



# Low-Height Aerial and Low-Cost Photogrammetric Recording: a Reliable Method for Preventive Archaeology

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# Low-height and low-cost photogrammetric recording

## a reliable method for preventive archaeology



Preventive excavations and evaluations are documented with conventional techniques by topographic surveys, manual drawings and photographs. But when the amount and complexity of structures <sup>1</sup> makes it difficult for a classic recording, then a photogrammetric survey is performed. The objective is to record and document the excavation as quickly as possible.

An aerial photogrammetric survey is able to complete or replace a topographic survey and classical drawing operations (stone by stone). Unfortunately, using an unmanned aerial vehicle (UAV) is often unthinkable for security issues, <sup>2</sup> administrative permissions <sup>3</sup> and cost. This is why a pole is used to perform detailed vertical recordings of excavation sites.

The pole <sup>4A</sup> is initially designed for sound recording. It is equipped with a three axes head <sup>4B</sup> permitting to correctly adjust the vertical position of the camera. It has the advantage of being handy and light, allowing the activation of a remote triggering system while holding the pole in position. <sup>5</sup>

The technique of photogrammetric survey has seen in recent years some significant progress. It is now possible to calculate three-dimensional models almost fully automatically from digital images. Preventive archaeology often requires exhaustive recording of huge datasets in a limited period. Digital photogrammetry enables to record complex elements in a simple and costless way. The originality of the implemented solution resides in the use of a free and open-source software (FOSS) and in the use of a low-cost hardware for photographic acquisition.

The National Institute of Geographic and Forest Information (IGN) has developed a software package dedicated to photogrammetry. This FOSS is designed to scientific use and can generate three-dimensional models similar to those obtained by commercial softwares. The software package is well documented and has an active community of developers and users.

