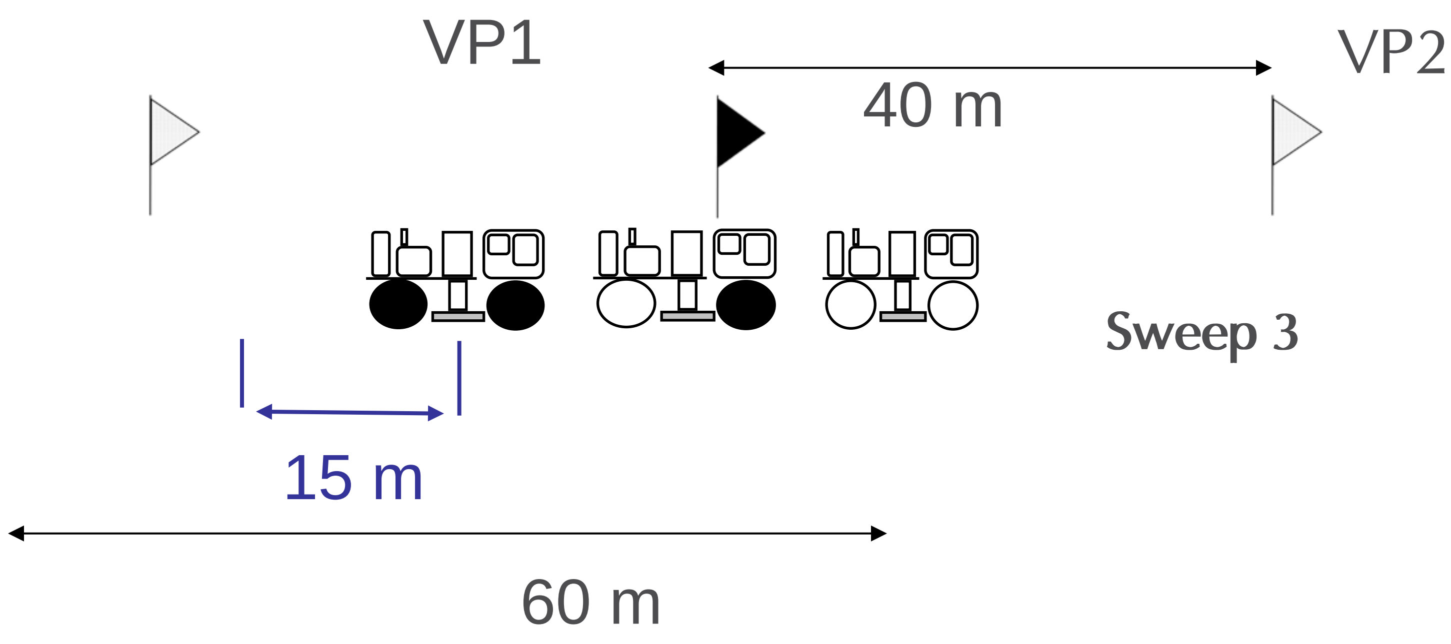
Acquisition

Recording – Acquisition Parameters – Source array

3 Vibes - 60 m centred between pegs **:** 15 m pad/pad **:**15 m move up

Vibe Point (VP) Interval: 80 m



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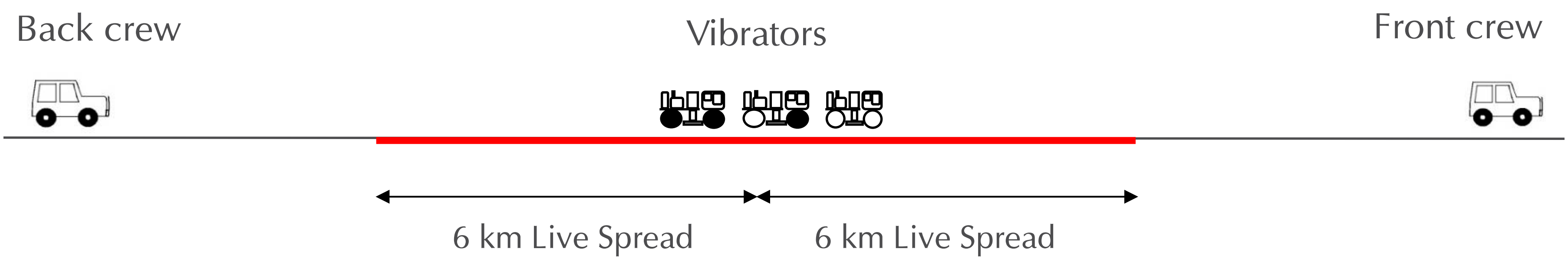
Acquisition

Symmetrical split spread, offset: minimum 20 m, maximum 6 km

300 channels at 40 m intervals, 75 nominal fold data

80 m VP interval



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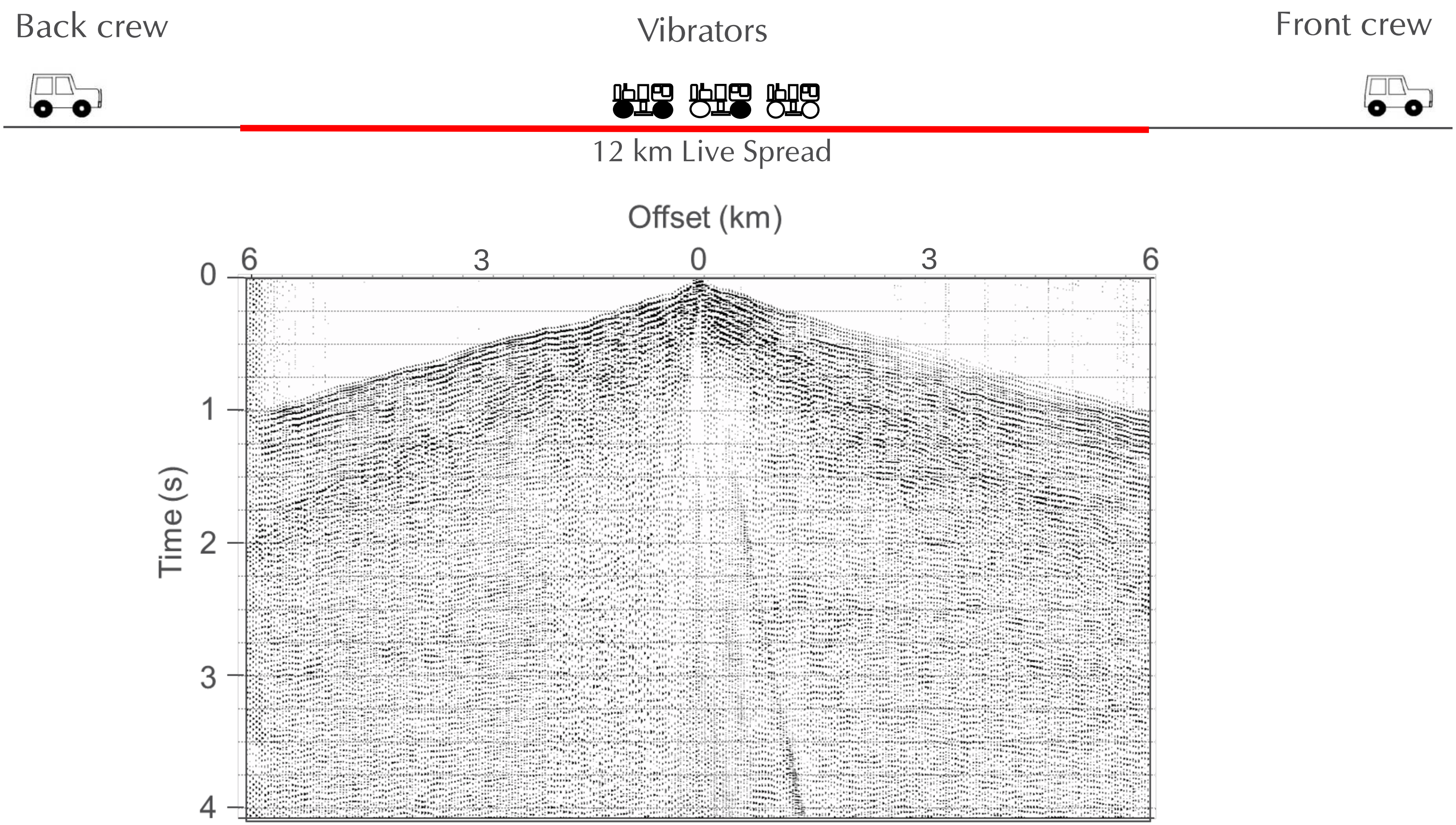
Symmetrical split spread – shot record



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Acquisition

Field QC and data management

Daily - field data on USB disk loaded on QC laptop

Shot records viewed

Brute stack created

At end of line – LTO tapes created containing all data

Total data volume from Albany-Fraser survey – 93.8 GBytes

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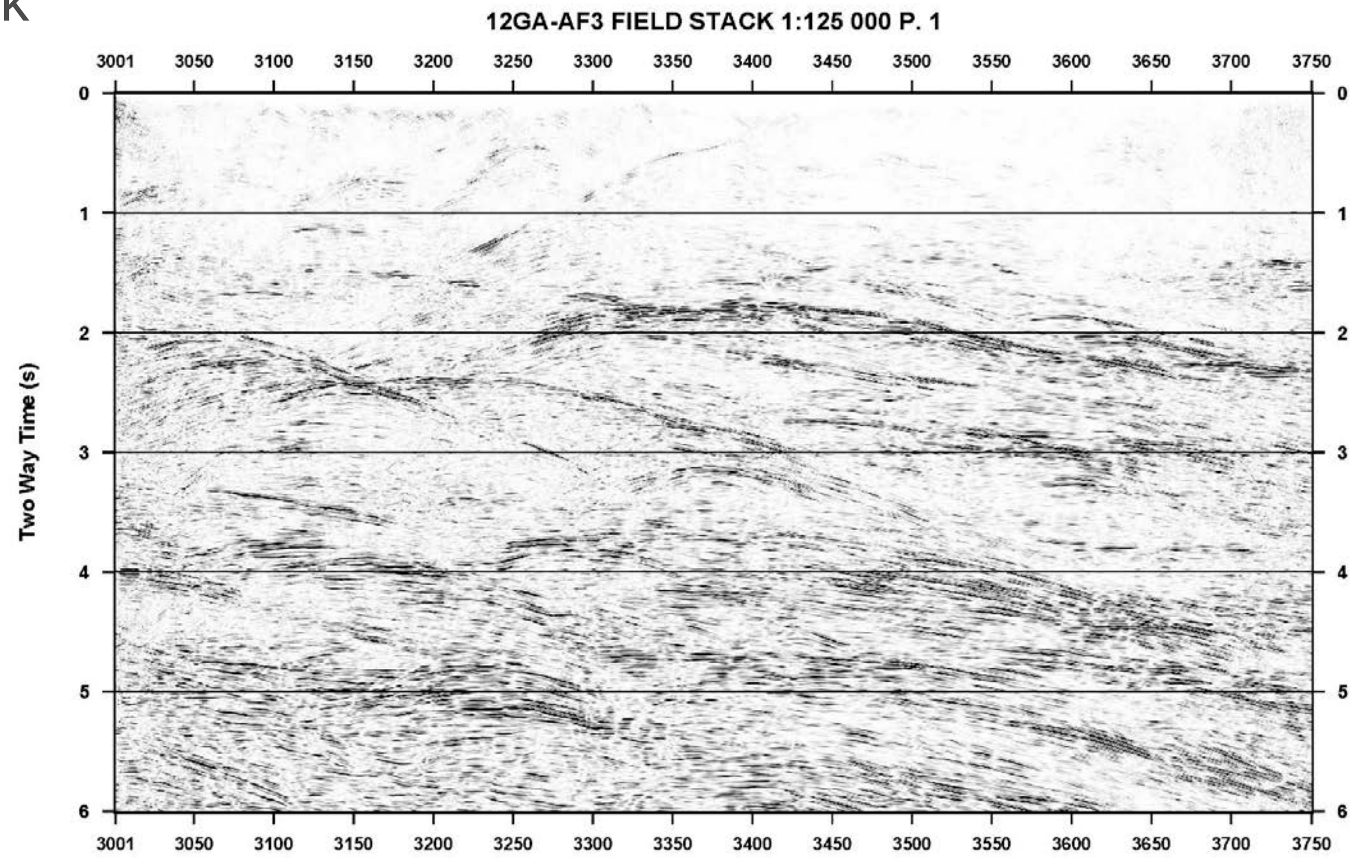
Acquisition

