



Core Analysis and Pulsed Arc Electrohydraulic Discharge (PAED) Stimulation of Coal Seam Interburden

Research team: Fei Ren^{1,2}, Victor Rudolph¹, Huilin Xing², Tom Rufford¹
1 School of Chemical Engineering 2 School of Earth Sciences

Project background and objectives

The coal seam interburden, as a viable methane source, has not yet been well researched or developed compared to that of sandstone, coal or shale.

This project aims to characterise interburden and develop a novel stimulation method to effectively crack this thick but malleable layer. The objectives regarding this project are:

1. Experimentally measure the coal seam interburden properties relevant to gas development
2. Develop pulse arc electrohydraulic discharge (PAED) and employ it to stimulate interburden samples
3. Investigate the mechanisms of interburden breakage.

Properties of coal seam interburden

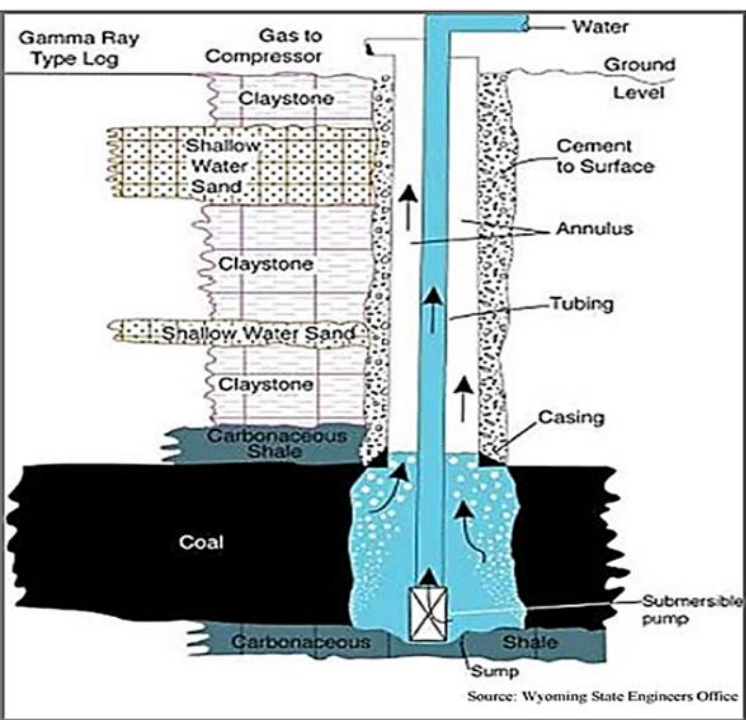
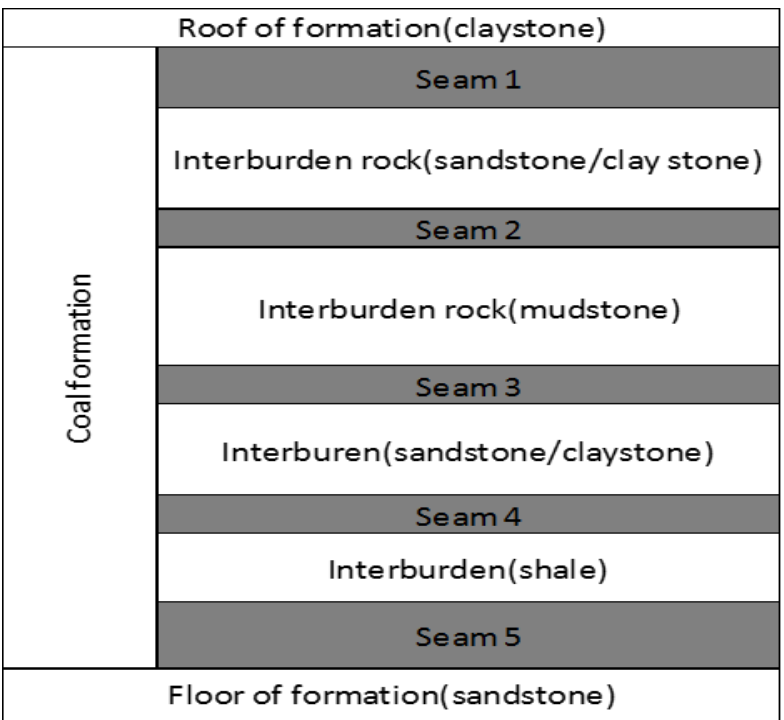
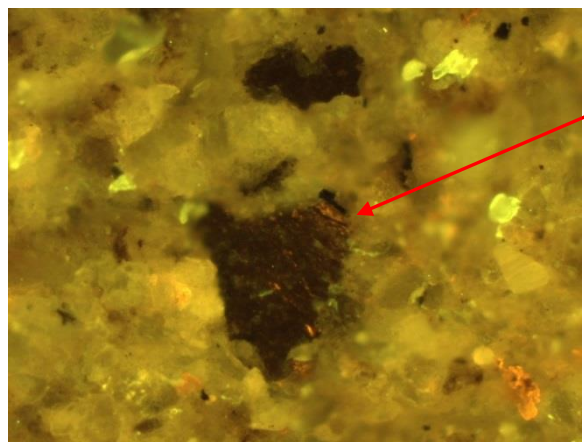


