

AI-Assisted Digitalization of Stratigraphic Logs for Geological Mapping: A Case Study of the CARG Sheet 263 - Prato (Italy)

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The management and integration of legacy geognostic archives into structured digital databases represent a major challenge in modern geological mapping. Traditional OCR-based approaches have proven insufficient for extracting structured information from borehole logs due to their complex graphical layouts and mixed symbolic content (Rapid Method for Information Extraction from Borehole Logs, 2020). More advanced AI-based pipelines have therefore been proposed, combining text recognition with higher-level semantic interpretation (Sanchez-Pinedo et al., 2024). This study presents the methodology and results of the systematic digitization of stratigraphic logs for the CARG Sheet 263 (Prato), based on an AI-assisted multimodal interpretation approach. The workflow was developed from a heterogeneous dataset of scanned PDFs lacking a native text layer and integrates geological-stratigraphic expertise with vision-language techniques to enable both the metric reconstruction of stratigraphic intervals and the semantic normalization of lithological descriptions. Recent developments in Large Multimodal Models (LMMs) have demonstrated strong capabilities in extracting structured information from unstructured geological data (Ghorbanfekr et al., 2024) and in automating complex geoscientific digitization tasks (DIGMAPPER, 2025). A comparative analysis was conducted between a Local AI Workflow based on OCR (Tesseract, Poppler) and an Online AI Workflow leveraging LMMs. Results indicate that vision-language reasoning significantly improves the consistency of vertical metric reconstruction. The methodology was applied to over 1,300 boreholes, achieving an average processing time of approximately 5 minutes per file, corresponding to a time reduction exceeding 70% compared to manual digitization. Reliability analysis shows a lithological classification accuracy between 95% and 98%, with an average vertical reconstruction error of approximately 0.10-0.15 cm. These results highlight the effectiveness of AI-assisted approaches in translating visual information into structured geological data, although a comprehensive evaluation of total error, including geological interpretation uncertainty, remains subject to further validation.

Sanchez-Pinedo G et al. (2024) - AI-based digitization of geotechnical ground data: Integrating OCR and semantic interpretation. Scipedia.

Ghorbanfekr M. et al. (2024) - Classification of geological borehole descriptions using a domain adapted large language model. Applied Computing and Geosciences, 25, 100229, <https://arxiv.org/abs/2407.10991>.

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