Field QC and data management

Brute stack



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Processing

Hardware and Software

Field - HP Elitebook laptop

- 8 GB memory
- 1 x quad-core CPU (4 cores)
- Redhat Linux - Paradigm Echos software

Office – HP DL585 rack mount server

- 384 GB memory
- 8 x dual-core processors (16 cores)
- Redhat Linux – Paradigm Echos software
- Some testing on SeismicUNIX

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Processing

Overall Goal

To produce an image of the sub-surface

by

Enhancing and correctly positioning reflections

and

Reducing undesired energy (noise)

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Processing

Setup Geometry — Crooked line geometry

Refraction Statics — Weathering and elevation corrections

Spectral Equalisation — Signal enhancement Noise attenuation

NMO Velocity Analysis

Auto-statics

DMO — Correct dipping reflections

Stack — Signal enhancement Noise attenuation

Post Stack Migration — Correct positioning of reflections

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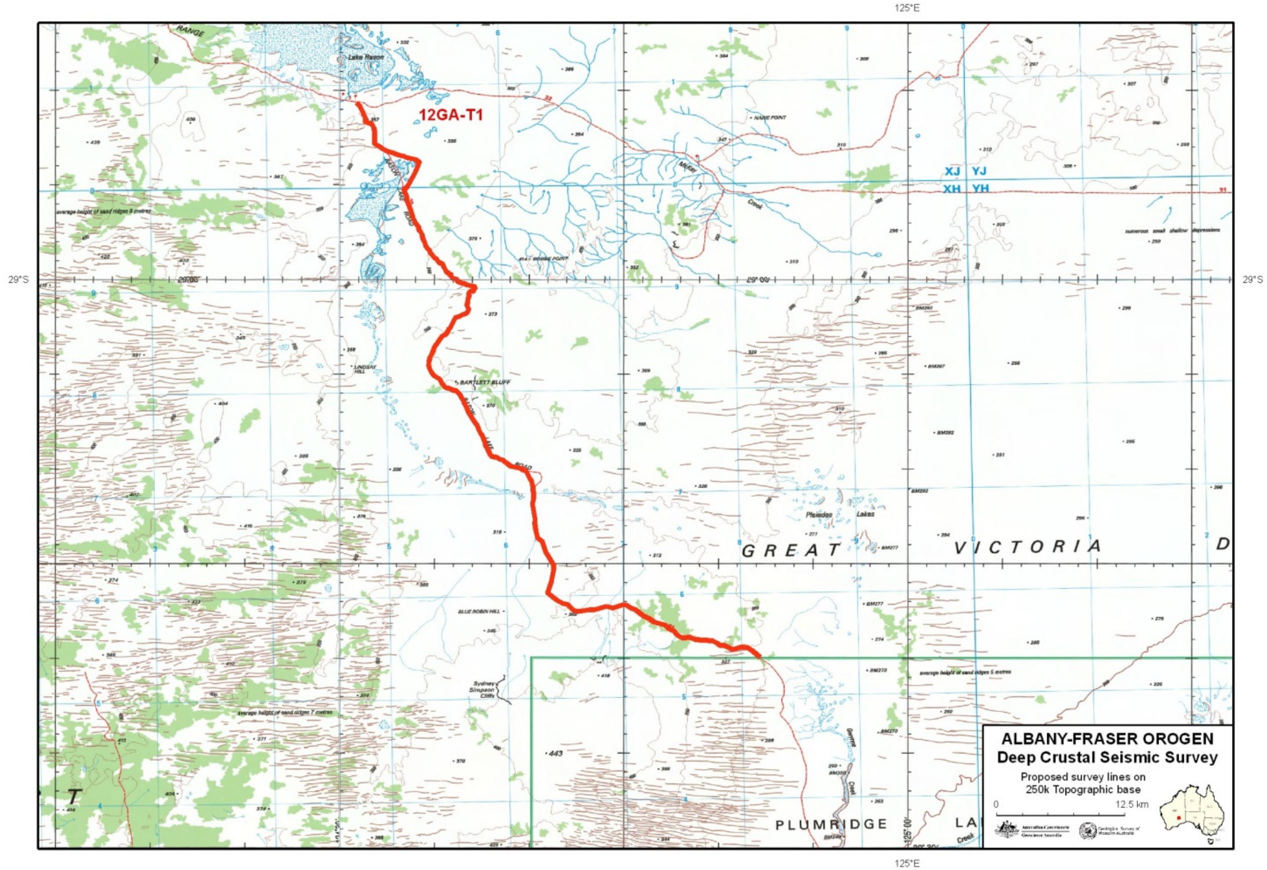
Processing

Crooked line geometry



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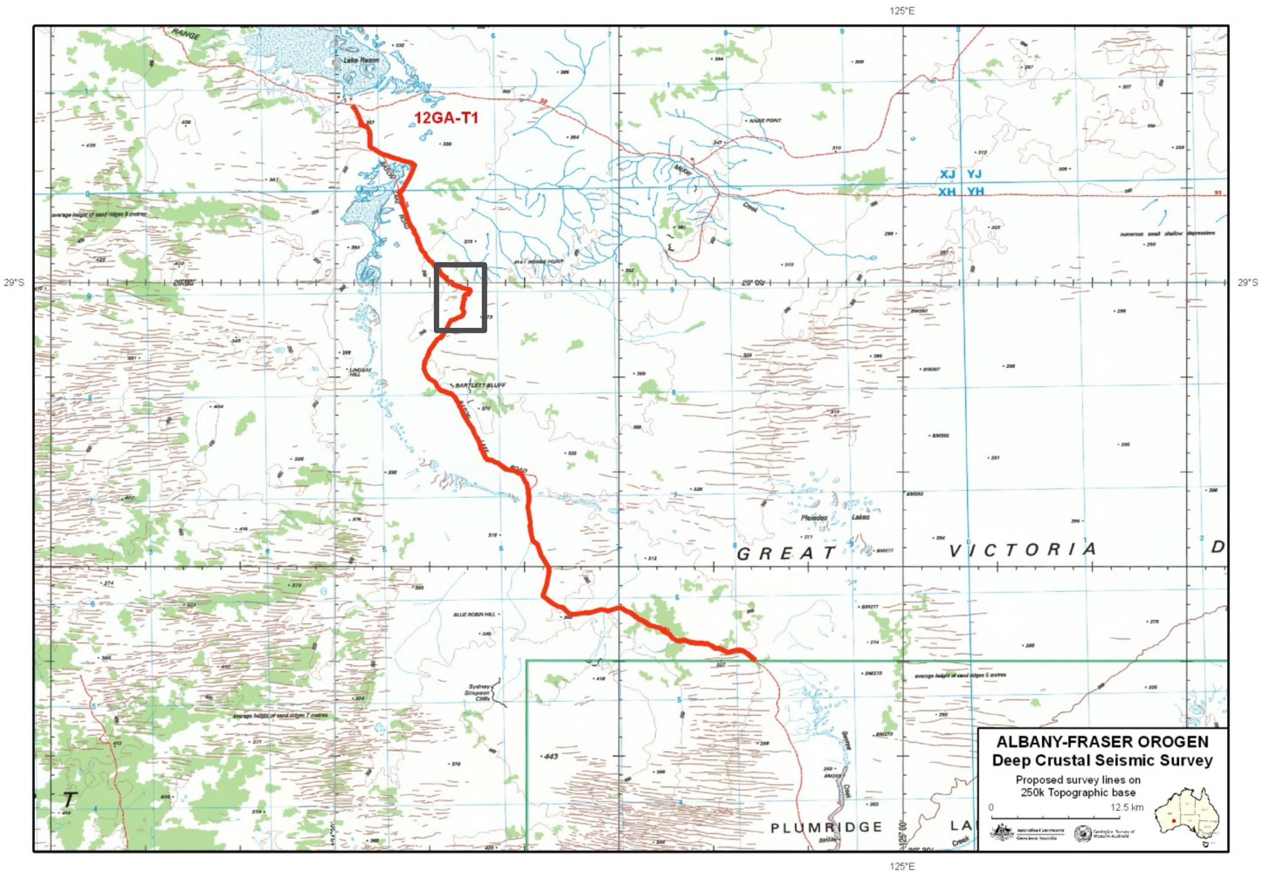
Processing

Crooked line geometry



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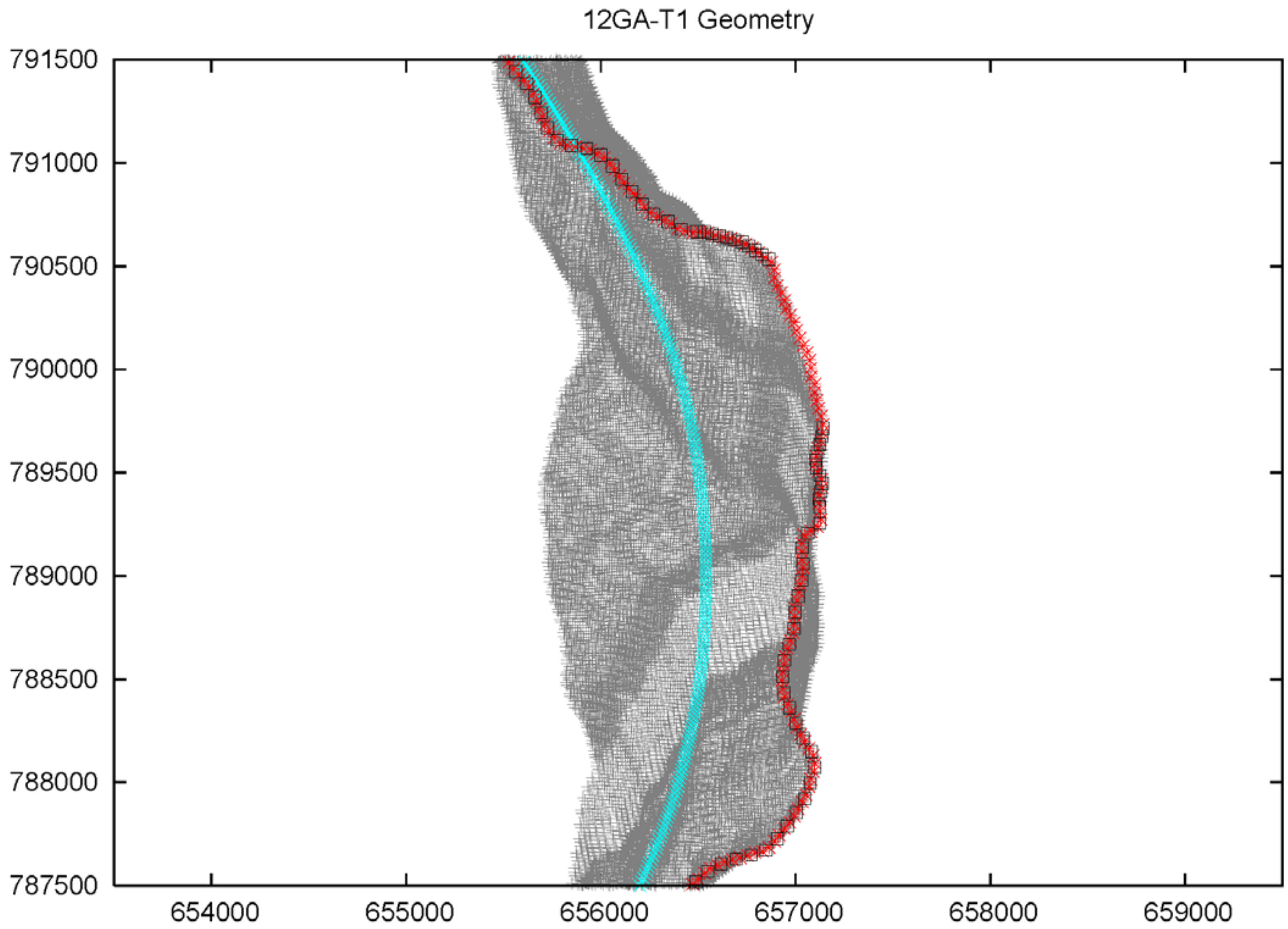
Processing

