

**PS Geomorphology Classification and Architecture Characterization of Braided River Reservoir: A Case Study
From Guantao Upper Formation of Gudong Oil Field, Bohai Bay Basin, China***

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Abstract

Studies on the architecture of braided river reservoirs have been carried out for decades, however some controversies still exist, including the depositional styles and architecture modeling of different braided rivers as well as their impact on reservoir heterogeneity. These difficulties in cognition and practice impede the high-efficient development for middle-late period of mature oil fields. The aim of this article is to define the geomorphology classification of a braided river and applying different types of quantitative prototype models to guide architecture characterization of braided river reservoirs.

In this study, braided rivers are divided into anabranch type and wandering type based on sedimentology and hydrology characteristics. From the perspective of fluvial geomorphology, anabranch braided channels are relatively fixed and present the appearance of alternation of single and multiple channels. While a wandering braided river is not fixed due to rambling flow and its channels migrate frequently with interweaved appearance. The satellite photos of 6 large river systems from around the globe are captured, where 46 samples are selected based on different scales and drainage basins. After calculating and analyzing quantitative relationships and empirical formulas between different architecture elements, two types of quantitative prototype models of braided river are established, whose application to reservoir characterization are demonstrated with examples from Gudong Oil Field, Bohai Bay Basin, China. For anabranch river of Guantao Upper Formation, the average length:width ratio of braid bar is 3.2:1. For wandering river of this formation, the average length:width ratio of braid bar is 2.1:1 and the average width of single channel is 88 m. There are three distribution types of interlayer inside braid bar: (1) the extensive distribution pattern of sheet silting layer, (2) the partly distribution pattern of sheet silting layer, and (3) the disperse distribution pattern of narrow banded cross-bar channel. The results of this study take a step to the establishment of quantitative prototype models for two types of braided river. As a practical effect of this study, the architecture analysis of braided river reservoirs has enabled a number of exploitation adjustments and improved oil recovery schemes to be considered.

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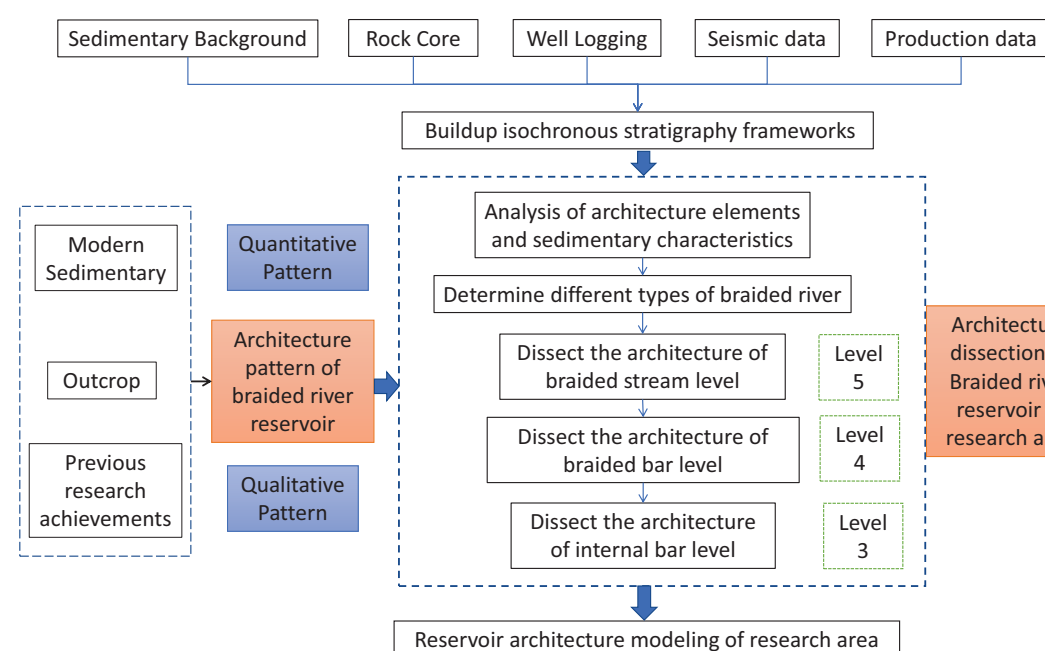
Introduction

Studies on the architecture of braided river reservoir have been carried out for decades. Whereas, some controversies still exist, including the depositional styles and architecture modelling of different braided rivers as well as their impact on reservoir heterogeneity. These difficulties in cognition and practice impede the high-efficient development for middle-late period of mature oilfield. The aim of this paper is to define the geomorphology classification of braided river and applying different types of quantitative prototype model to guide architecture characterization of braided river reservoir.

In this study, braided rivers are divided into **anabranching** type and **wandering** type based on sedimentology and hydrology characteristics. From the perspective of fluvial geomorphology, anabranching braided channels are relatively fixed and present the appearance of alternation of single and multiple channels. While, a wandering braided river is not fixed due to rambling flow and its channels migrate frequently with interweaved appearance. Two types of quantitative prototype models of braided river are established, whose application to reservoir characterization are demonstrated with examples from Gudong Oilfield, Bohai Bay Basin, China.

