



Smart-Geology for the World's largest fossil oyster reef

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The geo-edutainment park “Fossilienwelt Weinviertel” at Stetten in Lower Austria exposes the world's largest fossil oyster biostrome. In the past decade, significant progress has been made in 3D digitizing sensor technology. To cope with the high amount of data, processing methods have been automated to a high degree. Consequently, we formulated the hypothesis that appropriate application of state-of-the-art 3D digitizing, data processing, and visualization technologies allows for a significant automation in paleontological prospection, making an evaluation of huge areas commercially feasible in both time and costs. We call the necessary processing steps “Smart Geology”, being characterized by automation and large volumes of data. The Smart Geology project (FWF P 25883-N29) investigates three topics, 3D digitizing, automated geological and paleontological analysis and interpretation and finally investigating the applicability of smart devices for on-site accessibility of project data in order to support the two scientific hypotheses concerning the emerging process of the shell bed, i.e. was it formed by a tsunami or a major storm, and does it preserve pre- and post-event features.

This contribution concentrates on the innovative and sophisticated 3D documentation and visualization processes being applied to virtualise approximately 15.000 fossil oysters at the approximately 25 by 17 m accessible shell bed. We decided to use a Terrestrial Laserscanner (TLS) for the determination of the geometrical 3D structures. The TLS achieves about 2 mm single point measurement accuracy. The scanning campaign provides a “raw” point cloud of approximately 1 bio. points at the respective area. Due to the scanning configuration used, the occurrence of occluded areas is minimized hence the full 3D structure of this unique site can be modelled. In addition, approximately 300 photos were taken with a nominal resolution of 0.6 mm per pixel. Sophisticated artificial lighting (close to studio conditions) is used in order to minimize the occurrence of shadows.

The resulting datasets can be characterized as follows: A virtual 3D representation with a nominal resolution of 1 mm, a local accuracy of 1 mm (after noise minimization), a global accuracy of < 3 mm with respect to a network of reference points and integrated colour information with a resolution of 0.6 mm per pixel. In order to support both interactive and automated geological and palaeontological research questions of the entire site in an economically feasible manner, various data reduction and representation methods were evaluated. Within this contribution we will present and discuss results of 2D image representations, 3D documentation models, and combinations, i.e. textured models. Effects of data reduction (i.e. to make them more convenient for the analysis of large areas) and data acquisition configuration (e.g. the necessity for high-resolution data acquisition) as well as the applicability of the data for advanced visualization purposes (e.g. 3D real-time rendering; foundation for augmented-reality based applications) will be discussed.