ONSHORE INVENTORY – TARGETING NEW BASINS (OFFICER, PERTH, CANNING BASINS)

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SUMMARY

Following the 2016 publication of volume 1 of the Onshore Basin Inventory: the McArthur, South Nicholson, Georgina, Wiso, Amadeus, Warburton, Cooper and Galilee basins, central Australia (Carr et al, 2016); Geoscience Australia is continuing to provide a concise inventory of available data and geological knowledge of Australia's onshore basins. Three new basins, the Canning, Officer and Perth basins expand on this work (Hashimoto et al., in press).

Key words: Onshore basin inventory, Canning Basin, Officer Basin, Perth Basin

INTRODUCTION

Following the 2016 publication of volume 1 of the Onshore Basin Inventory: the McArthur, South Nicholson, Georgina, Wiso, Amadeus, Warburton, Cooper and Galilee basins, central Australia (Carr et al, 2016); Geoscience Australia is continuing to provide a concise inventory of available data and current geological knowledge of onshore basins of Australia. Three new basins, the Canning, Officer and Perth basins expand on this work (Hashimoto et al.,in press). These reports provide a comprehensive, whole of basin inventory of the geology, petroleum systems, exploration status and data coverage for these basins. They incorporate information gathered by the precompetitive work programs undertaken by Geoscience Australia and state and territory governments, as well as publically available exploration results and geoscience literature (e.g. Ahmad & Munson, 2013; Gravestock et al., 1998; Jell, 2013). This information, in conjunction with the eight previously released basins (Figure 1), will assist in advising the Australian Commonwealth Government, state and territory governments, exploration industry, and other stakeholders, about the exploration status and potential hydrocarbon prospectivity of onshore Australian basins. Furthermore, this work provides an assessment of issues and unanswered questions, and recommendations for future work.

Unlike the offshore basins reviewed by Totterdell et al. (2014), an official classification scheme ranking the basins is not applied due to the huge variation in geology, data availability, infrastructure, and the varying nature of the unconventional and conventional hydrocarbon plays onshore. Nevertheless, an overall prospectivity statement has been made specific to each basin (Table 1).

METHOD AND RESULTS

These reports provide a comprehensive review of the basins listed including:

Basin summaries

The geology and petroleum knowledge is summarised for each basin. This includes the jurisdictions that the basin falls under, the area of the basin, the approximate sediment thickness, the age of the basin, the spatial context in relation to other basins, the type of basin and its depositional environment, and the regional structure. A brief discussion of the level of knowledge is also given.

Petroleum systems

The petroleum systems of each basin is outlined, with detailed discussion about the source rocks present in the basin, the potential maturity of the source rock, along with possible reservoirs and seals acting in the basin. The different play types are summarised, followed by a list of critical risks that should be addressed when assessing the petroleum potential for the plays within the basin.

Unconventional hydrocarbons

Production from unconventional hydrocarbon prospects has begun in Australia; hence it is increasingly important to understand the unconventional resources of prospective basins. The unconventional hydrocarbon prospectivity is unique to each basin, being dependent on depositional history and source rock type. Where the basin has shale gas, coal seam gas and/or tight gas potential, the target plays are discussed.
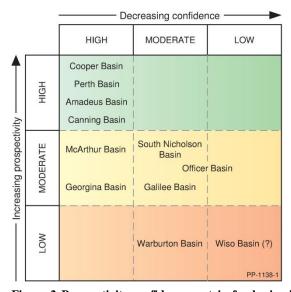
Exploration status

A summary of the exploration history is given which explains the significant wells drilled in the basin and briefly lists the companies who currently hold acreage within the basin of interest.

Data

The data available for a basin, whether these are well information, seismic data, geophysical data or other scientific studies, are one of the most important resources in assessing the prospectivity of a basin. Here, a summary is provided of all available data for the basin, showing a map of well locations, seismic and geophysical survey locations. The data summary (Carr et al., 2016 and Hashimoto et al., in press) table provides a list of publically available data, an estimate of the quality of that data, and a link to the source of the data, these are usually open file state or territory government databases).

Issues and remaining questions

This section discusses the major issues facing the prospectivity of the basin, for either conventional exploration and/or unconventional exploration. A list of recommendations is given to help reduce uncertainty and contribute to the success of the basin. This often includes acquiring new data to help develop a better understanding of basin architecture and structure, building petroleum systems models to understand the maturity and possible migration pathways for hydrocarbons and conducting studies to assess rock-stress properties for unconventional hydrocarbon extraction. An overall prospectivity statement for each basin and a reason for assigning the low, medium or high prospectivity ranking is provided in Table 1.