Crooked line geometry



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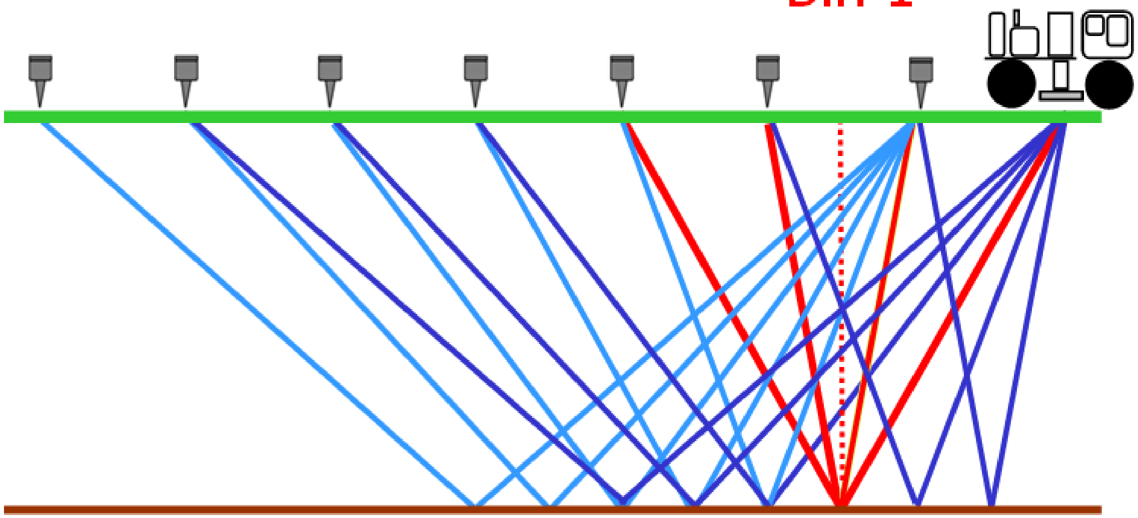
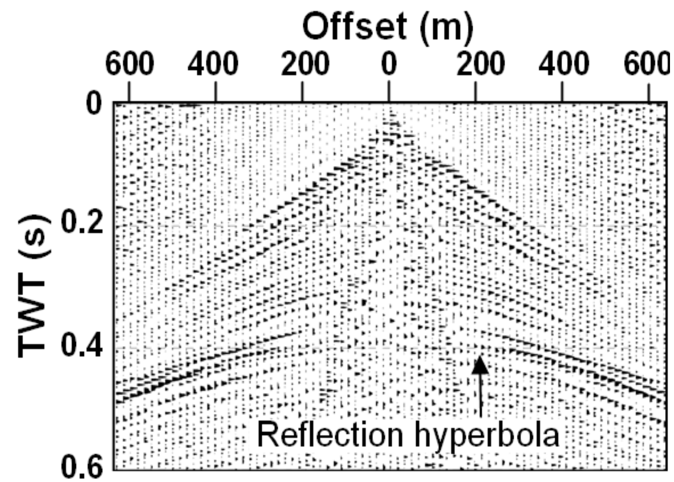
Processing

Crooked line geometry – CDP sort - sort data into CDP bins





CDP Bin

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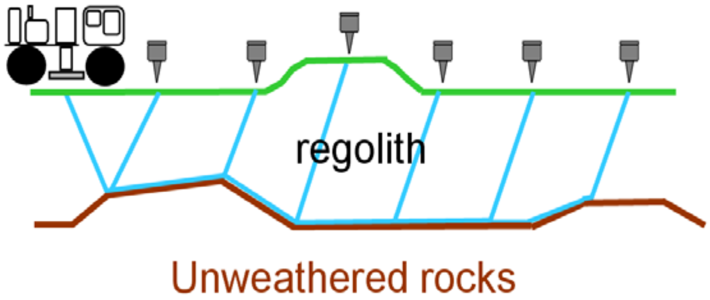
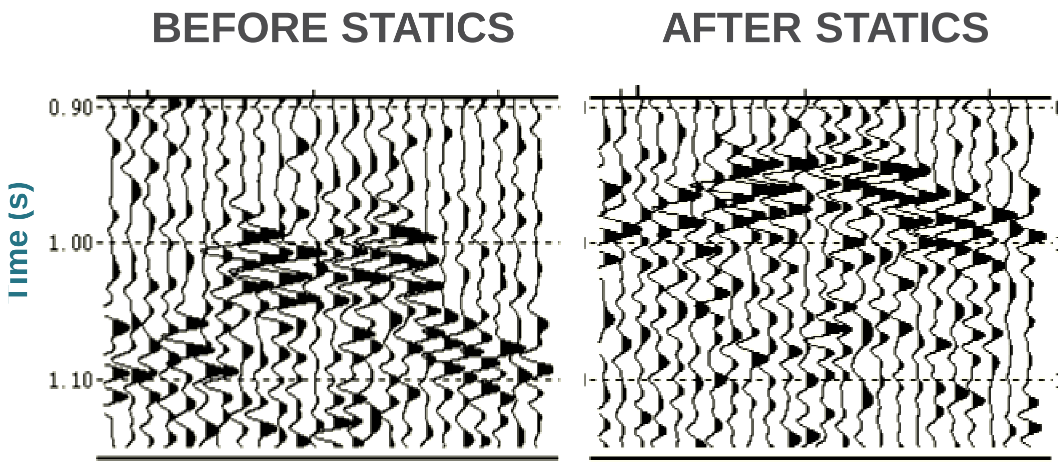
Processing and interpretation

Refraction Statics

Corrects for variable time delays in the regolith





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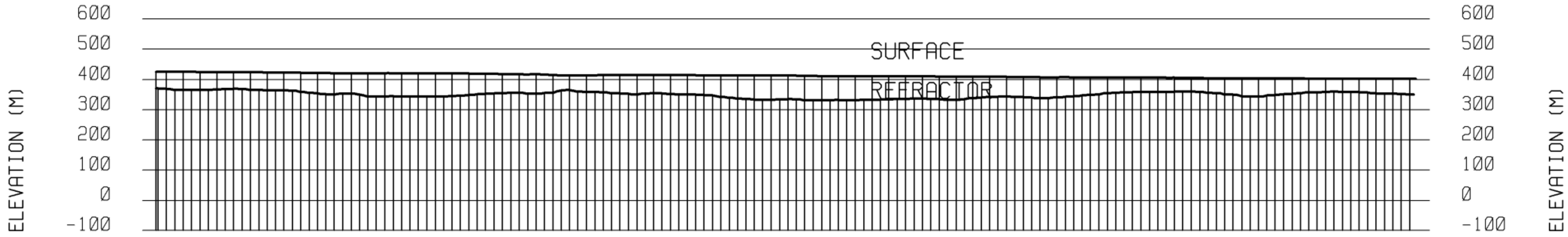
Processing and interpretation

Refraction Statics

Corrects for variable time delays in the regolith

Refractor model displayed on top of section plots



Indicative of regolith thickness, but not exact

Primary use is for statics corrections to seismic data

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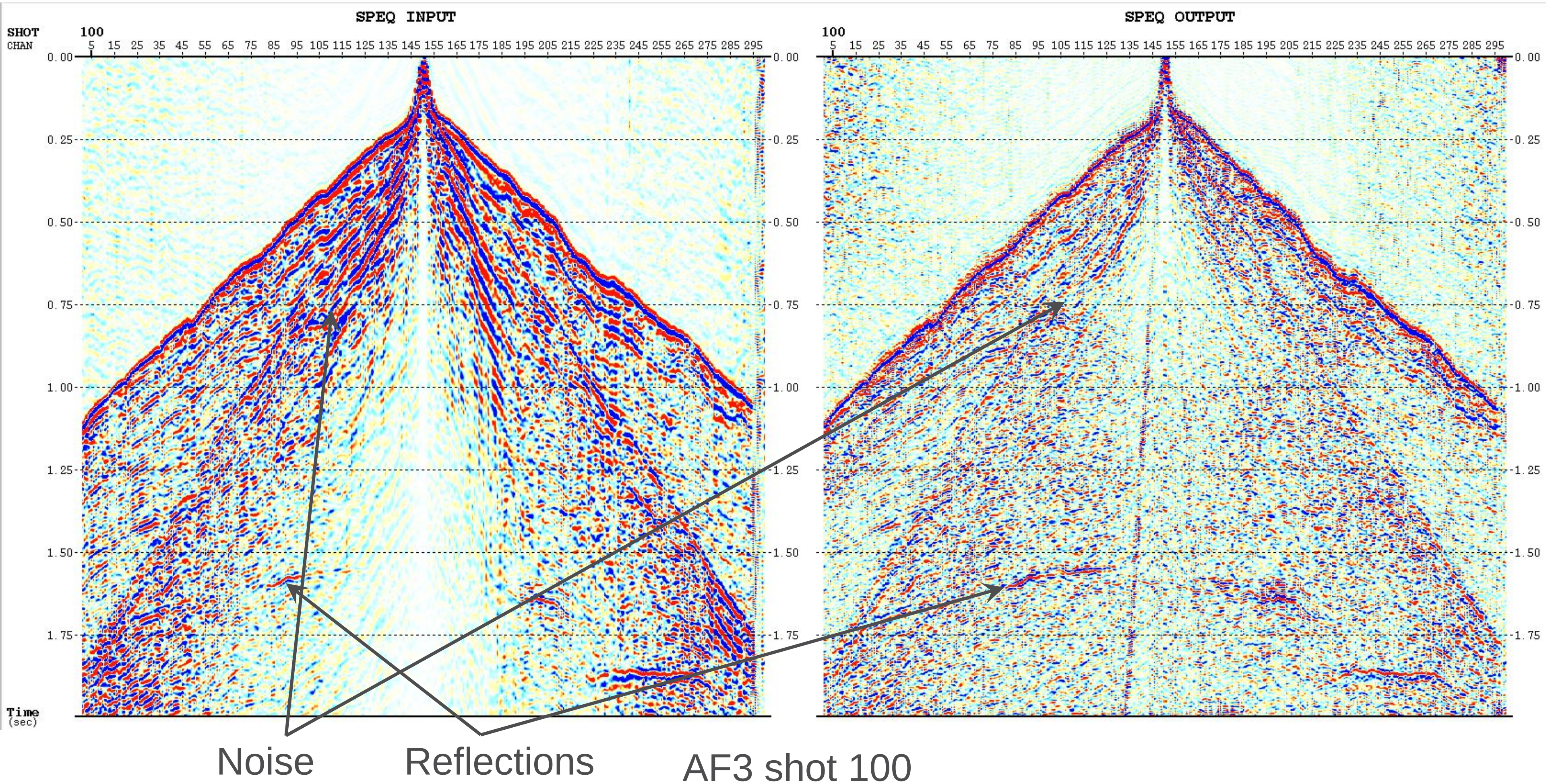
Processing and interpretation

Spectral Equalisation



AF3 shot 100

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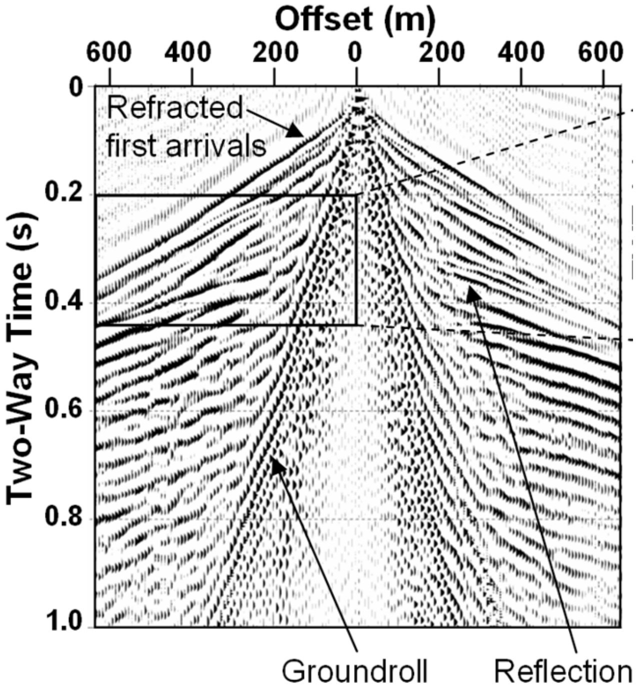
Processing and interpretation