Fig. 1 and 2 A layout of coal formation and Schematic of a coalbed methane well

Interburden is the mixture layer located between the coal measures



Organic matter
Inorganic mineral

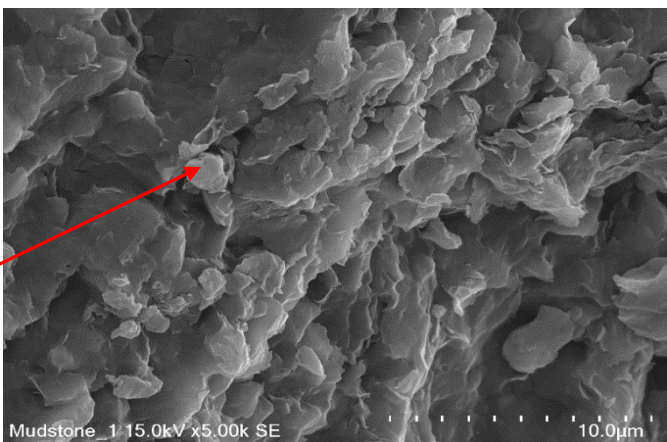


Fig. 3 Microscopy and SEM of interburden sample

1. Surat Basin interburden mainly consists of clay minerals, quartz and organic matter.
2. The percentage of clay, quartz and organic matter in interburden affects the pore volume, mechanical properties and gas adsorption ability, respectively.

Preliminary core analysis

Preliminary tests were carried out with a comprehensive characterisation system using SEM/EDS, XRD, mechanical test, isothermal adsorption, mercury & helium tests, etc. Part of the results are reported as follows:

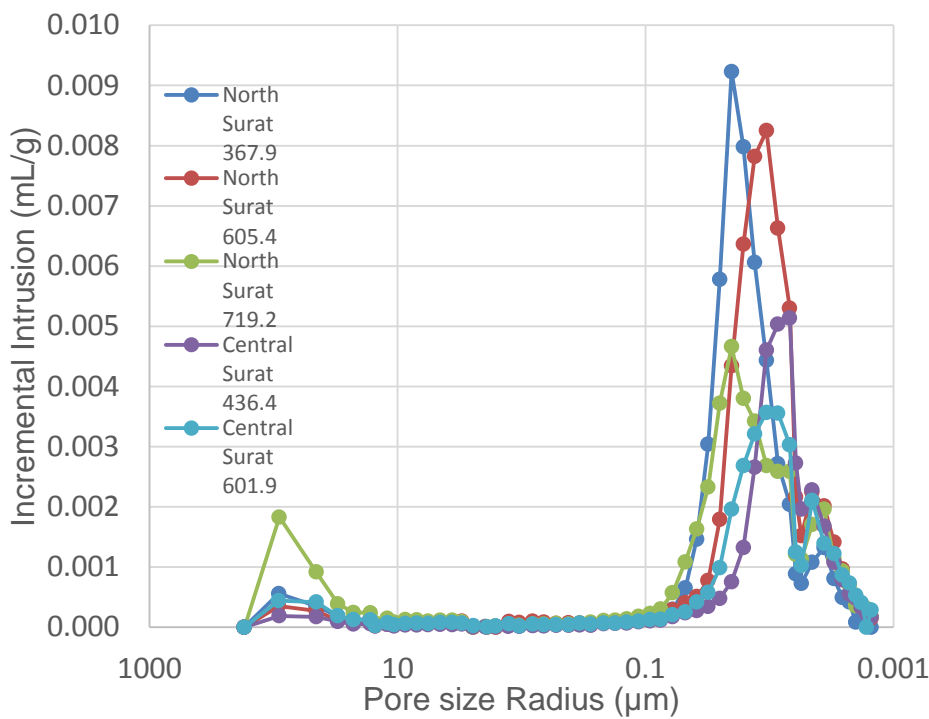


Fig. 4 Pore size VS incremental intrusion

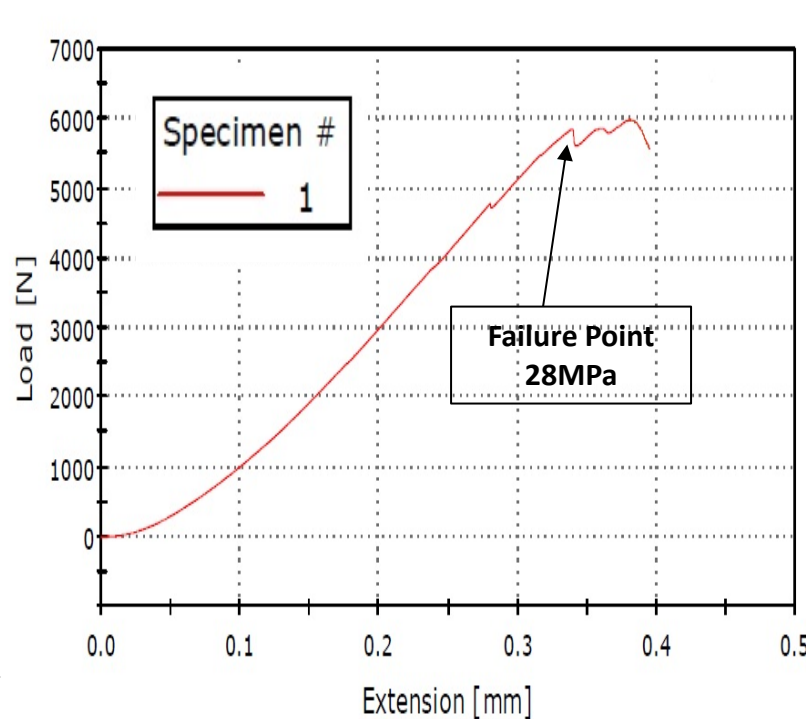


Fig. 5 Compressive strength curve for interburden sample

Fig. 4 shows the interburden has a centralised pore volume distribution and the mesopore is the dominant pore. This is favourable for gas storage and adsorption.

Fig. 5 shows the compressive strength of interburden is around 28 MPa, which will be taken into consideration during PAED design.

