Supplementary Material

Appendix A. Morphometric methods

Three methods to map pockmarks were tested, two semi-automated and one manual to check the validity of the two previous. The Fill method (Gafeira et al., 2012) involves pockmark extraction based on a succession of Geographical Information System (GIS) operations focused on the numerical filling of depressions and then the subtraction of filled bathymetry. The second method called the BPI (Bathymetric Position Index, Wright et al., 2012) is based on the calculation of differential bathymetry cells side by side and seafloor roughness analysis. Both semi-automated methods map a large number of depressions which are not pockmarks. Around 500 times more features than manually mapped pockmarks were detected with the Fill method and 300 times more with the BPI method. For both semi-automated methods, the detected features were filtered with correction based on the pockmark surface and the surface/perimeter ratio. Features with small ratio are more likely to be an artefact (Gafeira et al., 2012). The number of remaining features is 10 and 20 times higher than the number of manually mapped pockmarks, with Fill and BPI methods respectively and most likely corresponds to spurious pockmarks and artefacts which have not been filtered. Therefore, in order to minimize the biases observed with semi-automatic methods, all pockmarks were manually delimitated.

Pockmark internal depths were calculated in two ways, using the Fill method developed in Gafeira et al. (2012) and by calculating the difference between the maximum and minimum bathymetric values over the delimitated pockmark surface. The calculation of pockmark internal depth based on the method by Gafeira et al. (2012) leads to strongly minimize the internal depth of the studied pockmarks with results showing that most of the pockmarks (82%) have an internal depth < 1 m and 8% have an internal depth of 0 m. Instead, the method based on the difference between maximum and minimum bathymetry provides realistic values. It is clear from our results that the Fill method is not able to calculate the effective infilling of the studied pockmarks, most likely because of their irregular morphology (e.g., collapsed flank) and regional slope of 3°. Thus, this method suits uniform areas with well-shaped pockmarks (Gafeira et al., 2012; Geldof et al., 2014) but does not fit with complex morphologies with slopes. In the latter case, it is more appropriate to calculate the internal depth by subtracting the maximum bathymetry over the entire pockmark from the minimum one.

Both semi-automatic methods and manual picking show advantages and drawbacks. Semi-automatic methods are based on a succession of quick numerical calculations, but most of these latter have to be manually checked to limit the number of artefacts. 5433 features were detected as depressions with the “Fill” method (Gafeira et al., 2012) and 10437 with the BPI method (Wright et al., 2012) whereas the manual picking only gives 606 pockmarks. The elimination of a large amount of artefacts is time-consuming, hence defeating one of the main advantages of semi-automatic methods. Although manual picking is considered time-consuming, it is much more appropriate in the case of complex seafloor morphologies due to the human capability to focus on features of interest. Indeed, along the Aquitaine slope, there is the superimposition of different scale morphologies such as slope, canyons and sediment waves that prevent the semi-automated detection process from being accurate. Thus, semi-automatic methods should be used in relatively flat bathymetry areas to obtain successful results, e.g., at continental shelves (Gafeira et al., 2012), bays (Andrews et al., 2010) and in basins (Geldof et al., 2014). For large extents and huge densities but of similar features, the automatic methods are clearly efficient (Andrew et al., 2010; Gafeira et al., 2012; Geldof et al., 2014). Semi-automatic methods to map pockmarks are not appropriate in the study area because of the complex bathymetry inherited from several orders of morphologies, the slope angle and the presence of features such as canyons and sediment waves. Pockmark morphometry was therefore based on manual mapping.

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Geldof, J., Gafeira, J., Contet, J., Marquet, S., 2014. GIS Analysis Of Pockmarks From 3D Seismic Exploration Surveys, in: Offshore Technology Conference. Houston USA, OTC 25088.

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Appendix B.

Figure including scatter plots of pockmark surface versus bathymetry with internal depth as point colour, for both a) inter-canyon and b) sediment wave areas with regression lines and determination coefficients (R^2).

Appendix C.

Figure exhibiting bottom current velocity, a) east-west (U_E) and b) north-south (U_N) components, recorded with ASPEX mooring 10 (see location in Fig. 2). Current velocities are integrated between 17 m and 33 m above the seafloor. Recorded velocity and orientation of currents are shown in blue and red curves for raw and tide-filtered data, respectively.