Spectral Equalisation

Suppresses low frequency noise



10GA-PA1 NT, 2010, groundwater survey

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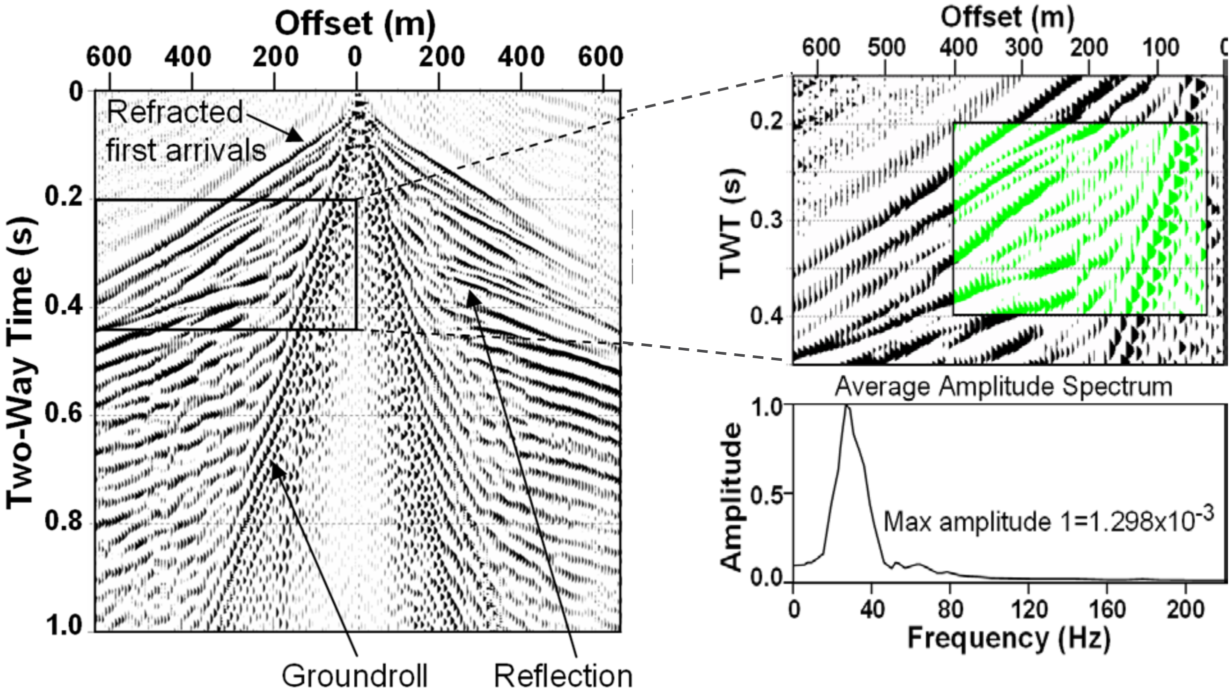
Processing and interpretation

Spectral Equalisation

Suppresses low frequency noise



10GA-PA1 NT, 2010, groundwater survey

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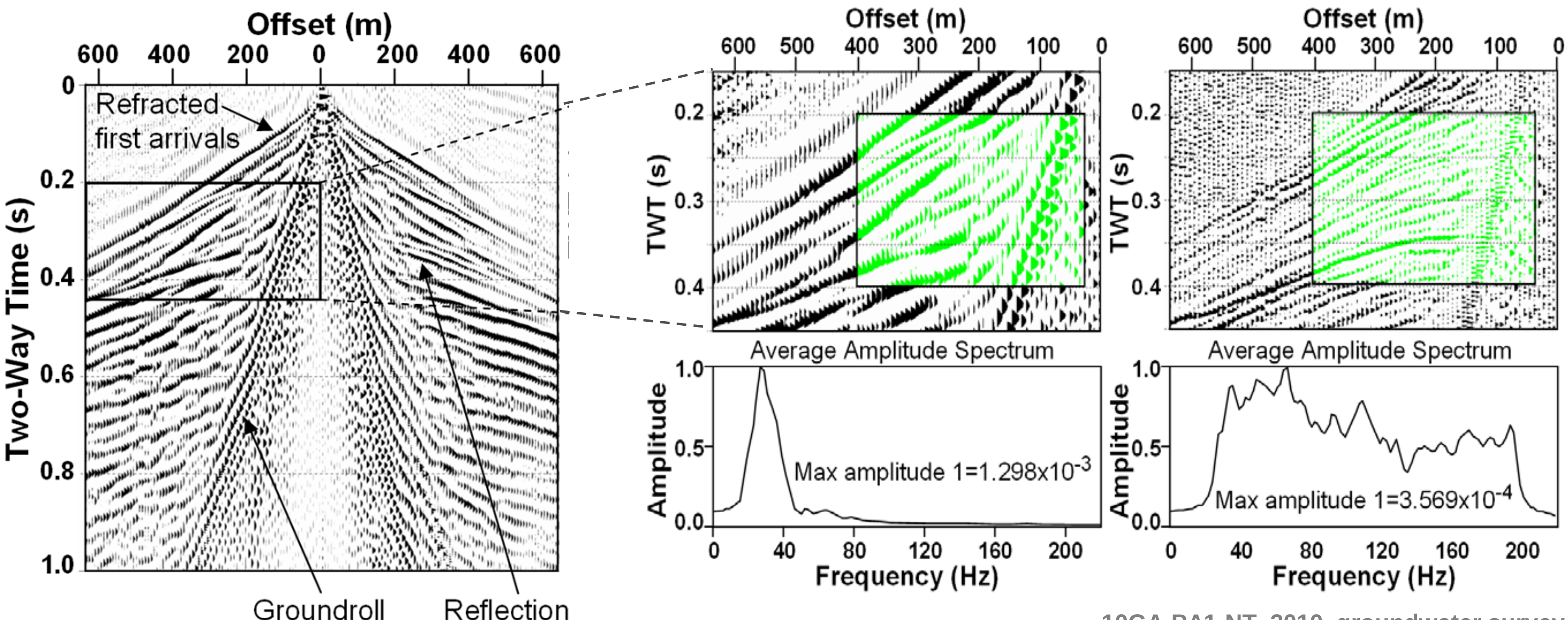
Processing and interpretation

Spectral Equalisation

Suppresses low frequency noise



10GA-PA1 NT, 2010, groundwater survey

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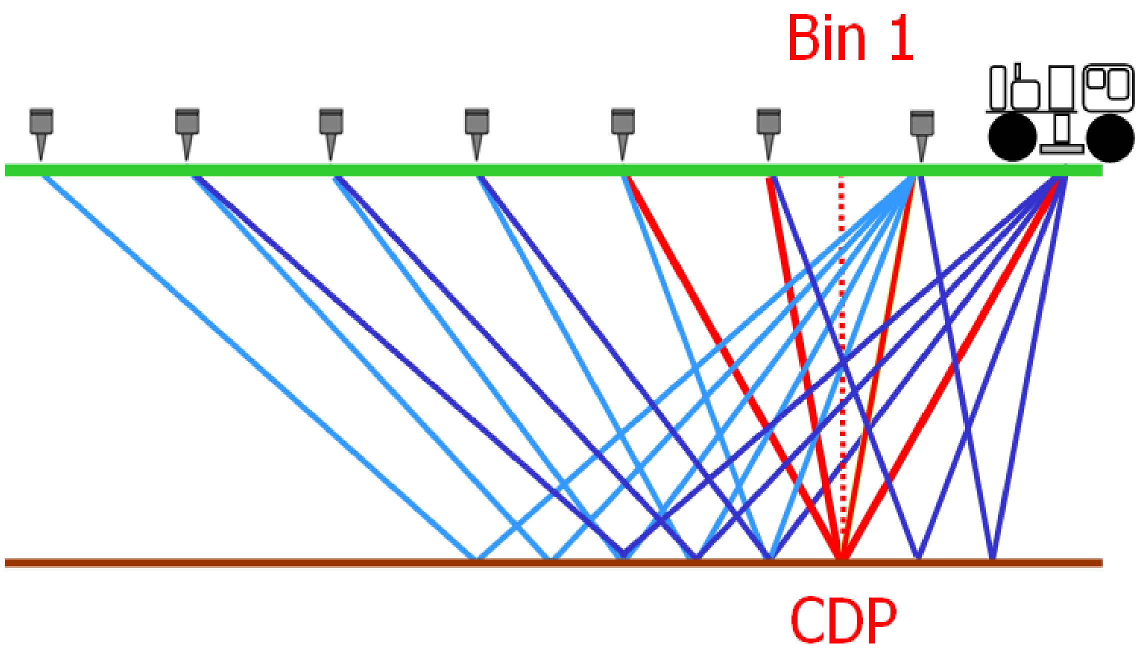
Processing and interpretation

Normal Moveout (NMO)

Corrects for source-receiver offset differences

Velocity analysis



10GA-PA1 NT, 2010, groundwater survey

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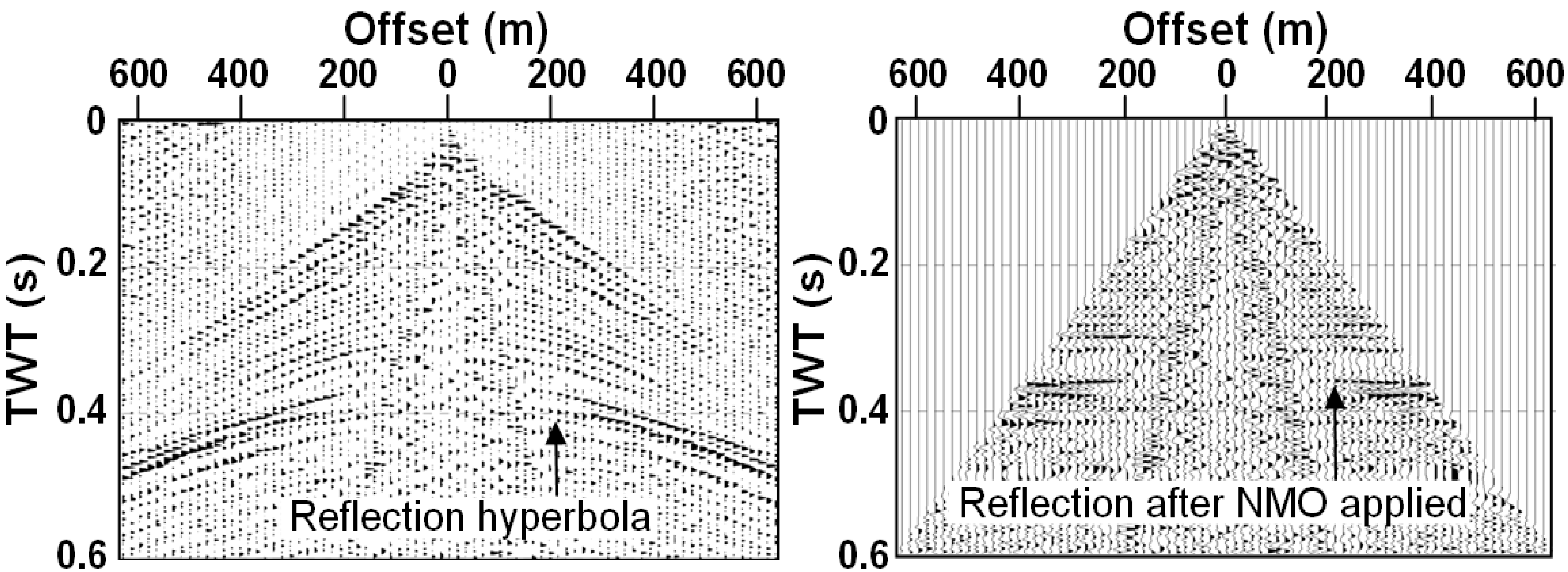
Processing and interpretation

Normal Moveout (NMO)

Corrects for source-receiver offset differences

Velocity analysis



CDP Gather

10GA-PA1 NT, 2010, groundwater survey

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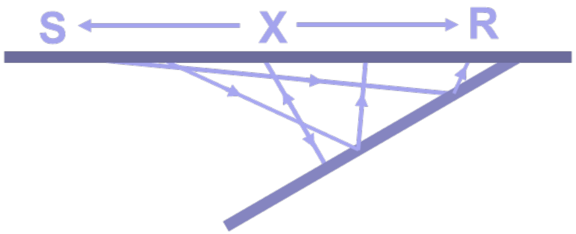
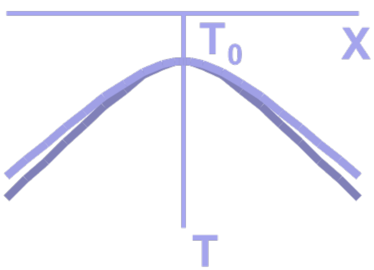
Processing and interpretation

