



Deposited via The University of Leeds.

White Rose Research Online URL for this paper:

<https://eprints.whiterose.ac.uk/id/eprint/92082/>

Version: Accepted Version

Conference or Workshop Item:

Medici, G, West, LJ, Mountney, NP et al. (2015) Inferred Fluid Flow Behaviour in a fractured Red-bed aquifer: St Bees Sandstone Formation. In: 42nd IAH Congress: AQUA 2015, 13-18 Sep 2015, Rome (Italy).

Reuse

Items deposited in White Rose Research Online are protected by copyright, with all rights reserved unless indicated otherwise. They may be downloaded and/or printed for private study, or other acts as permitted by national copyright laws. The publisher or other rights holders may allow further reproduction and re-use of the full text version. This is indicated by the licence information on the White Rose Research Online record for the item.

Takedown

If you consider content in White Rose Research Online to be in breach of UK law, please notify us by emailing eprints@whiterose.ac.uk including the URL of the record and the reason for the withdrawal request.

Inferred fluid flow behaviour in a red-bed fractured aquifer: St Bees Sandstone Formation, UK

Giacomo Medici¹, L. Jared West¹, Nigel P. Mountney¹, Noelle E. Odling¹, Philippe Ruelland²

1 School of Earth and Environment, University of Leeds, Woodhouse Lane, Leeds, W Yorkshire, LS2 9JT, UK

2 Total France EP, CSTJF, Av. Larribau, Pau, France

Corresponding author: Giacomo Medici, eegm@leeds.ac.uk

KEYWORDS: red-beds, channel sandstones, overbanks, silt drapes, faults, fractures

Understanding fluid-flow behaviour in arenaceous red-bed successions is globally important because such accumulations represent major aquifers for water supplies, geothermal energy and hydrocarbon reservoirs. The St Bees Sandstone Formation comprises Triassic fluvial red-beds and represents a case study to address this issue. This geological formation is part of the Sherwood Sandstone Group, which is the UK's second most important aquifer. The formation is dominated by channelized fluvial architectural elements in which sandstones represent the most permeable lithology based on laboratory analyses (porosity 18 - 22%; K_h 800 - 4000 mD; K_v 150 - 700 mD). Mud-prone fluvial overbank architectural elements occur both at the base of channel belts and as interbedded bodies within channelized elements. Overbank elements are characterized by lower porosity and permeability values (porosity 14% - 18%; K_v 3 - 10 mD; K_h 50 - 400 mD) with respect to channelized elements, and therefore represent a key heterogeneity. Multi-level piezometer data indicate that the aquifer is horizontally layered whereas overbank elements enhance the aquifer's layer-cake behaviour when they are interbedded in channelized elements. Another sedimentary heterogeneity is represented by white, in-channel silty sandstone drapes (porosity from 8% - 10%; permeability values of a few milliDarcies). Although matrix conduits facilitate fluid flow, tectonic features, which have been characterised through scanline surveys, also potentially represent significant fluid pathways. Vertical joints form strata-bound systems which terminate at bedding surfaces; bedding-parallel fractures establish communication between sub-vertical joints in adjacent units. Additionally, normal faults have extended damage zones with high fracturing density and high connectivity. The work conducted, that will be completed analysing pumping tests, has revealed how the St Bees Sandstone Formation potentially represents a heterogeneous dual-permeability aquifer.