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A 3D study of the effect of pollution in fish scales using PIXE, SEM and BS

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In Mozambique, various industries were established on the periphery of natural resources, especially on the banks of the Matola River, the main river in the country. The river has been polluted over the past years and there is therefore the need for pollution control. Pollution events that occurred previously are at times difficult to detect, and hence to quantify, because of the continuous flow of the river. However, changes in the chemical composition of the freshwater are incorporated into the matrix of fish scales as growth occurs [1]. Hence, the previous pollution events can be identified by the analysis of fish scales. A surface analysis (2D study) of fish scales has been done before [2]. In that study it was found that the various growth patterns were inhomogeneous. The question now arises whether the growth in the third dimension is homogeneous or heterogeneous. This was established by using Particle-Induced X-ray Emission (PIXE) [3], for elements of atomic number, z , for $12 \leq z \leq 40$, Scanning Electron Microscopy (SEM) for carbon, oxygen and nitrogen, and Backscattering (BS) to discern any layer formation. [1] S.M. Tang et al., Nucl. Inst. Met. Phys. Res. B, 130, 396-401 (1997). [2] Guambe et. al. (2012), NIMB, vol. 273, pp. 171-172. [3] Ryan et. al. (1995) NIMB, vol. 104, pp. 157-165.