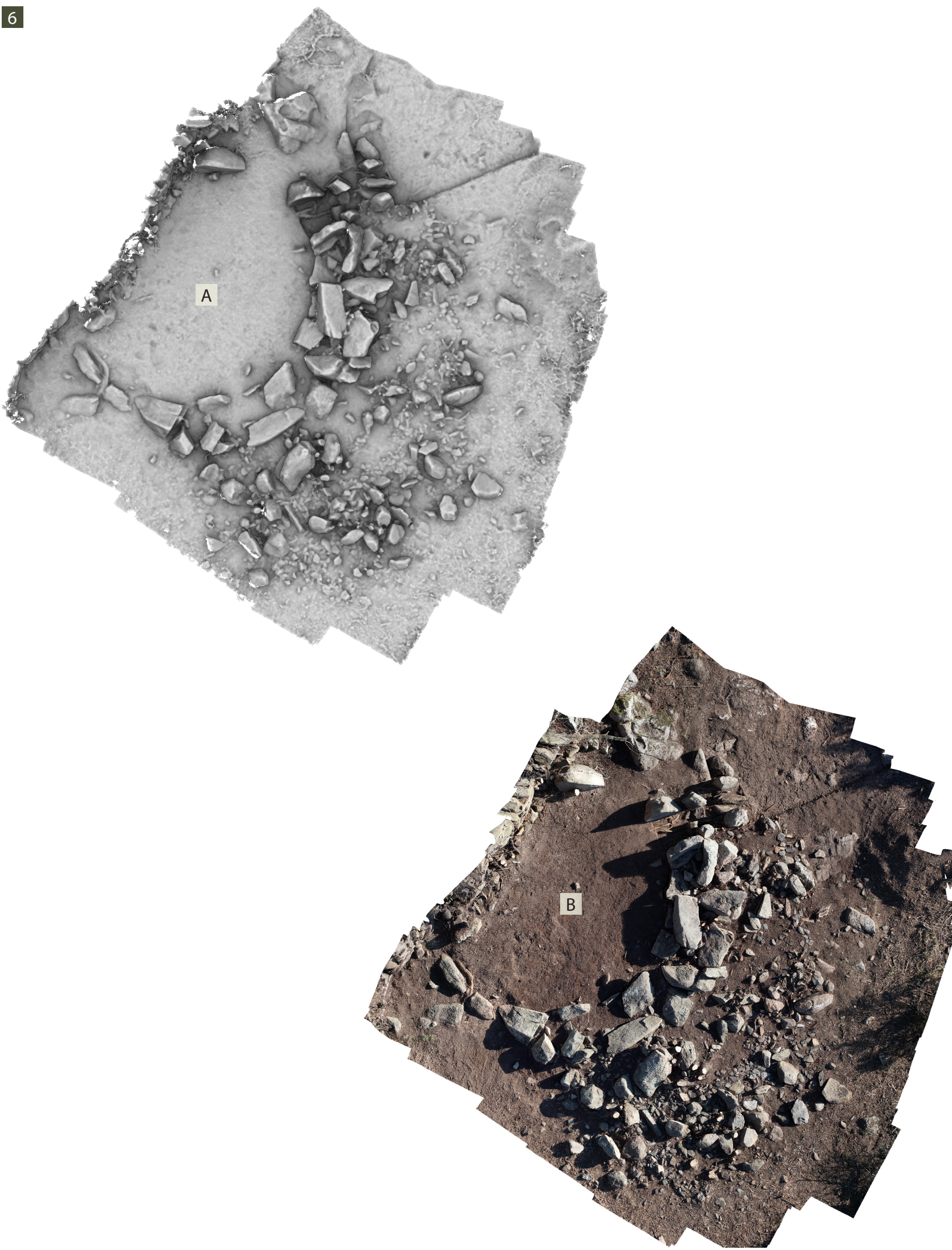
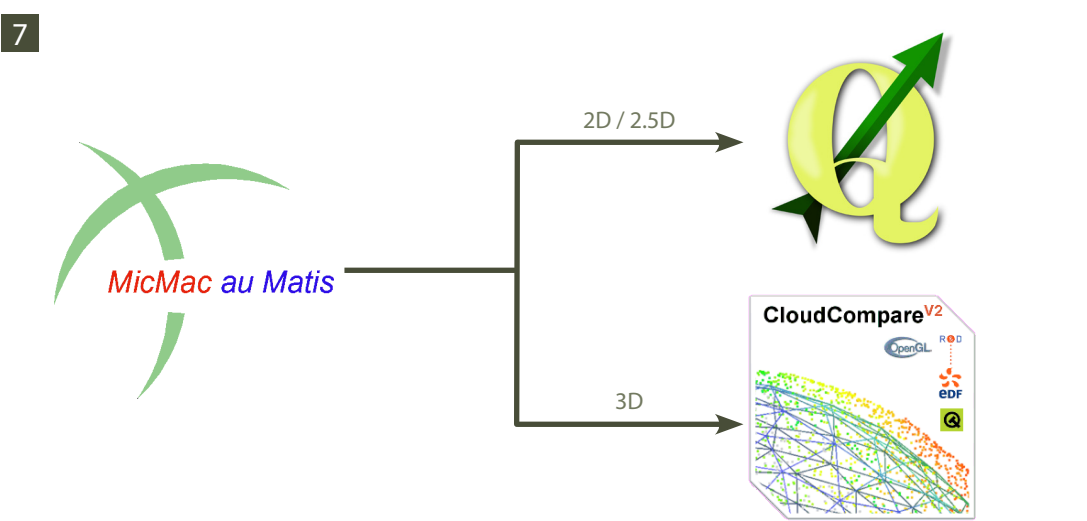
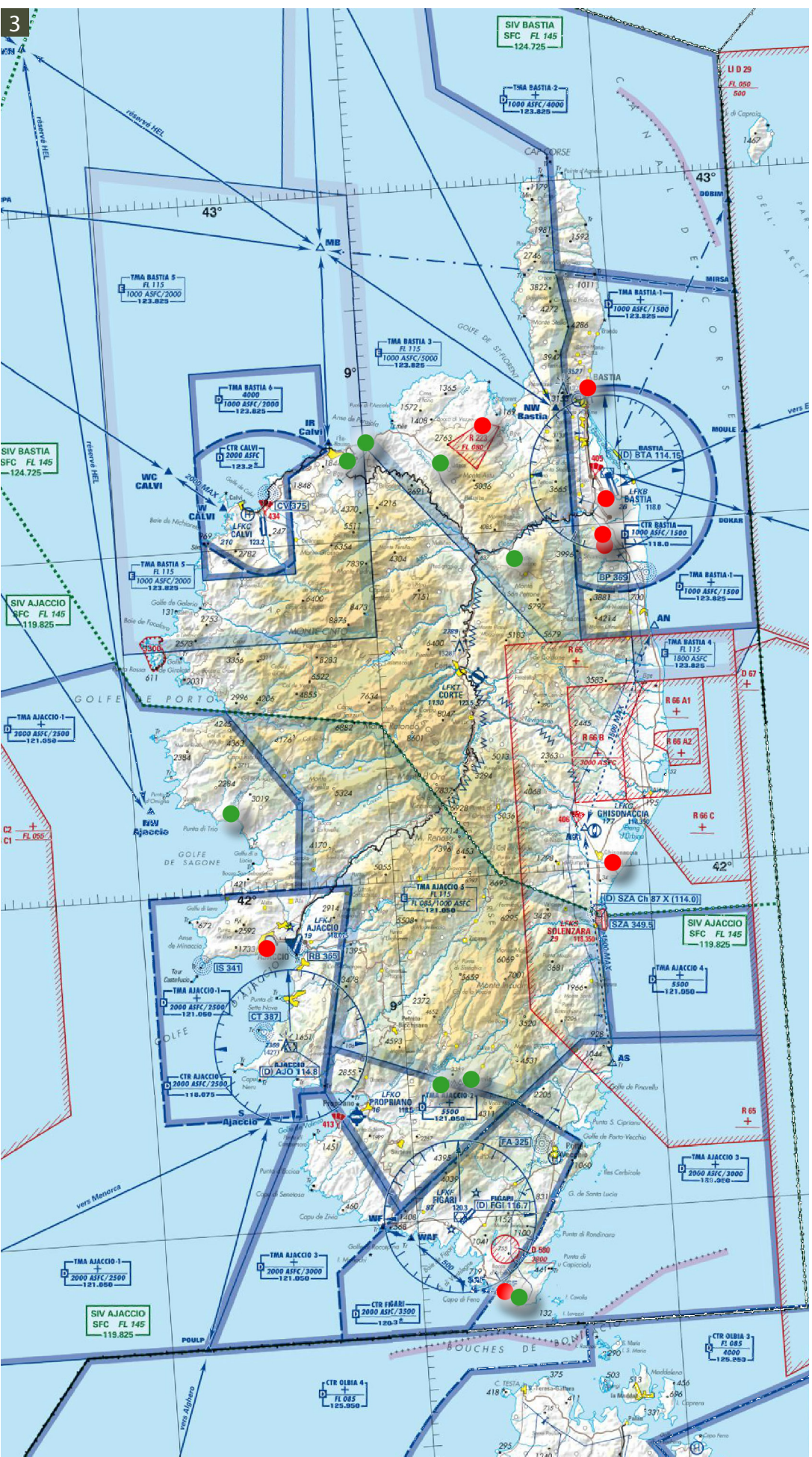
Generated point clouds <sup>6A</sup> can then be exploited by archaeologists with CloudCompare. It is a FOSS for processing point clouds with a great toolbox. Its main interest resides in its ability to process large point clouds.