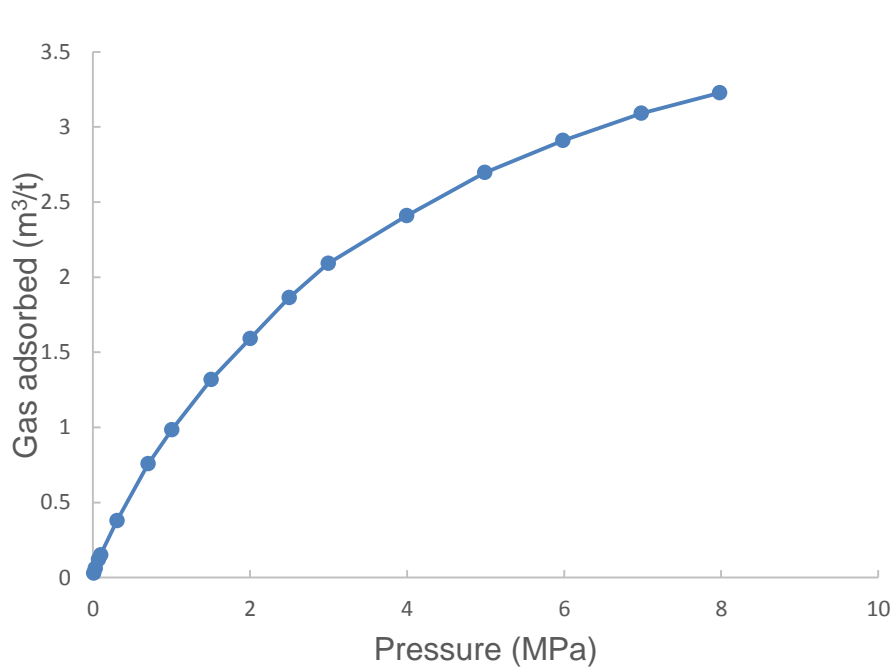


Fig. 6 The isothermal adsorption curve of methane for the sample of North Surat 605.4

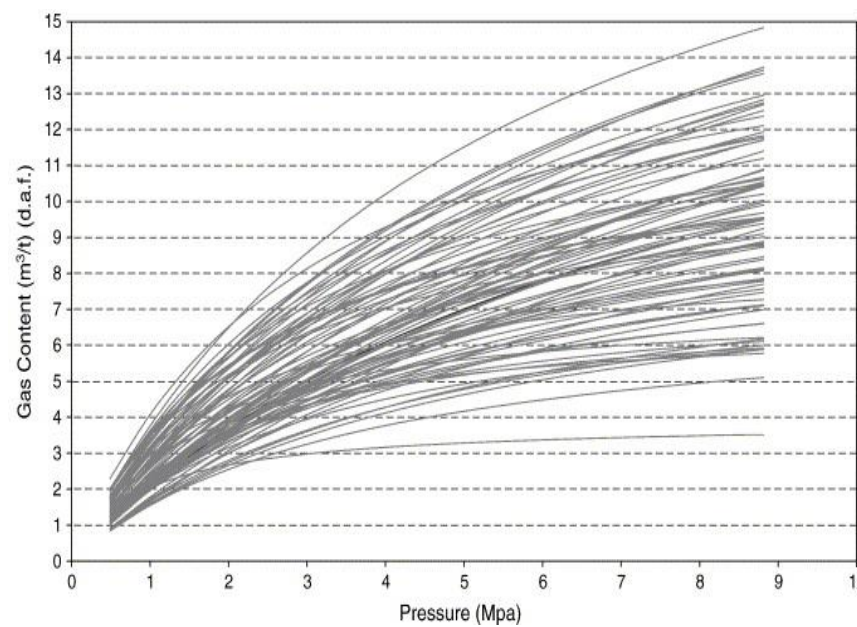


Fig. 7 Desorption isotherm curve of coal reservoir in Surat basin (After Scott S. et al. 2007)

Fig. 6 shows the isothermal adsorption capacity of the tested interburden. Based on comparison with coal samples from the Surat Basin (Fig. 7), the adsorption capacity of the interburden is around 20% that of coal. This indicates interburden has promising potential for gas development as the interburden layer has greater thickness than the coal layer.