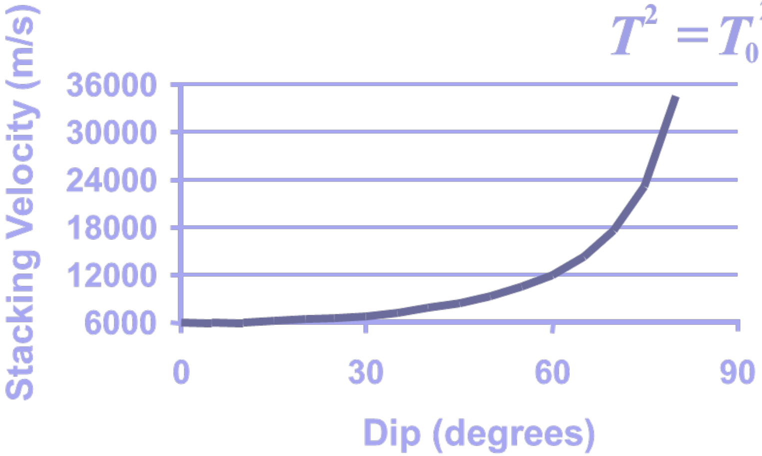
Dip Moveout (DMO)

Corrects for dipping reflectors

Allows stacking of different dips at same location







Need Dip Moveout Correction (DMO)

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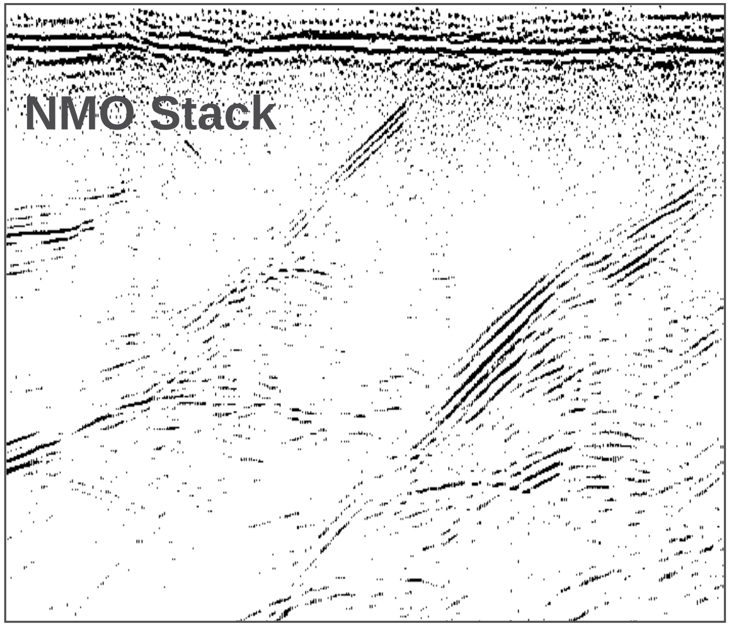
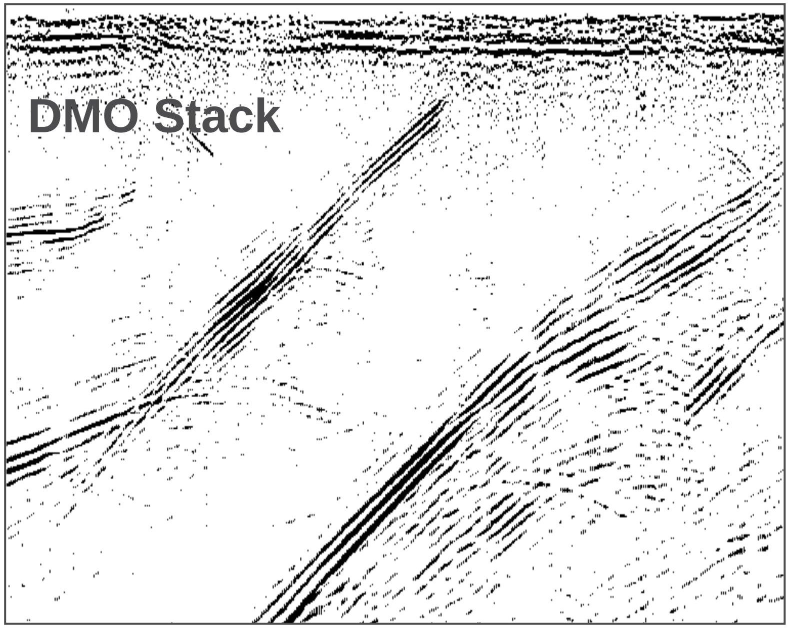
Processing and interpretation

Dip Moveout (DMO)

Corrects for dipping reflectors

Allows stacking of different dips at same location





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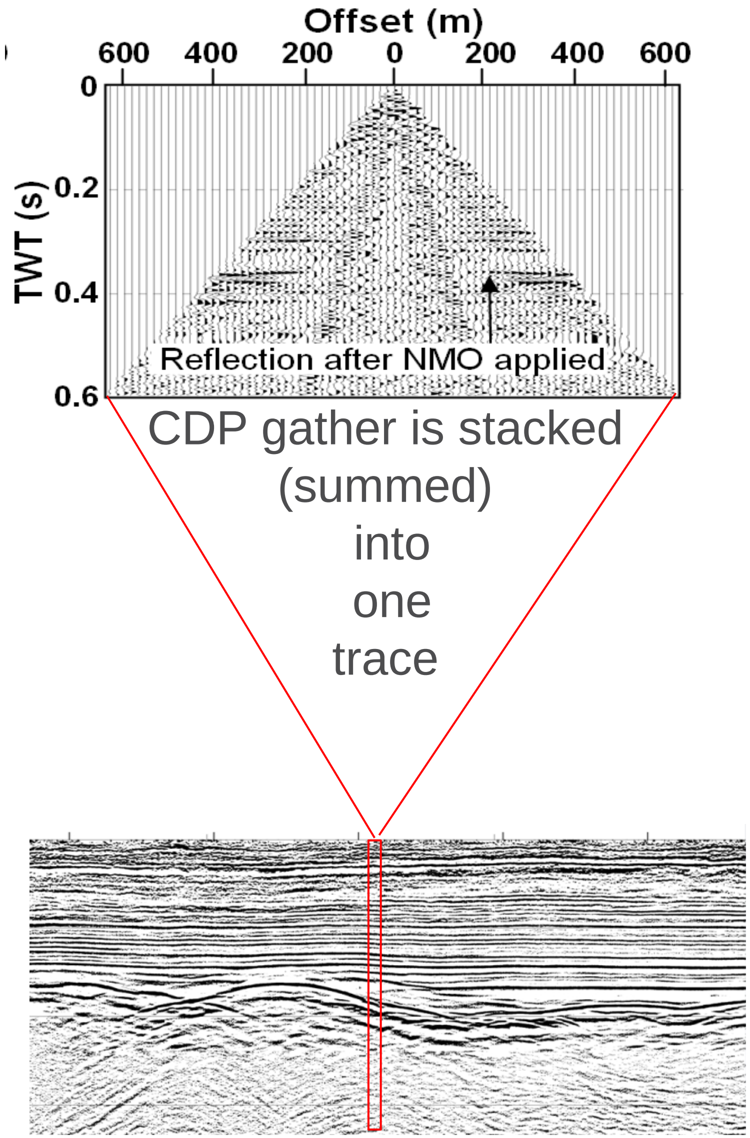
Processing and interpretation

Common midpoint stack

Improves signal to noise ratio

by √(fold)

Fundamental idea behind CDP method



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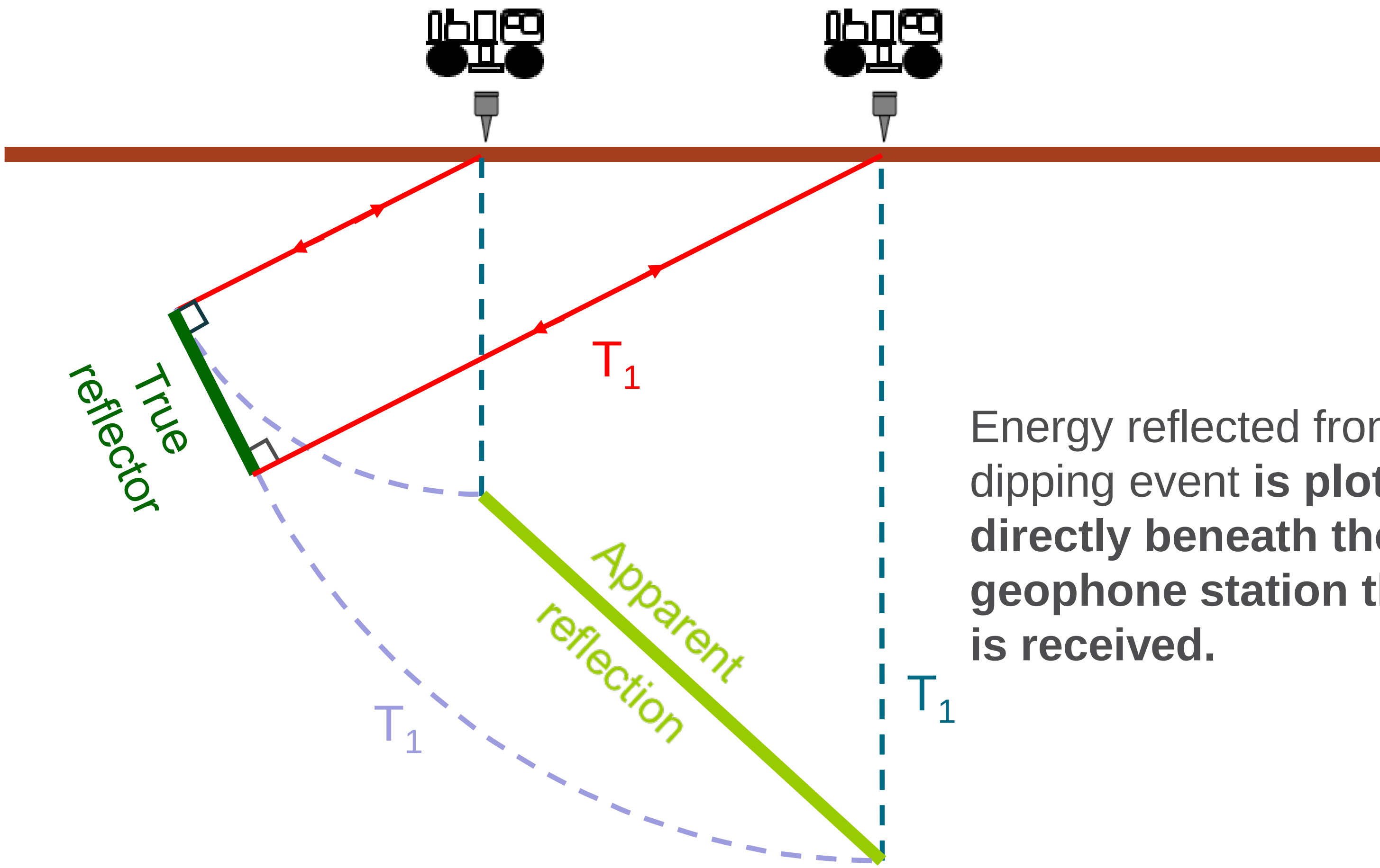
Migration of a dipping reflection



Energy reflected from a dipping event **is plotted directly beneath the geophone station that it is received.**

