Geological Proxies with Scrum: A Practical Approach for the Taubaté Basin

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ABSTRACT

The utilization of Digital Elevation Models (DEMs) holds significant importance within geosciences, offering support across various applications ranging from research to educational pursuits. This particular study addresses the existing dearth of standardized protocols for creating geological proxies through 3D printing, specifically focusing on the Santos Basin as a case study. The primary aim of this research is to formulate a reproducible framework for developing rock proxies, with the implementation of the Scrum methodology to delineate the project iteratively. By adopting a Minimum Viable Product (MVP) approach, the model is subjected to validation and iterative improvement through multiple sprints, thereby ensuring the continual integration of feedback. The amalgamation of data derived from topographic and subsurface sources facilitates the creation of a 3D proxy model that effectively encapsulates surface and geological structures. Preliminary findings suggest that the agile methodology enhances process efficiency and fosters greater control over project timelines. This holds promise for potential applications within other geoscientific domains, including paleontology and seismic analysis. The conclusion drawn underscores that the employment of Scrum offers a flexible and replicable protocol for multidisciplinary geological modeling projects.
Key-words: (insert up to five words different from those contained in the title, separated by a semicolon).

Introduction

The Shuttle Radar Topography Mission (SRTM) was a mission to capture a comprehensive digital elevation model covering approximately 80% of the Earth's land surface, spanning latitudes from 60N to 56S (Rabus et al. 2003). The SRTM mission's elevation data has improved Earth's surface mapping and enabled various applications. The usual method for handling this task is to add elevation information, the third dimension, to regulate two-dimensional maps using a separate digital elevation model (DEM). Several datasets providing global or near-global DEM coverage have been released thus far (Yang, 2011). Digital Elevation Models (DEMs) hold intricate data best unlocked through innovative mathematical techniques; the application of DEMs can extend beyond geosciences, encompassing diverse fields such as resource estimation, spatial planning, decision-making, predictive analytics, and beyond, enriching a wide array of studies (Sagar, 2020).

Foreseen advancements in 3D printing are poised to ignite a decentralized industrial shift, potentially generating an annual business impact of up to $550 billion by 2025 (Cohen et al., 2014). We designate 3D models representing rocks or geological formations as 'rock proxies.' Digital Elevation Model data can be converted into rock proxies. 3D printing of morphologies holds significance in geoscience research, particularly in experiments involving rock-breakdown processes (Yang, 2011). The Geosciences Teaching Resources Laboratory (LRDG) at the State University of Campinas (Unicamp) has embraced 3D printing models to enhance geosciences education due to the diverse applications of rock proxies. Rock proxies are a subject of exploration in education, with numerous academic studies in geosciences

focusing on projects involving the creation of reservoir models using seismic and well data, often utilizing 3D printing techniques (DeFilippis et al., 2015).

Despite the recognized potential of 3D printed models in geosciences, the absence of a standardized protocol for creating rock proxies from Digital Elevation Models (DEMs) is a significant challenge. This endeavor's technical and multidisciplinary nature poses challenges in devising models in an agile, effective, and practical manner within a Geosciences laboratory. The agile methodology encompasses processes aligned with the agile philosophy, which embodies agile values and principles (Al-Saqqa, 2020). Agile methodology employs a short-cycled iterative improvement model and incremental delivery mechanism, enabling rapid deliveries and increased efficiency within diverse teams (Jain, 2018). The Agile Planning Lifecycle encompasses several stages, including Pre-planning, Planning, Release Planning, Iteration Planning, and Management of the Product Backlog, integrating methodologies such as Scrum, Extreme Programming, Kanban, and Lean (Waja, 2021). Scrum is a project management approach that uses an iterative and incremental framework based on "inspect and adapt" principles; the project is delivered in increments known as 'Sprints,' typically lasting 2-4 weeks (Sutherland, 2009).

The integration of terrain elevation data with subsurface data offers substantial potential for the development of a significant rock proxy, contributing substantially to geoscientific research.

Considering the significance of generating rock proxy models in geosciences, there arises a necessity to formulate a protocol for project development, facilitating professionals in the field to effectively create these models, notwithstanding the requirement for intricate technical procedures associated with 3D printing. Scrum is a framework comprising a set of tools that enable individuals to address intricate problems while delivering innovative products of the utmost value (Schwaber, 2013). Schwaber (2013) states that Scrum theory is founded on managing empirical processes, employing an iterative and incremental methodology to enhance predictability and control risks.

A Minimum Viable Product (MVP) is an experimental version of a product used to empirically test value hypotheses (Münch, 2013). The main objective of an MVP is to build it with minimal effort and development time (Ries, 2011). The MVP project can effectively address the challenges of involving multiple disciplines in creating a highly detailed rock proxy for educational purposes. The Project Owner is responsible for ensuring the fulfillment of the project's business case and the attainment of expected benefits and holds the primary stakeholder position (Bovens, 2007). Project feedback is regarded as a metric for customer satisfaction and is one of the key factors contributing to project success (Maloney 2002). Scrum is an iterative and incremental project management approach that offers a

straightforward 'inspect and adapt' framework. The feedback provided by the Product Owner on the MVP can validate the backlog, ensuring alignment for the final product's production.

The current research endeavors to amalgamate requirements and methodologies to devise a simplified and replicable protocol for producing rock proxies for geosciences and sedimentary basin studies. The main objective of this study is to establish a developmental framework for rock proxies, employing agile and Scrum methodology. These methodologies are specifically tailored to create corresponding 3D models for sedimentary basins. The final results are based on discussing the MVP and the validated model efficiency aligned with the project's general goals.