

Interactive comment on “Morphology of the pore space in claystones – evidence from BIB/FIB ion beam sectioning and cryo-SEM observations” by G. Desbois et al.

G. Desbois et al.

Received and published: 14 May 2009

ANSWERS TO THE ANONYMOUS REFEREE 1

In the text: "The methods and assumptions used in this study are clearly outlined, although, it would be useful to include some more details on the operating conditions used for ion sectioning and electron imaging."

Answer: The operating conditions (WD, EHT, mag., detector) used for electron imaging are included in each figure. As mentioned in the manuscript, operating conditions used for FIB ion sectioning is the same used in Desbois et al. (2008). The operating conditions used for BIB ion sectioning are not presented in our manuscript.

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They are the following: we used a stand-alone argon beam machine (cross-section polisher JEOL SM-09010) to produce high quality polished cross-sections of about 2 mm². We used 6 kV voltage, achieving currents of about 150-200 nA. The polished cross-sections were then coated with carbon, suitable for SEM imaging and EDX chemical analysis. We will include this information in the revised manuscript.

In the specific comments:

1. Abstract. The authors claim that their findings call for re-interpretation of traditional pore size distributions calculated from mercury injection experiments. In the discussion, it is shown that the SEM measured porosity can be described by a fractal dimension but not comparison is made with distributions from mercury injection experiments. The only comparison between SEM data is for the porosity. A comparison with pore distributions from mercury injection should be included or the abstract should be re-worded.

Answer 1: We will re-word slightly the end of the abstract

2. Different terms are used for the ion beam sectioning in different parts of the paper (ion beam sectioning, ion beam excavation, ion beam cutting). It would be better to use one term to describe the removal of material by ion sputtering.

Answer 2: All of these terms are used to describe the removal of material by ion sputtering. In the final revised manuscript, we will use only one term: ion beam cross-sectioning

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3. In section 3.1; on line 15 the word melting should be replaced by sublimes.

Answer 3: It is right. We will change it in the revised manuscript.

4. Section 3.2: how was the organic material, left in the pore space after sublimation, identified?

Answer 4: The organic material was identified using EDX chemical analysis, which show a high content of carbon.

5. Section 3.3; line 10. It would be useful to indicate on the image, locations where the connection of pore throats to neighboring pores can be seen.

Answer 5: We think that the figure is enough demonstrative. The segmented pictures in Fig. 5b show clearly that the biggest pore throats surrounding the quartz grain are interconnected. Other indications could load down the figure.

6. Section 3.4; is the volume studied in detail representative of the clast content of the clay?

Answer 6: Yes. All studied samples show apparently the same clast content as presented in figure 3 and 4.

7. Section 4.1: in this section the authors note on line 2 that plunge freezing vitrifies the pore fluids. Yet on line 11 they state that the vitrification of our samples is not fully validated. These statements appear to be contradictory.

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Answer 7: Without evidence of phase segregation (particularly the formation of ice-crystals which could damage the microstructures by increasing the volume of frozen-fluids), which could indicate that the cooling-rate was not fast enough to vitrify the fluids, authors assumed that the fluids were vitrified (please check also in Desbois et al., 2008). The vitrification can be definitely demonstrated using cryo-TEM to check if frozen-fluids are amorphous. Thus, we will re-word slightly the section 4.1 taking account into this comment.

8. Section 4.2; line 16, it is noted that the SEM-measured porosity (20.4

Answer 8: It was a typing error. We will re-word slightly this paragraph for the revised manuscript.

Interactive comment on eEarth Discuss., 4, 1, 2009.

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