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# Recipe Book for Larger Benthic Foraminifera X-ray Investigation: a Process Approach

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During the past years X-ray microtomography (microCT) has become an essential tool in imaging procedures in micropaleontology. Apart from highest standards in accuracy, well conducted microCT scans aim to resolve the whole specimen in constant quality and free from any artifacts or visual interferences. Normally, to get used to X-ray techniques and get usable results, countless attempts are needed, resulting in enormous waste of time. This work tries to provide an insight into how best exploitable results can be obtained from the scanning process concerning Larger Benthic Foraminifera (LBF).
As each specimen features different characteristics regarding substantial composition, density and conservation status, it is impossible and probably erroneous to give standardized guidelines even within this systematic group. Depending on the attributes of the specimen and on the desired visualization, several details have to be taken into account.
Samples preparation: to get sharp images the X-ray has to cross the specimen along its shortest diameter, for LBF the equatorial view is almost always the best positioning (not for alveolinids!). The container itself has to be chosen wisely as well; it must not affect a flawless penetration of the specimen by the X-ray and has to provide a high degree of stability. Small plastic pipettes are perfect to store the specimen (or specimens) and some cardboard may help in keeping the position. The nature and quality of the paste used to fixate the object and its container are essential in ensuring a smooth rotation of the specimen which is inevitable for the consistent quality of the image and to avoid vibrations.
Scan parameters: beside the correct choice of dedicated filters (which are always different depending on the working station), settings for kv, $\mu$A and resolution might have to be revised for each new object to deliver optimal results. Standard values for hyaline forms with empty chambers are normally around 80 Kv and 100 uA, always checking if the X-ray will penetrate also the specimen in axial view during rotation. Normally, a rotation step between 0.15 and 0.20 degrees and an average shooting of 20 pictures per step are enough to get high qualitative imaging, despite of 6 to 7 hours scanning.
Reconstruction parameters: scan shoots alignment, beam hardening correction and ring artifacts reductions are steps which are due on each scan. Furthermore, defining the Region of Interest (ROI) as the smallest possible reduces the file size up to 70% without affecting the quality of the scan. Such size reductions shorten the time to reconstruct, the amount of needed resources to run the process and speed up future segmentations and rendering processes.
Reslicing process: further size reduction can be accomplished in LBF scans. LBF tests are normally large flat discs therefore an opportune resclice along the equatorial view reduces significantly the amount of data. For alveolinids and fusulinids axial reslices are the most convenient.