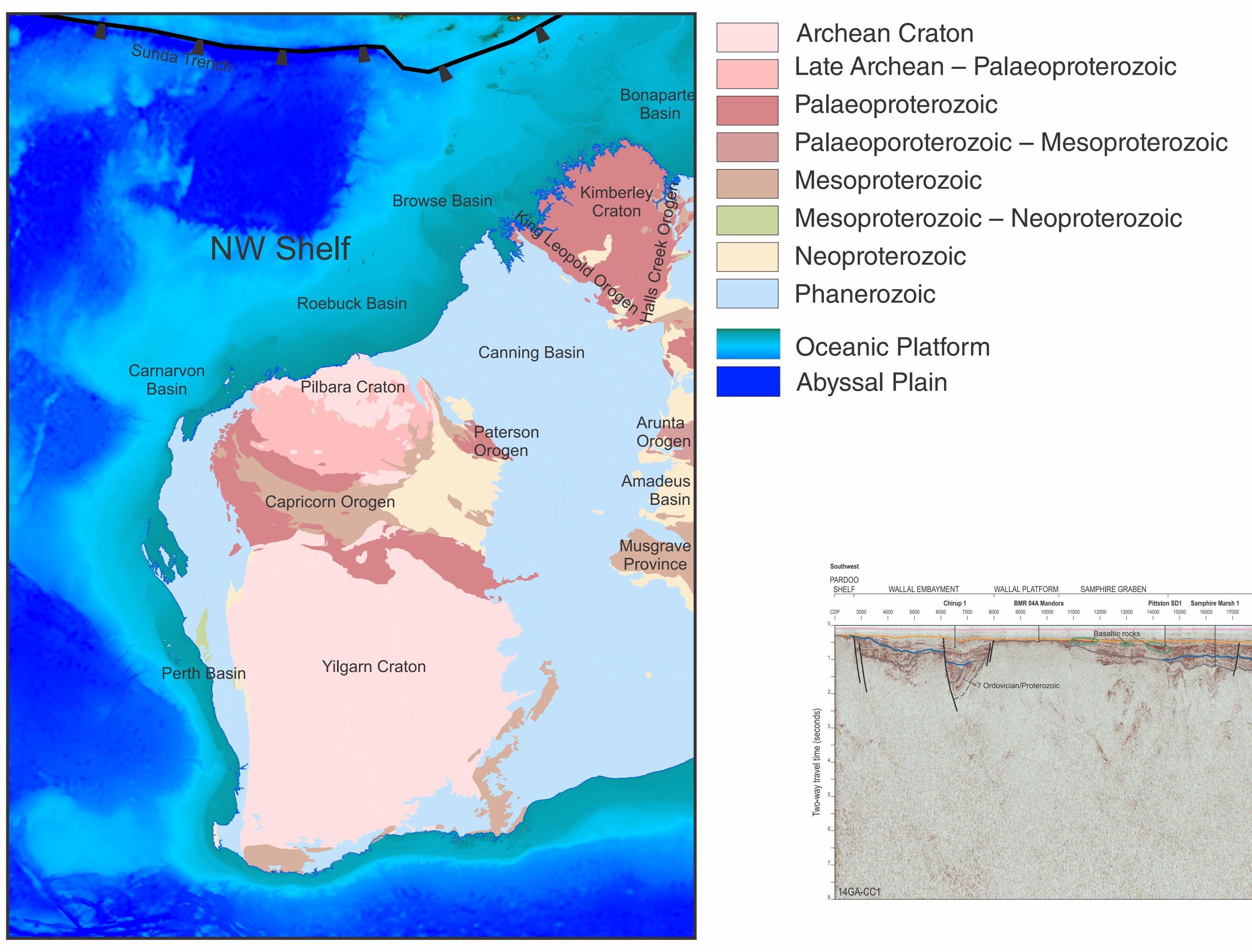
CANNING BASIN PASSIVE SEISMIC

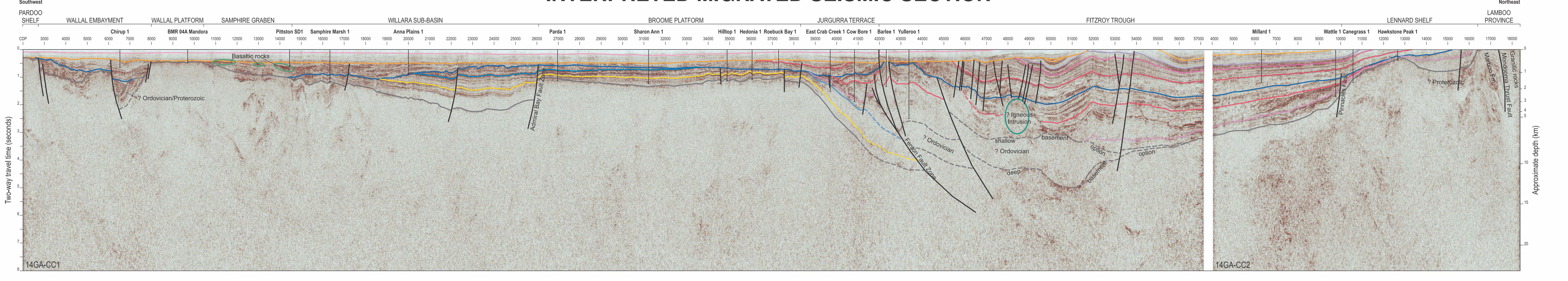
The Canning Basin Passive Seismic project is in collaboration with UWA, Macquarie University and the Institute of Geology and Geophysics at the Chinese Academy of Sciences (ICG-CAS). The Canning Basin of Western Australia is one of the largest Palaeozoic basins in the world with a total extent of > 640 000 km^2 of which 530 000 km^2 is onshore. Despite oil production offshore, it is one of the least explored Palaeozoic basins in the world.

