

A Method for Automatic Shale Porosity Quantification Using New Advanced Edge Threshold Technique

Shansi Tian (1), Leon Brown (2), Fang Zeng (1), Haitao Xue (1), Shuangfang Lu (1), Valentina Erastova (3), and Chris Greenwell (4)

(1) China University of Petroleum (East China), School of geoscience, Qingdao, China (heavenfanger@icloud.com), (2) G. J Russell Electron Microscopy Facility, Department of Physics, Durham University, Durham, DH13LE, United Kingdom, (3) Department of Chemistry, Durham University, Durham, DH13LE, United Kingdom, (4) Department of Earth Science, Durham University, Durham, DH1 3LE, United Kingdom

Scanning Electron Microscopy is one of the most prevalent methods used to image and quantify the pore size distribution of shale rock, critical in understanding unconventional petroleum production. Generally, digital greyscale SEM images of shale are currently processed either by a manual drawing method, manual threshold method, automatic threshold method, edge detection or watershed methods, all of which have some limitations that will impact the quality of obtained image pore extraction results. A new, Edge-Threshold Automatic Processing (ETAP) method is reported here to enable robust extraction and quantification of pore data in shale images. Image pre-treatment makes the greyscale of regions brighter than that of kerogen set to the peak value of kerogen greyscale. The pore image is subsequently obtained using an edge detection method. Then, a discriminant function has been designed to determine the best threshold of the greyscale image to obtain the pore image. Finally, combination of both processed pore images gives the final pore image. Our new method overcomes the impact of kerogen, mineral, roughness and artificial debris caused by pre-treatment of samples, which potentially introduce errors in the processing of pore image extraction using alternative methods. We compare our new method to a systematic manual drawing method. The processing results through ETAP provide reliable results.