Orthophotographs <sup>6B</sup> are georeferenced and come with a digital terrain model (DTM) which enables direct measurement of the altitude of the elements through a geographic information system (GIS) interface. The GIS software used at Inrap is the free and open-source software QGIS. Orthophotographs are directly integrated into the GIS, in addition to traditional surveying and vectorized manual drawings.

This methodology of acquisition and processing is now commonly used at Inrap and more particularly in Corsica. Indeed preventives excavations, in this offshore region, involve some logistical problems. Ultimately, this methodology tends to be used in other regions, when the use of an UAV is not possible.



- 1 Field evaluation for solar powerplant project  
A megalithe and many traces of human occupation were discovered. Stone by stone was not an option, due to time constraint and state of preservation.  
Santo-Pietro-di-Tenda (Haute Corse).  
© L. Vidal, Inrap
- 2 Security issues  
Archaeological excavation near Suale power plant and under high-tension line.  
Lucciana (Haute Corse).  
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- 3 Administrative permissions and 2015's archaeological sites  
ICAO-VFR map with airspace information, special conservation area and special use airspace. Red dots indicate archaeological sites where administrations permission would have been required.  
© IGN, M. Seguin, Inrap
- 4 Hardware  
A - Telescopic pole (950 g),  
B - Three axes pan and tilt head (570 g).  
Rode® "Manfrotto"
- 5 Photogrammetric survey  
© L. Vidal, Inrap
- 6 Deliverable  
A - Point cloud (PCV and EDL processing with CloudCompare),  
B - Orthophotograph.  
© M. Seguin, Inrap
- 7 Workflow



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