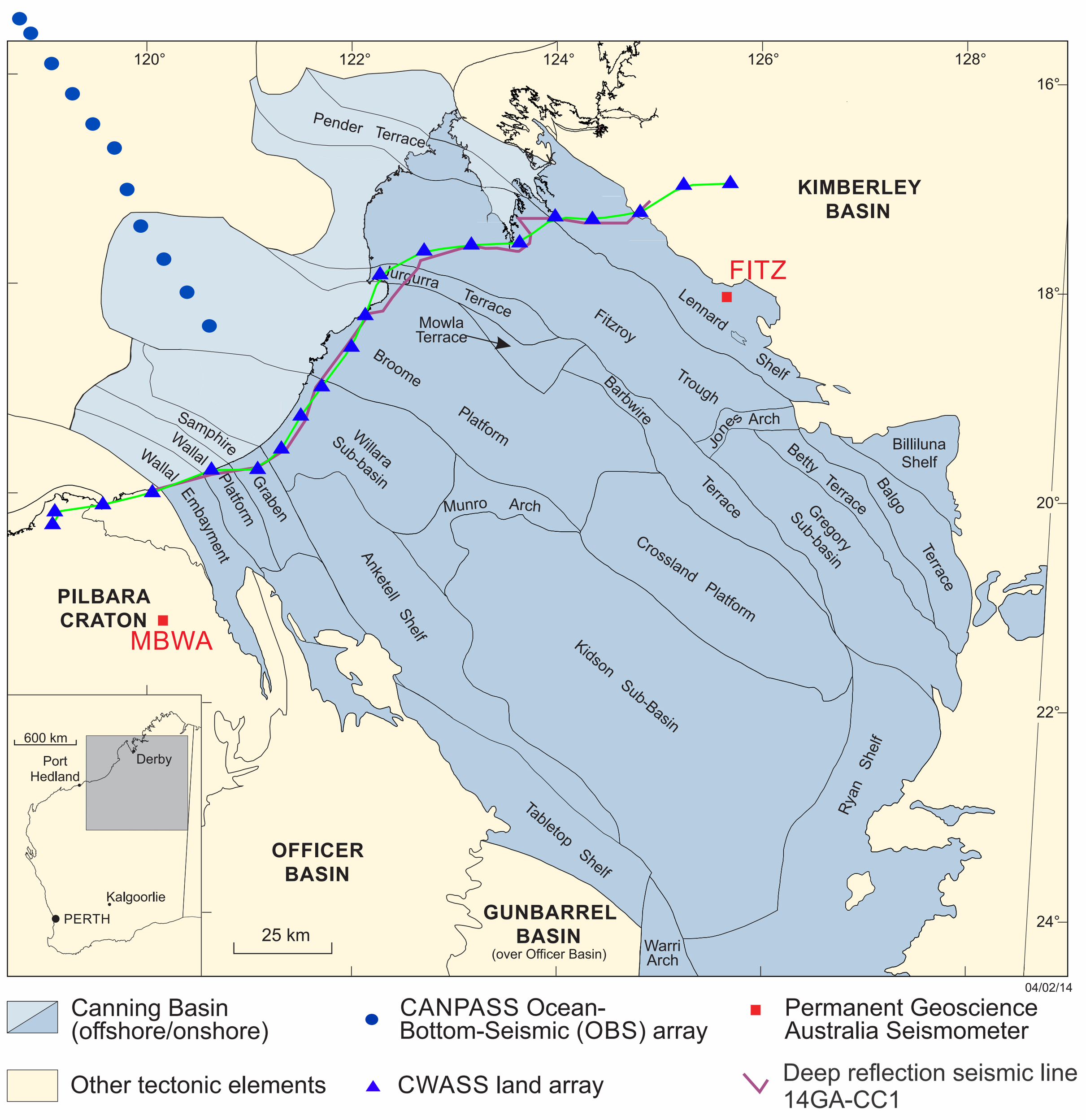


The Canning Basin covers the area between the Proterozoic Kimberley Basin, King Leopold Orogen and Halls Creek Orogen of the Northern Australian Craton and the Pilbara Craton of the Western Australian Craton. The suture between these two cratons is interpreted to underlie somewhere under the Canning Basin.

Although a recent seismic reflection line 14GA-CC, shot in collaboration with Geoscience Australia, and many commercial seismic lines have imaged individual sub-basins well, the deeper structure including the Moho were poorly imaged. This project aims to look at the deep structure of the basin and look at the history of craton amalgamation and subsequent rifting and basin development.

INTERPRETED MIGRATED SEISMIC SECTION





Twenty Nanometrics Trillium 120 broadband seismometers recording data to Nanometrics Taurus Seismographs have been installed along the Canning Basin Coast and up into the Kimberley. Each station will be recording seismic waves, both earthquakes and seismic noise for two years. A densification of the array will take place in 2018 with additional broadband and long period seismometers.