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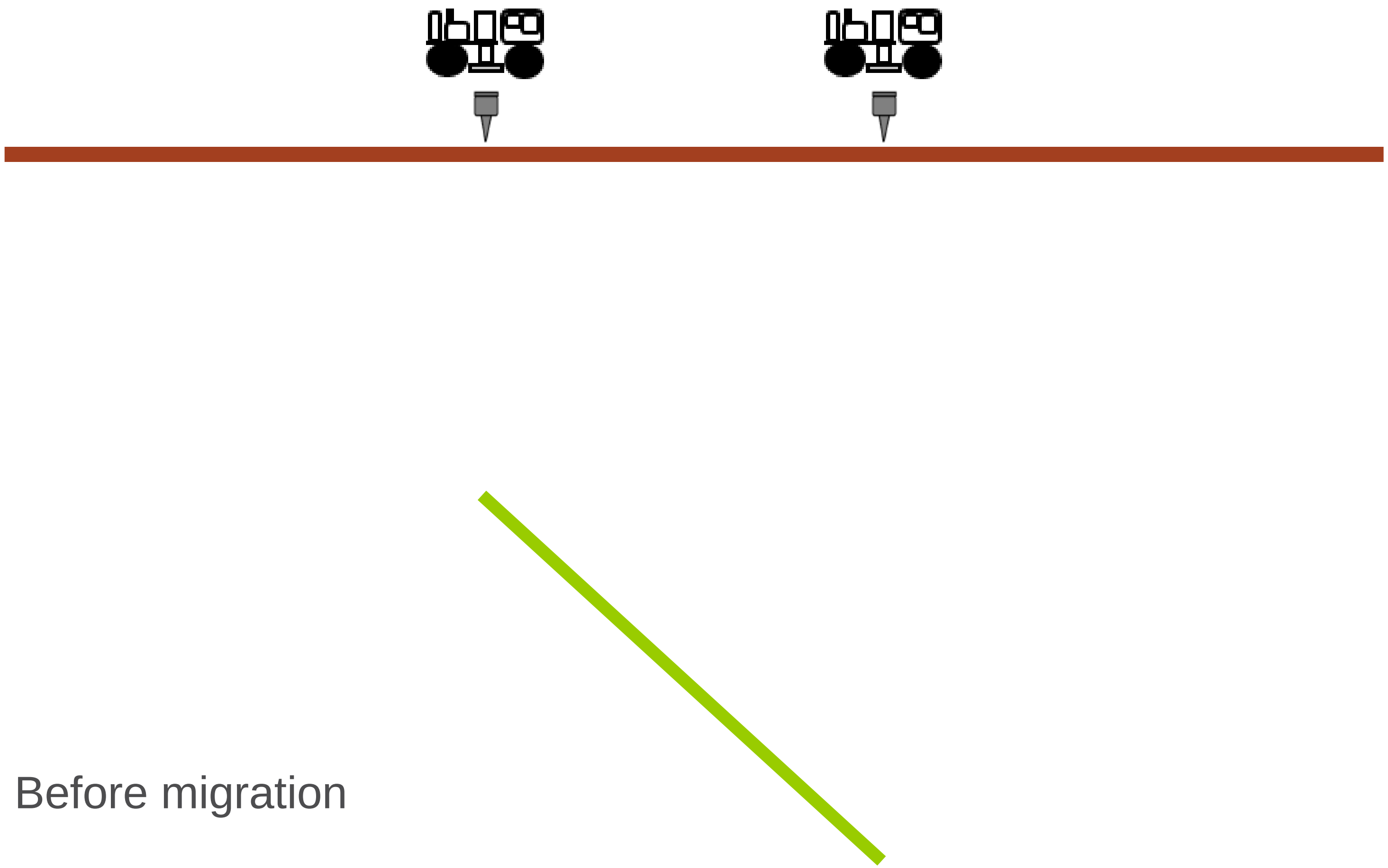
Migration of a dipping reflection



Before migration

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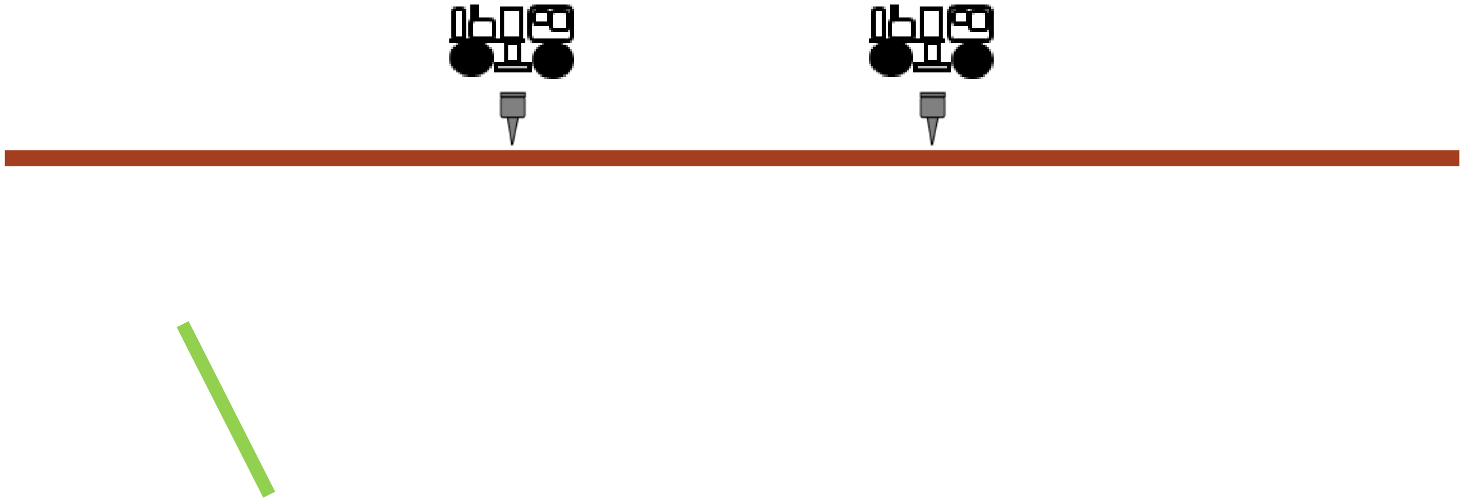
Migration of a dipping reflection



Correct migration

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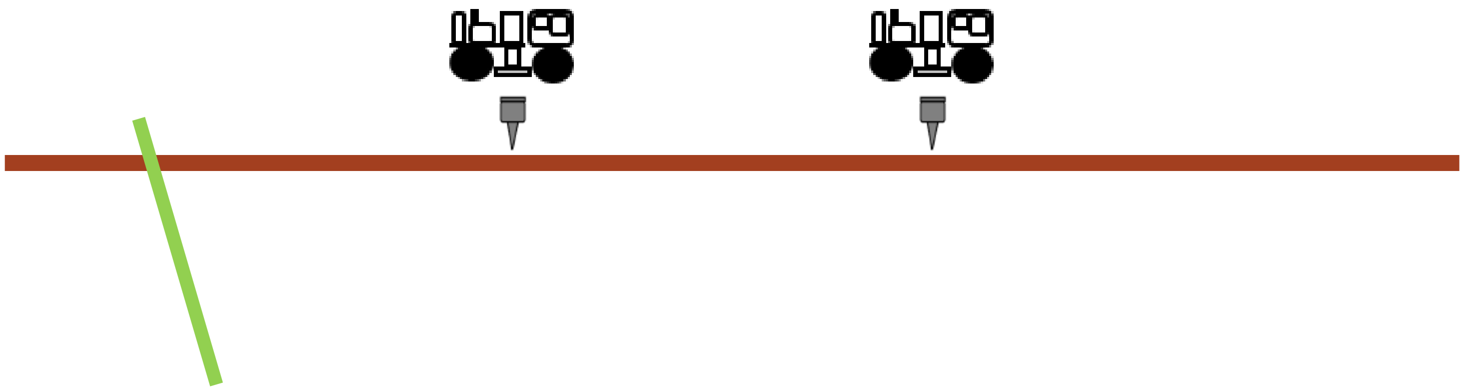
Migration of a dipping reflection



Over migration stretches and smears reflections

Over migration

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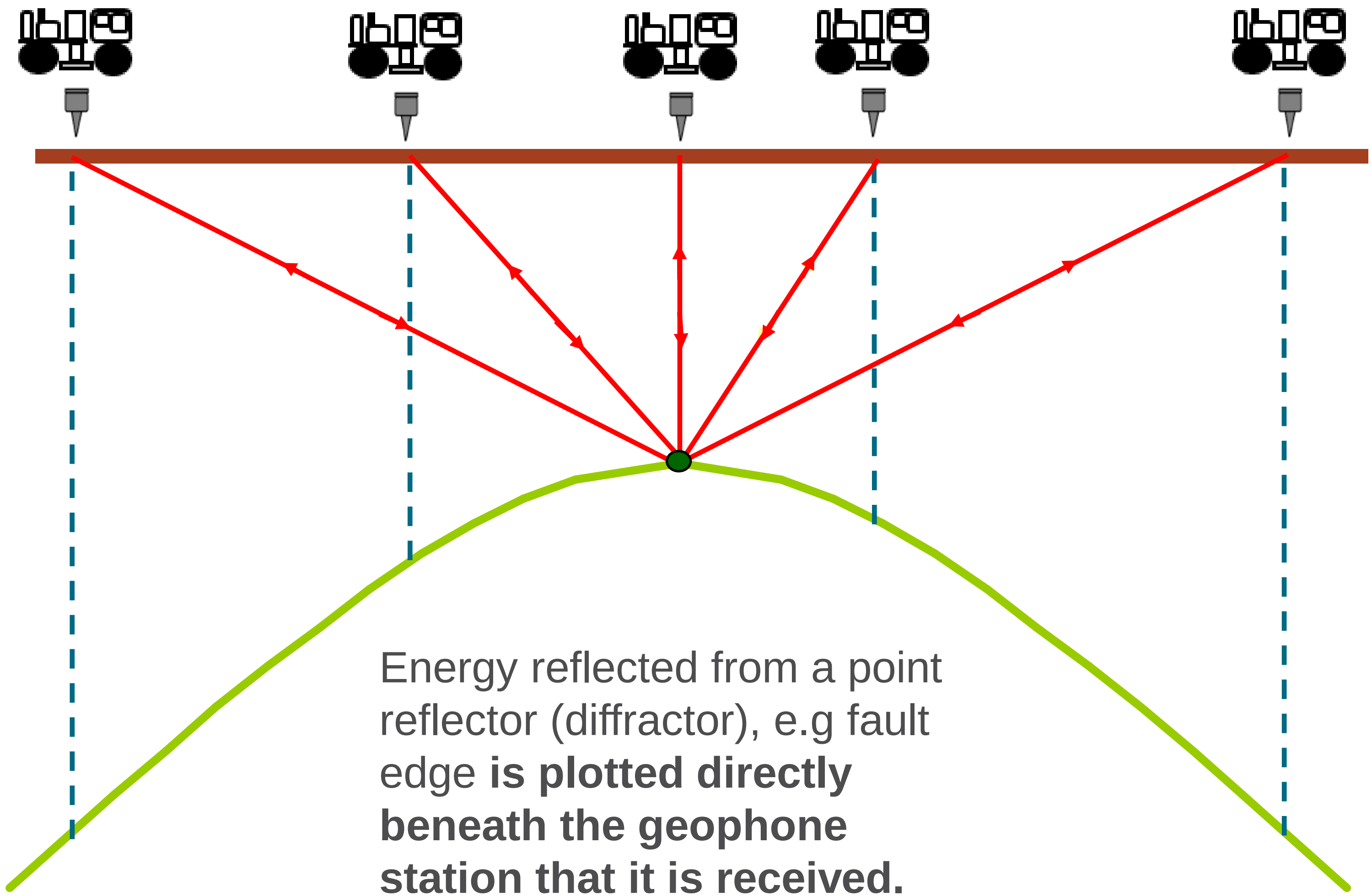
Migration – collapse diffractions



Energy reflected from a point reflector (diffractor), e.g fault edge **is plotted directly beneath the geophone station that it is received.**