Summary of Prospectivity

For the basins assessed for both volumes of Australia's onshore basin inventory (Carr et al., 2016; Hashimoto et al., in press), a range of prospectivities are assigned, as summarised in Table 1. The rankings are qualitative and are based on the level of knowledge and available data for the given basin. Figure 2 provides a visual summary of the relative prospectivity of the basins compared with the confidence that we have of the current knowledge of the basins. The confidence is based on both the amount of data available within the basin and the quality of that data; less data with lower quality will result in low confidence for the prospectivity ranking, whereas a high confidence will indicate the prospectivity rating is more accurate.

From these assessments the Cooper Amadeus, Canning and Perth basins rank with the highest prospectivity and confidence, being a

Figure 2 Prospectivity-confidence matrix for basins in Australia's onshore basin inventory volume 1 and 2 based on the reasoning given in Table 1.

result of the measured success and extensive exploration in these basins. The McArthur, Georgina, South Nicholson, Officer and Galilee basins all ranked with a moderate prospectivity, with a varying amount of confidence due to reduced data quantity and quality. The two basins that are ranked with low prospectivity are the Warburton and Wiso basins, which also have moderate to low confidence rankings due to poor data quantity and quality. These rankings could be improved with more data collection to increase the knowledge of the basin, and by conducting further studies as described in the basin recommendations list.

CONCLUSIONS

The results of this project provide a concise inventory of the available data and geological knowledge of onshore Australian basins. This information will assist in advising the Australian Government, state and territory governments and industry stakeholders about the exploration status and prospectivity of onshore Australian basins and help promote Australia as an economic exploration option. These reports are available for download from the Geoscience Australia website (www.ga.gov.au).

ACKNOWLEDGMENTS

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Basin	Prospectivity ranking	Reasoning
McArthur	Moderate	Given the known source rock and exploration interest, this basin has been rated as moderately prospective for both conventional and unconventional hydrocarbons.
South Nicholson	Moderate	Given the lack of detailed geological data on this basin, yet its possible correlations with the nearby McArthur Basin, it is likely that the basin is moderately prospective for both conventional and unconventional hydrocarbons.
Georgina	Moderate	Given the exploration interest and known source rocks the Georgina Basin has been rated as moderately prospective.
Wiso	?	Given the lack of detailed geological data on this basin it is difficult to provide a comment on the conventional and unconventional hydrocarbon prospectivity.
Amadeus	High	Due to the existing production of hydrocarbons within the basin and known source rocks, this basin has been rated as highly prospective for hydrocarbons.
Warburton	Low	Due to the unknown nature of both the occurrence of any source rocks and the lack of data specifically targeting the Warburton Basin geology, the prospectivity of this basin is considered low.
Cooper	High	Due to the existing production of hydrocarbons within the basin and the well understood source rocks, this basin has been rated as highly prospective for hydrocarbons.
Galilee	Moderate	Parts of the Galilee Basin are poorly understood, resulting in no successful conventional petroleum wells, and due to lack of data, the basin has been rated as moderately prospective. However, there is exploration interest in unconventional hydrocarbons (coal seam gas).
Officer	Moderate	Given some geologic relationship to the producing Amadeus Basin, and evidence for several active petroleum systems, the Officer Basin has been rated as moderately prospective.
Perth	High	Due to the existing production of hydrocarbons within the basin and the well understood source rocks, this basin has been rated

		as highly prospective for hydrocarbons.
Canning	High	Due to the existing production of hydrocarbons within the basin and the well understood source rocks, this basin has been rated as highly prospective for hydrocarbons.

Table 1 Summary of basin prospectivity rankings of Australia's onshore basin inventory (Carr et al., 2016 and Hashimoto et al., in press).
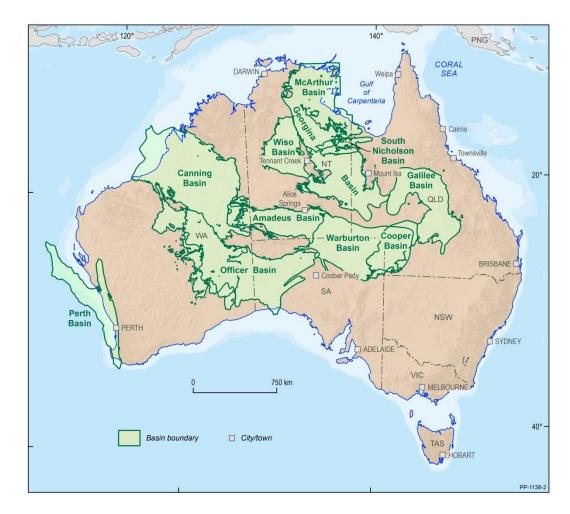

Figure 1 Location map of basins assessed for the Australian onshore basin inventory volume 1 (Carr et al., 2016) and 2 (Hashimoto et al., in press). Basin outlines from Stewart et al. (2013).