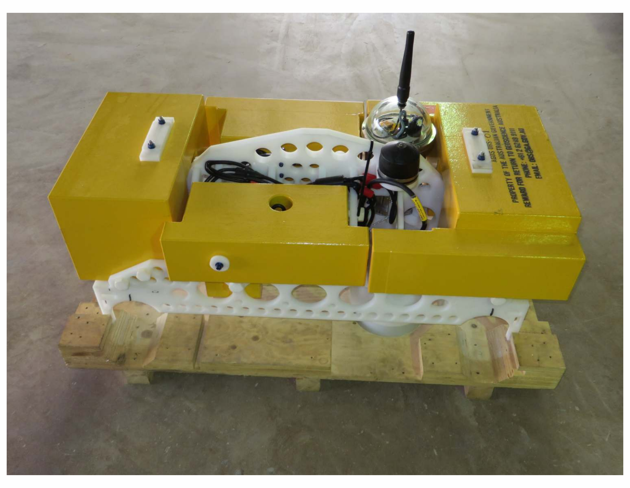
Taurus seismograph

Trillium seismometer

Site installation in progress

Programming the system

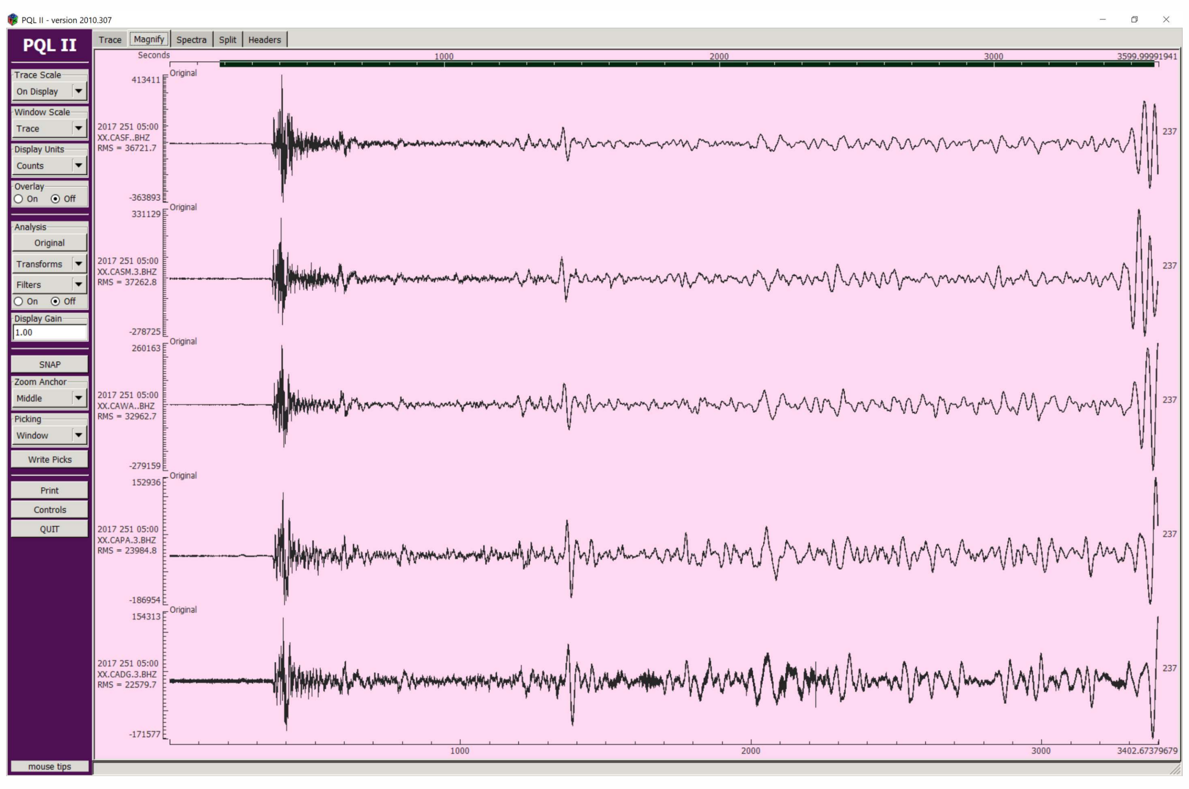
The OBSs on the ship just before deployment



An ocean bottom seismometer

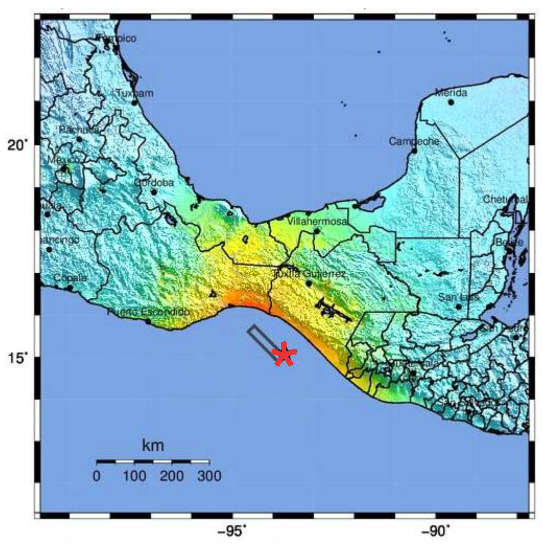
In addition to our onshore deployment and array of eleven ocean bottom seismometers has been deployed off the coast of northern Western Australia for a period of nine months in a collaborative project between ANSIR, Macquarie University and ICG-CAS.
The purpose of this transect is to investigate structures which may be relics of the opening of the Tethys Ocean when Australia split apart from India in the Late Cretaceous

Within the first two weeks of the installation on September 8th 2017 there was an extremely large Magnitide 8.1 earthquake in Mexico. Usually earthquakes from the Americas are in the "shadow zone" for seismometers in Australia. However, this one was so large that the whole Earth resonated like a bell and we received very clear signals on the Canning network.