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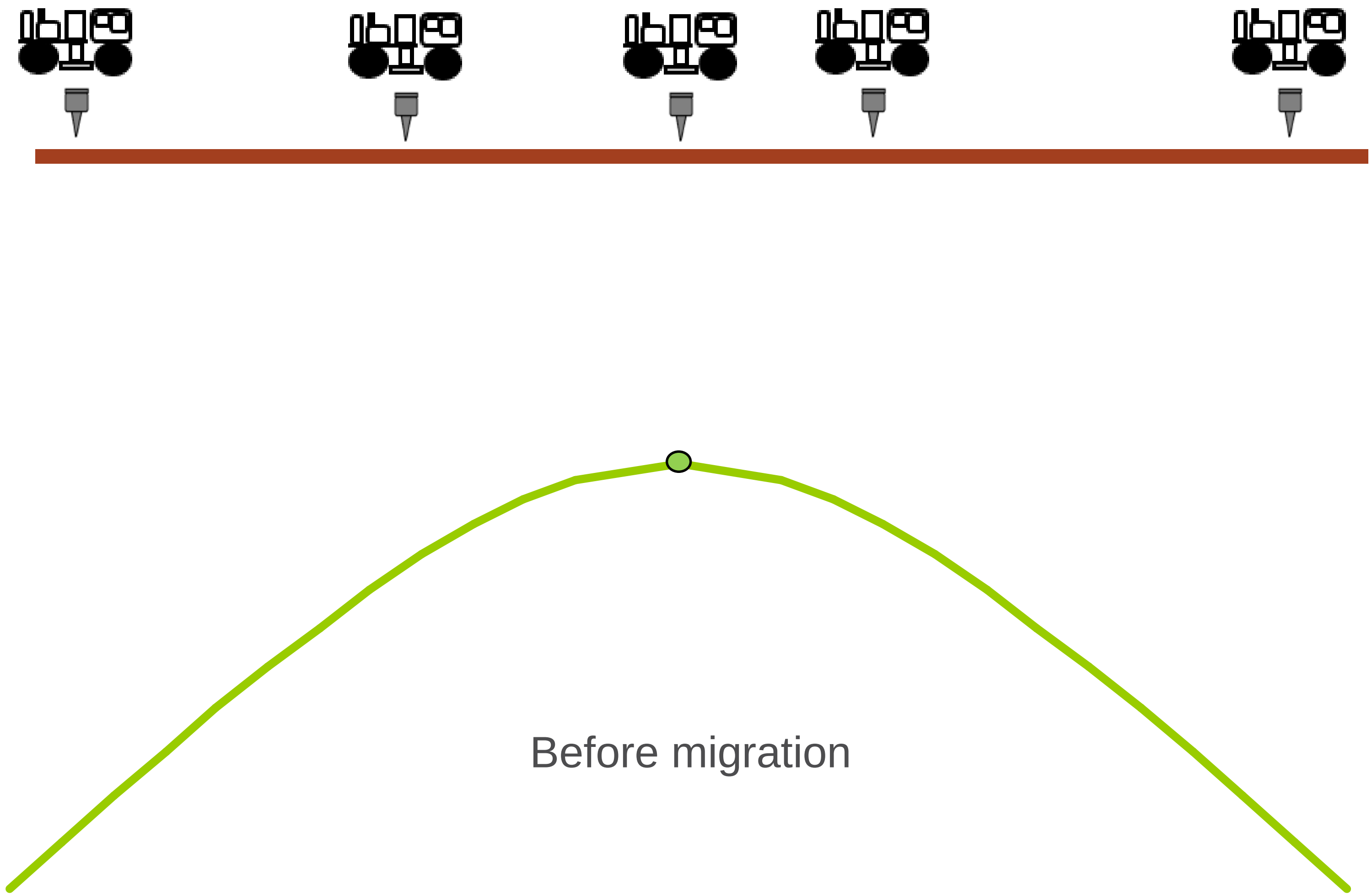
Migration – collapse diffractions



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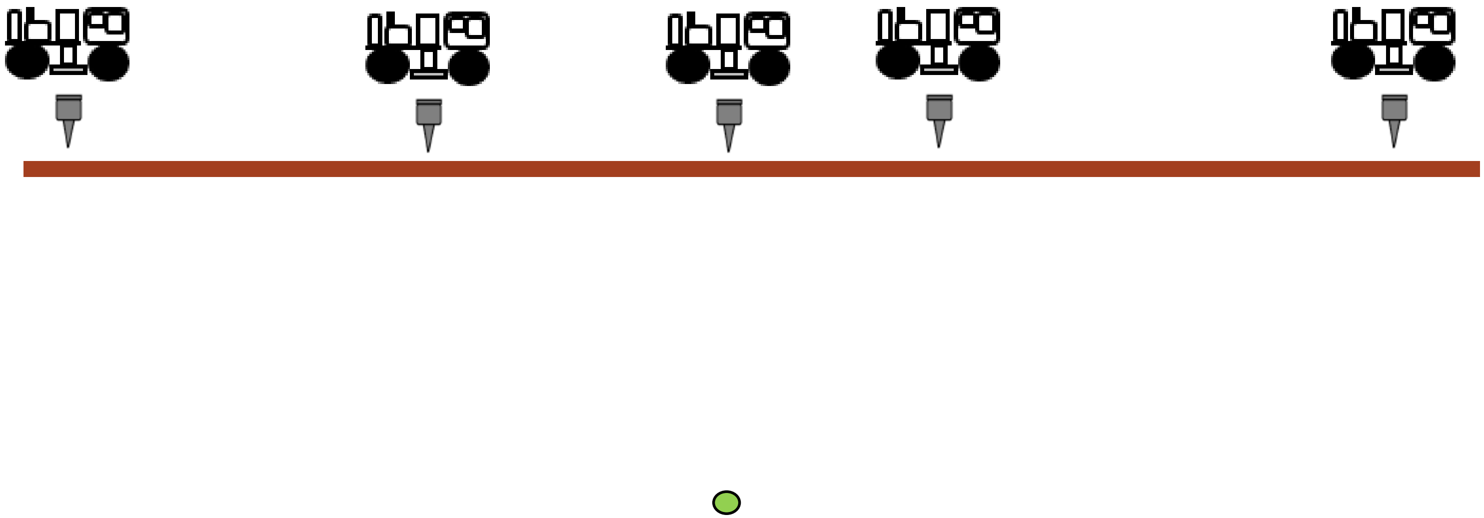
Migration – collapse diffractions



Correct migration

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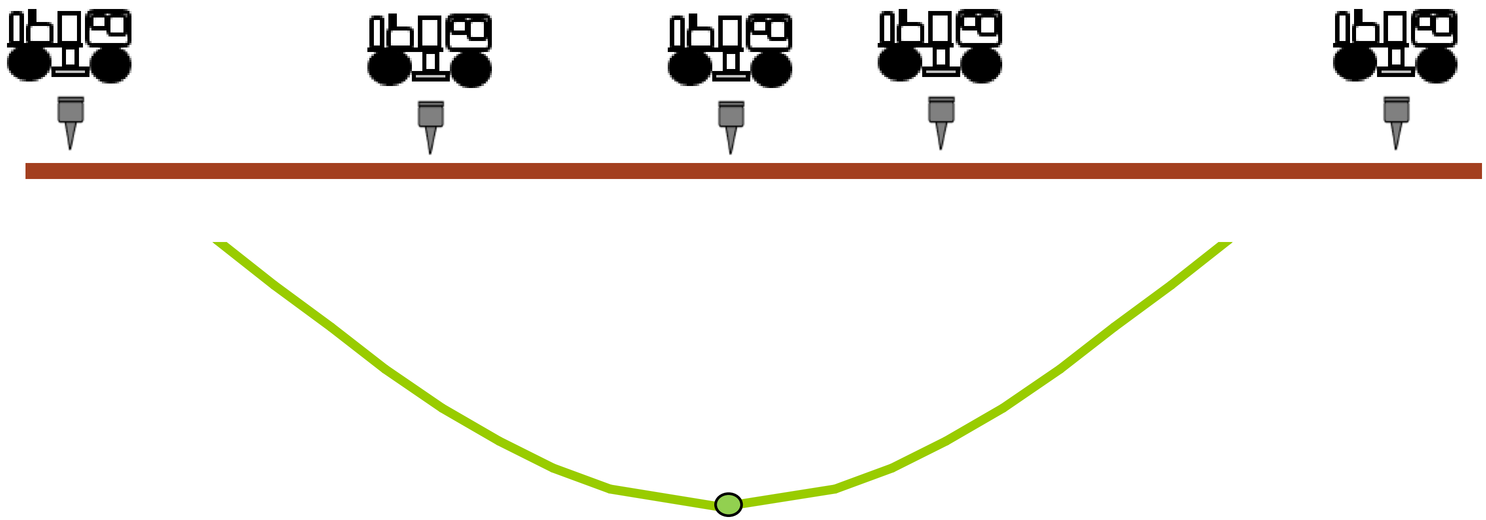
Migration – over migration



Over migration

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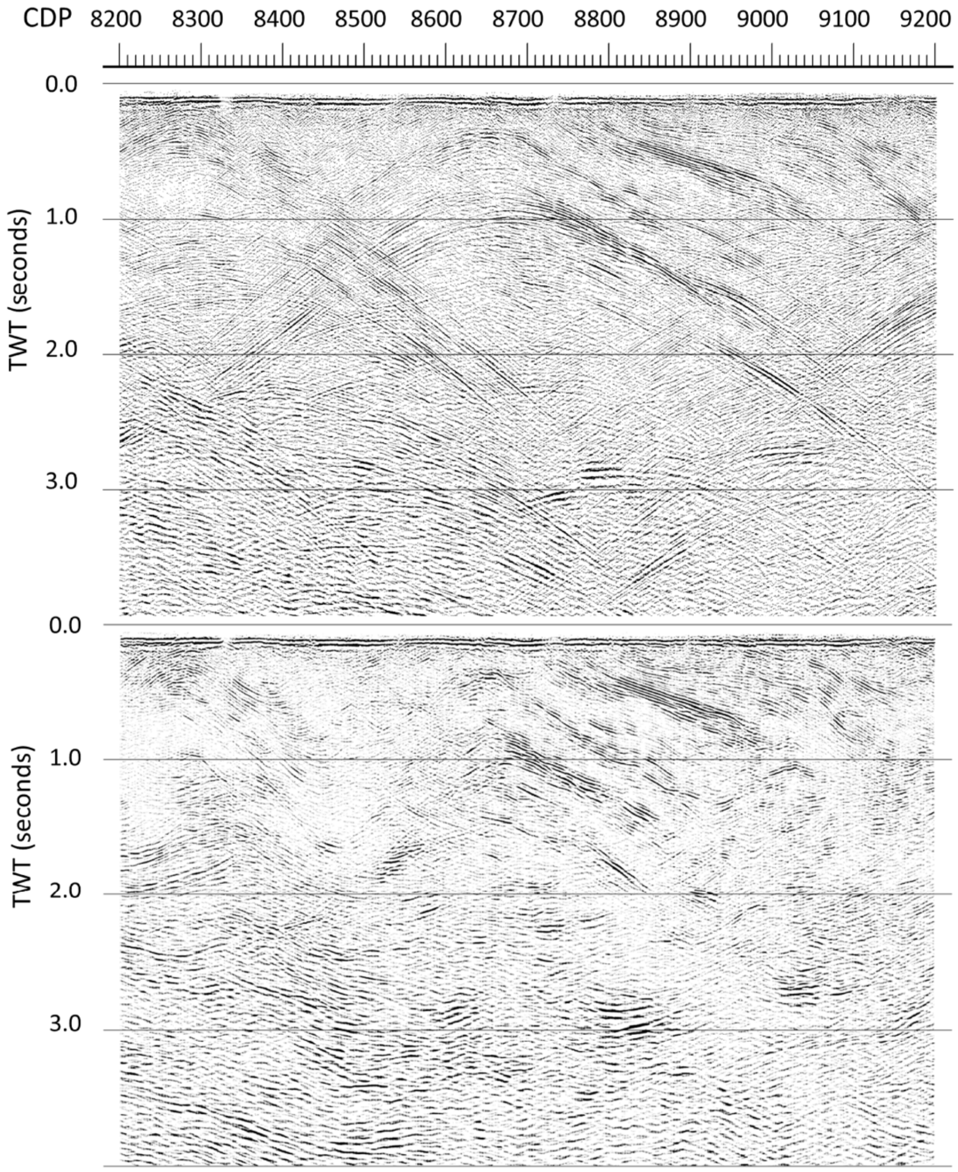
Processing