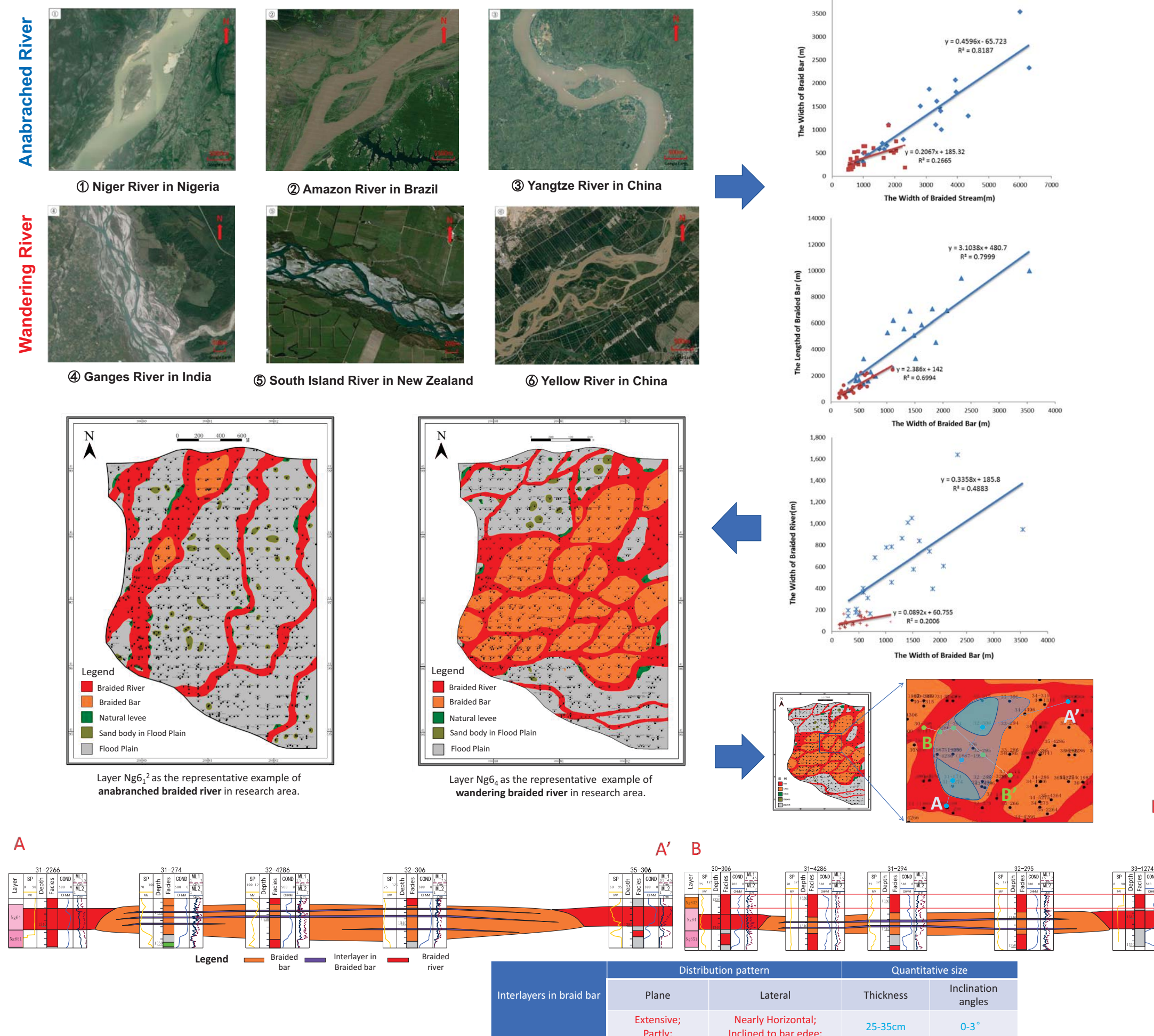
Methods

The methods include the research of prototype models by satellite photos and the integrated analysis which utilizes core data, well logging data, seismic data and production data. Below is the research technical route.



Results

The satellite photos of 6 large river systems from globe are captured, where 46 samples are selected based on different scales and drainage basins. The empirical formulas are obtained to guide the architecture analysis in research area. For anabranching river of Guantao upper formation, the average length-width ratio of braid bar is 3.2:1. For wandering river of this formation, the average length-width ratio of braid bar is 2.1:1 and the average width of single channel is 88m. There are three distribution types of interlayer inside braid bar: the extensive distribution pattern of sheet silting layer, the partly distribution pattern of sheet silting layer and the disperse distribution pattern of narrow banded cross-bar channel.



Conclusions

1. Based on synthetical sedimentary analysis, five architecture elements were determined in the research area, which includes braided river, braid bar, natural levee, flood plain and sand body in food plain.
2. Two classification types in geomorphology of braided river were quantitatively investigated and summarized, which are divided into the anabranching type and the wandering type. Based on the analysis of satellite photos, quantitative patterns of two types of braided river were established.
3. With the guidance of above pattern, the field case was studied to characterize the reservoir architecture of braided river. The average length-width ratios of braid bar of two types river are summarized as well as other paramters of architecture elements.
4. The distribution patterns and quantitative sizes of interlayer in braid bar were concluded from the dissection results of architecture elements in level 3.

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