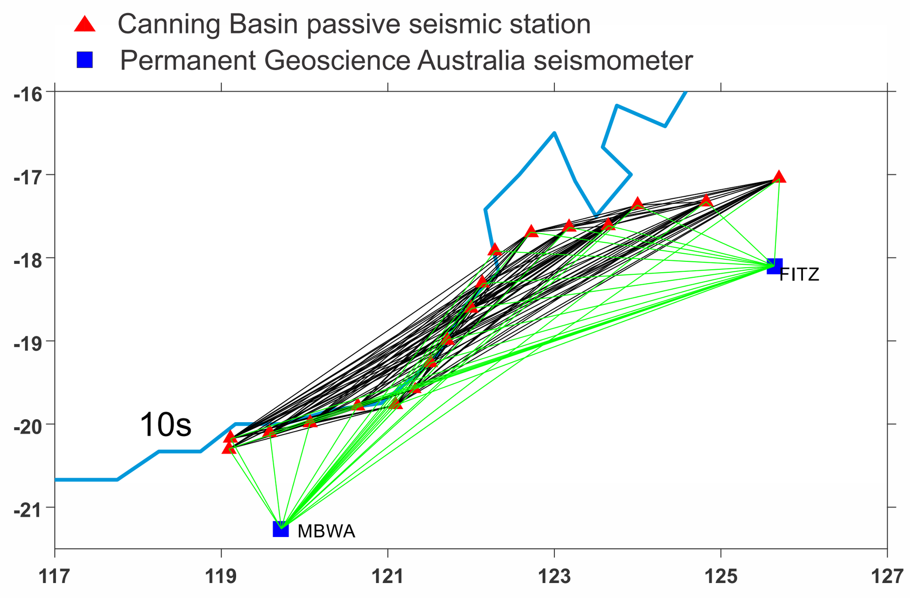


Waveforms from the Mexico M8.1 earthquake as recorded on five of the Canning Basin stations

Modified Mercalli Intensity	Perceived shaking
X	Extreme
IX	Violent
VIII	Severe
VII	Very strong
VI	Strong
V	Moderate
IV	Light
II-III	Weak
I	Not felt



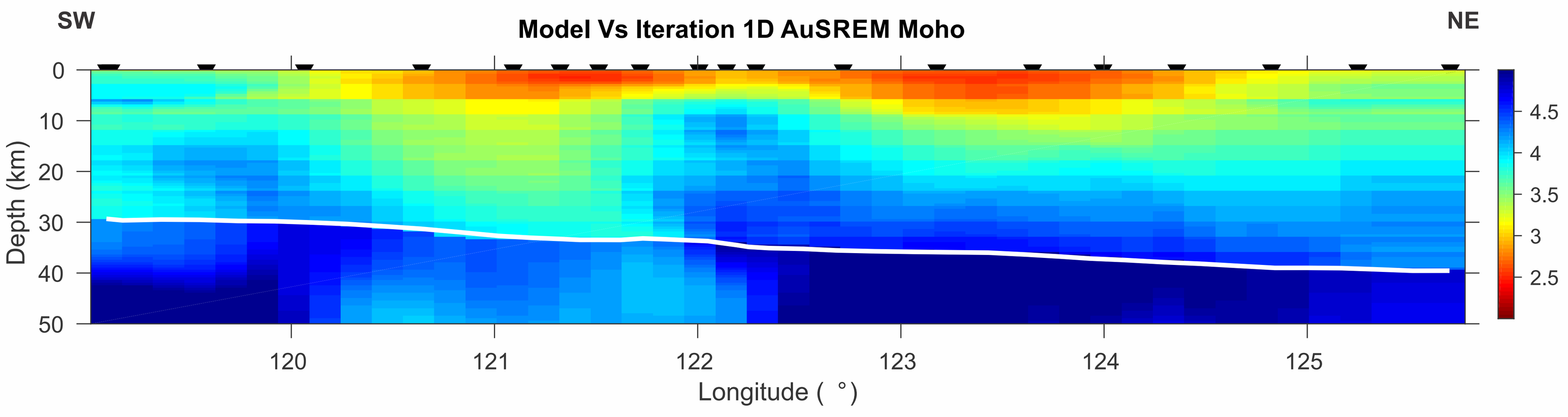
Location of the Mexico M 8.1 earthquake and the estimated shaking intensity



Ambient Noise Processing

We processed the raw vertical channel waveforms recorded by 19 of the 20 stations using ambient noise tomography. Vibrational noise is generated by many things, but a large component is generated by ocean waves crashing onto the land. This noise data is taken from pairs of stations time over the same time period is stacked and magnified to form coherent surface wave signals. The dispersion data i.e. the group and/or phase velocities are measured across each station pair across the network (black lines). All the station pairs are combined to form a tomographic inversion to give a profile of period against distance along the profile and further inverted to give a depth section as below.

The next stage will be to include data from two Geoscience Australia permanent stations,MBWA and FITZ to expand the spatial coverage (green lines).



Even with only 3 months of data, initial results show the King Leopold Orogen with the faster crust (dark blue) in the NE and the thicker crust (pale blue) in the centre of the Canning Basin and possibly edge of the Pilbara Craton in the far SW of the image.

Eventually the data from the ocean bottom seismometers will also be included in a 3D volume model.

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