Crutchley, G.J., et al., 2018, How tectonic folding influences gas hydrate formation: New Zealand's Hikurangi subduction margin: Geology, https://doi.org/10.1130/G45151.1

Supplement A: Seismic acquisition and processing:

The PEG09 and APB13 seismic data used in this study were processed by CGG Services (Singapore) Pte. Ltd under contract to Anadarko New Zealand Company in 2014. Anadarko New Zealand Company was the operator of exploration permits PEP54858 and PEP54861 in the Pegasus Basin, on New Zealand's offshore East Coast. The following information about acquisition parameters and processing has been extracted from Petroleum Reports[1-3] available from New Zealand Petroleum and Minerals, which is part of New Zealand's Ministry for Business, Innovation and Employment. At the time of publishing this paper, the reports, and data, can be accessed from: https://www.nzpam.govt.nz/maps-geoscience/exploration-database/

Acquisition parameters:

PEG09 Survey	
Vessel	*M/V* Reflect Resolution
No. of channels	800
Group length	12.5 m
Offset - source to Channel 1	140 m
Offset - source to Channel 800	10140 m
Streamer depth (nominal)	9 m
Sample interval	2 ms
Nominal fold	133
Record length	12 s
Source array depth (nominal)	6 m
Source array volume	5400 cu-in
Shotpoint interval	37.5 m

APB13 Survey	
Vessel	*M/V* Duke
No. of channels	648
Group length	12.5 m
Offset - source to Channel 1	80 m
Offset - source to Channel 800	8180 m
Streamer depth (nominal)	18 m
Sample interval	2 ms
Nominal fold	108
Record length	10.5 s
Source array depth (nominal)	12 m
Source array volume	3610 cu-in
Shotpoint interval	37.5 m

Processing (key steps, both surveys):

- 2D geometry assignment
- Low pass filter 3 Hz at 18 dB/Octave (two passes)
- Debubble and zero phased designature
- Spherical divergence application (V^2T function)
- Swell noise attenuation, despiking, receiver motion correction, SRME, linear noise attenuation
- Deghosting using ghost wavelet estimation
- Velocity analysis at 1 km interval

- Adjacent trace decimation in shot domain with K filter & NMO wrap
- Radon demultiple
- Diffracted multiple attenuation
- Shot and channel scaling
- First iteration Kirchhoff PSTM
- Migration velocity analysis at 1 km interval
- Pre-migration denoise in common offset domain
- Removal of spherical divergence correction
- Full Kirchhoff PSTM
- High-resolution automatic velocity analysis (50 m interval)
- Radon demultiple
- Denoise in common depth point (CDP) domain
- Angle stack and full stack
- Q compensation and time variant scaling (post stack)
- Source and streamer datum correction (+10 ms for PEG09 survey, +20 ms for APB13 survey)
- Amplitude matching (APB13 scaled by 0.00025 to match PEG09 survey)

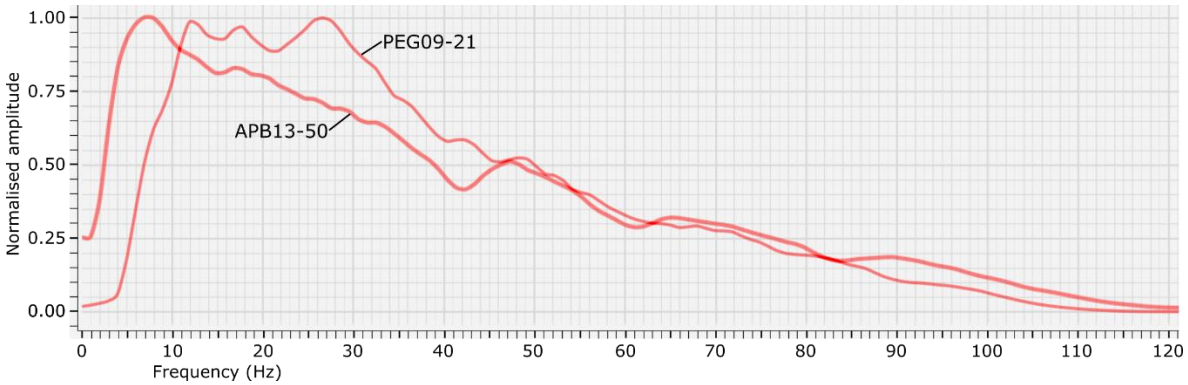

Figure SA-1. Comparison of normalized amplitude spectra from adjacent seismic lines APB13-50 and PEG09-21.

Note: The data we analyzed in this study were the full angle stacks – i.e. where the full range of offsets given in the previous tables are used for imaging. For more information on acquisition and processing of the APB13 and PEG09 surveys, the reader is referred to the complete seismic processing reports listed below.

<u>Acquisition and Processing Reports (PEG09 and APB13 surveys):</u>

- *Anardarko New Zealand Ltd (2014). PEP 54858 and PEP 54861 PEG09 PSTM Reprocessing Report 2014. NZP&M, Ministry of Business, Innovation & Employment (MBIE), New Zealand Unpublished Petroleum Report PR4959*
- *Anardarko New Zealand Ltd (2014). Seismic Data Processing Report - APB-13-2D Pegasus Basin 2D PEP54858. NZP&M, Ministry of Business, Innovation & Employment (MBIE), New Zealand Unpublished Petroleum Report PR5171*
- *Anardarko New Zealand Ltd (2014). APB-13-2D Pegasus Basin 2D Quality Assurance Report PEP 54861 Marine 2D Seismic Survey PEP 54858. NZP&M, Ministry of Business, Innovation & Employment (MBIE), New Zealand Unpublished Petroleum Report PR5172*