Experimental setup to stimulate interburden

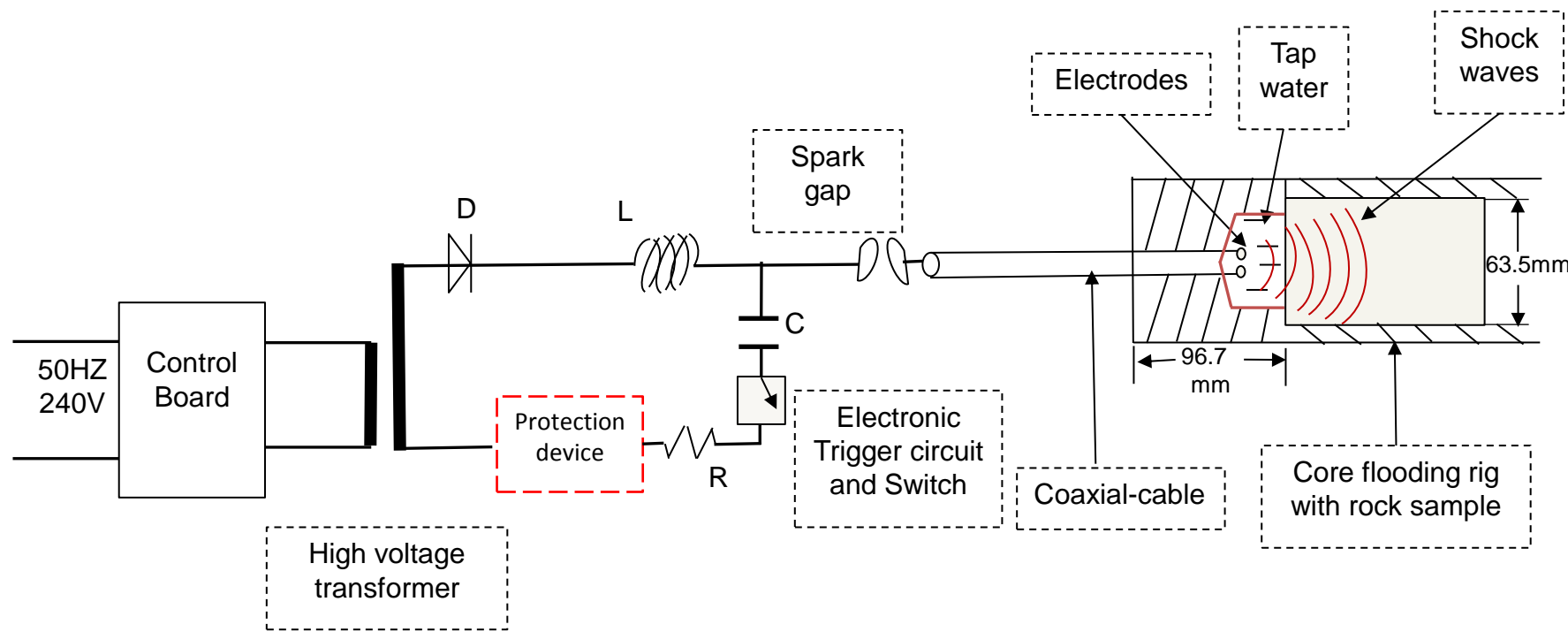


Fig. 8 Schematic of laboratory PAED setup for stimulation

The rationale of PAED stimulation is to convert a proportion of the electricity into mechanical force to crack the interburden.

Expected outcomes

1. Advancement of knowledge regarding coal seam interburden, in particular of the properties related to gas development, to exploit this added gas resource.
2. Development and employment of an innovative stimulation technique, i.e., pulsed arc electrohydraulic discharge (PAED), for interburden stimulation.

Acknowledgement and References

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Rudolph V. et al. 2014. Mudstones as methane sources: stimulation and gas production from coal seam interburden. Project Proposal.

Scott S. et al. 2007. Coal petrology and coal seam gas contents of the Walloon Subgroup — Surat Basin, Queensland, Australia. International Journal of Coal Geology, Volume 70, Issues 1-3, 2007.