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Methods and Tools for Digital Data Collection and Construction of 3-D Geological Computer Models in the Field; Examples from the Tanqua Karoo Turbidites, South Africa

With the advent of easy to use high-resolution differential GPS systems, digital geological field mapping has become a reality. Data may be collected accurately and efficiently and be imported into reservoir modelling software while in the field. Differential Global Positioning System (DGPS) surveying allows the structure and geometry of a study area to be mapped accurately at a resolution of a few cm., capturing sedimentological and structural data at multiple scales. Digital photogrammetry allows the collection of 3D geometric data from stereo photograph pairs or strips, and is also applicable at a variety of scales. Software has been developed which allows the integration of DGPS data with the detailed sedimentological logs of the field geologist, and export of data to modelling software with the minimum loss of information. These mapping techniques have been applied to a Permian turbidite fan complex in the Tanqua Karoo Basin, South Africa. The study area comprises five turbidite fans, deformed by sub seismic-scale thrusting. Fan architectures and faults have been mapped at a regional scale using DGPS surveying. Over 300 sedimentological logs have been measured and processed using in-house software allowing analysis of grain size variations, facies distributions and paleocurrent information. Successful DGPS mapping has provided the framework for multi-scale 3-D model construction of the submarine fan architectures. More detailed surveys have addressed turbidite channel geometries, channel fill characteristics, and sheet sand architecture through a combination of DGPS mapping and digital photogrammetry to obtain geometric and statistical data to aid construction of 3-D reservoir models.