Stack

Migration



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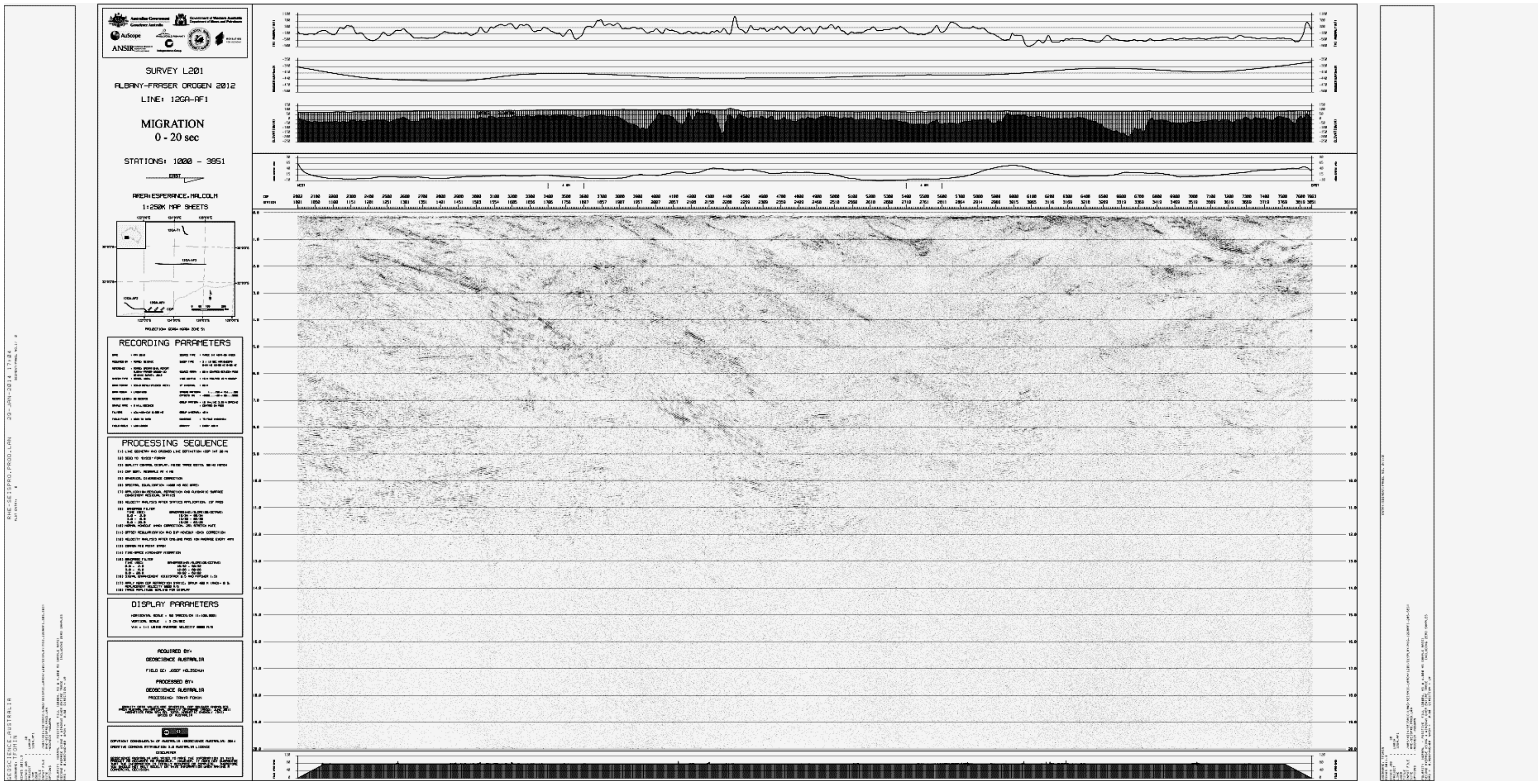
Processing

Final Migration



12GA-AF1

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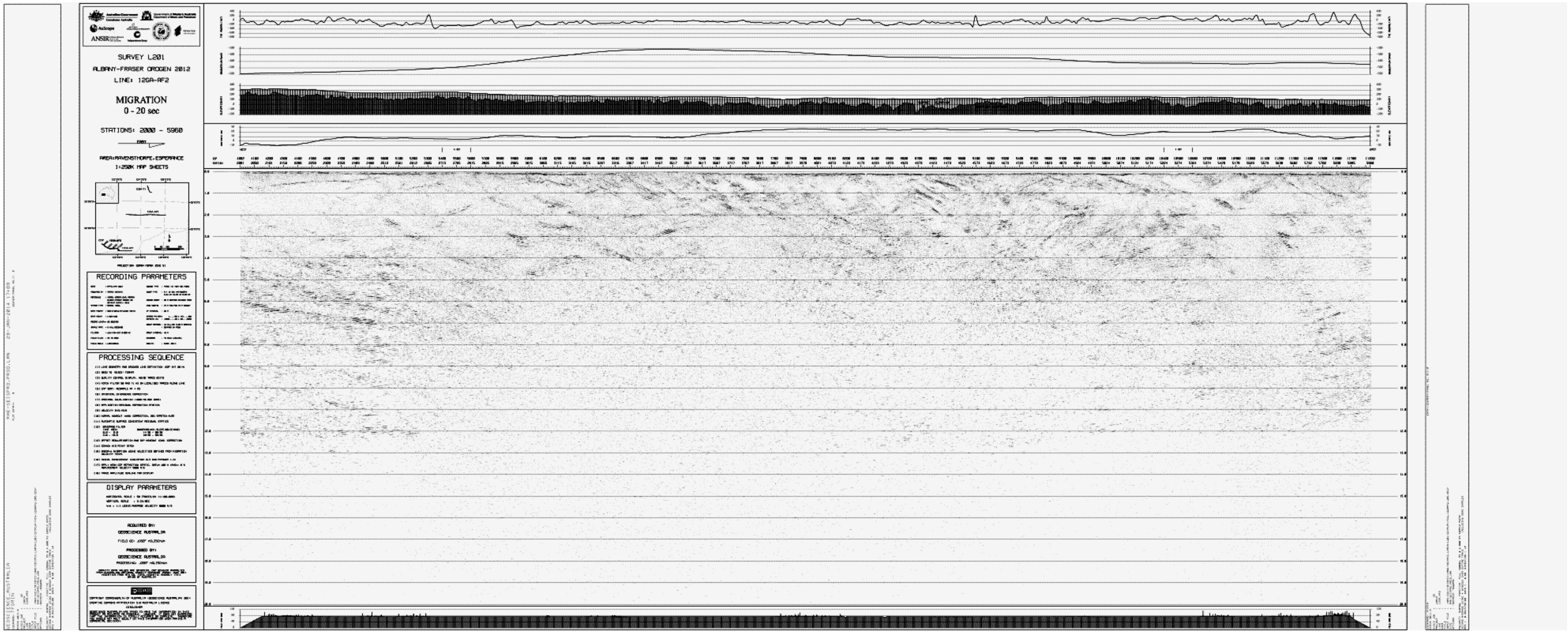
Processing

Final Migration



12GA-AF2

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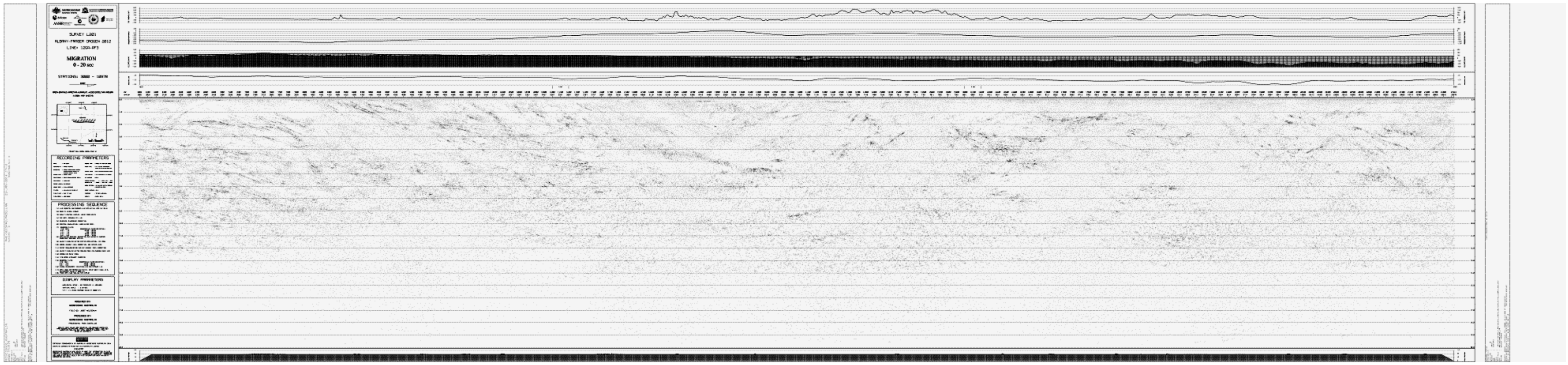
Processing

Final Migration



12GA-AF3

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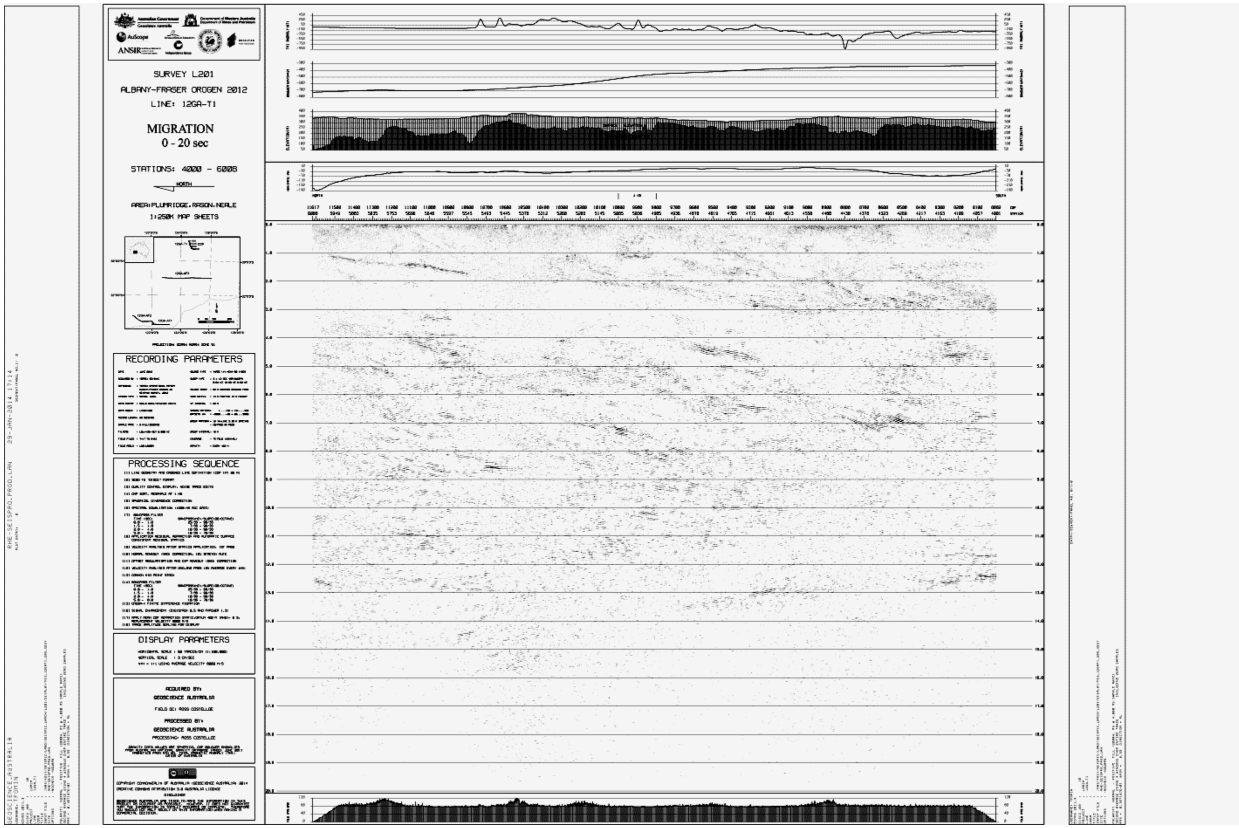
Processing

Final Migration



12GA-T1

Testing Program

Testing Program

AF3

4.5 Hz geophones vs 10 Hz geophones

Linear sweeps vs non-linear sweeps

Testing Program

Test	VP Range	Sweep Type	Sweep Frequencies
1	10675.5 – 10910.5	Linear	3-48 Hz 3-24 Hz 3-16 Hz
2	10824.5 – 10848.5	Linear	3-64 Hz 10-96 Hz 8-80 Hz
3	10824.5 – 10844.5	Non-linear - 9dB/Oct	3-48 Hz 3-24 Hz 3-16 Hz
4	10824.5 – 10833.5	Non-linear - 9dB/Oct	3-64 Hz 10-96 Hz 8-80 Hz

Testing Program

AF3

4.5 Hz geophones vs 10 Hz geophones

Linear sweeps vs non-linear sweeps

Results - Existing parameters as good as other tests

- Plan future surveys using existing acquisition parameters

Eucla-Gawler survey since collected – extending from AF3 across Eucla Basin to the Gawler in South Australia.

Australian Government
Geoscience Australia

Summary

Albany-Fraser seismic lines provide good images of the entire crust over the Yilgarn – Albany-Fraser – Eucla regions and provides insights into the structural relationships between the terranes.

Data available from Geoscience Australia

http://www.ga.gov.au/minerals/projects/current-projects/seismic-acquisition-processing.html

Albany-Fraser Orogen Acquisition and Processing Data Release, Perth WA, April 2014