# THE GEOMETRIC DATA COLLECTION WITH 3D LASER SCANNER IN EXCAVATED ARCHITECTURE: EXAMPLE OF CAVE HOUSE IN THE PROVINCE OF ALMERIA.

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An abundance of recent research have been performed in the study of the indoor behavior on cave houses, especially in Cuevas del Almanzora (Almería), but also in different areas of Spain. Not only can be found some studies of cave houses in other areas of Almeria (Terque, Gador), but also in the high plateau of Granada (Guadix, Huescar, Galera), Alicante (Crevillente) and Valencia (Paterna), Albacete (Chinchilla de Montearagón, Alcalá del Jucar), Murcia (Puerto Lumbreras, Águilas), Toledo (Villacañas), Madrid (Tielmes, Titulcia, Perales and Morata de Tajuña), Guadalajara (Hita, Almogera); even in areas of Aragon (Calatayud) and Navarra (Agreda, Valtierra). Especially in the Canary Islands (Barranco de Guayadeque) are the one that have invested in giving concrete solutions to the legalization of different types of cave houses as housing.

Most of these areas correspond to the sedimentary Spain, easily excavated material, where unfortunately (or fortunately), were the only way out of many families to live.

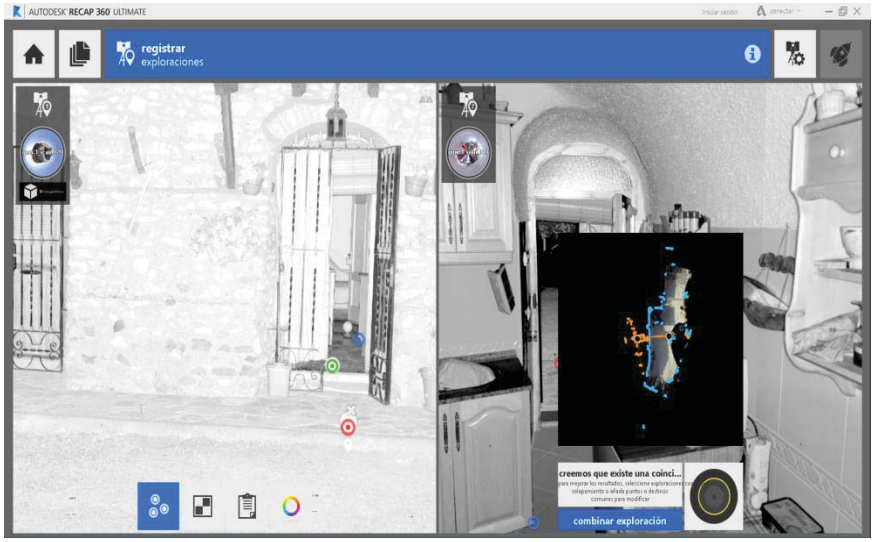
Not only this kind of constructive solution or *vernacular architecture* exists in Spain, but also in many places in the Mediterranean, such as Greece (Santorini), Tunisia (Matmata) or Turkey (Goreme valley). Furthermore, we may find other places in the Asian Continent as China (Loes) or Nepal (the caves of the cliffs in Mustang).

Many of them proceeded from medieval times, although different typologies of cave houses from Neolithic have been found excavated horizontally, even in inaccessible areas. As a result, underground cave houses have been discovered as the example of the silos of Villacañas. In brief, *it is a rich historical heritage that deserves to be preserved.*

The difficulty of data collection, ones due to being in inaccessible areas while others the need to obtain 3D models[1] for the study of the behavior, has made it required to use new technologies in the data collection, such as the use of data 3D laser scanner.


With the technique of three-dimensional digitalization, it can be obtained a 3D model of point cloud [2]. Later, with an appropriate educational software [3], we may get linear 3D models (models in BIM), necessary to simulate their behavior, such as quality of air (ventilation). Although mainly these are used to demonstrate that the necessary habitability requirements have been achieved in any type of housing and to compare them with the on-site data collection, it can be useful for other applications and studies too.

The purpose of this study is to verify the obtained results with 3D laser scanner [4] in a case of study located in the town of Cuevas de Almanzora (Almeria), both outside and inside, in order to obtain a linear model in 3D. To this effect, we have analyzed the results and we have considered possible difficulties in the use of this data collection technology.




## REFERENCES

[1] [1] González Muñoz, Manuel J. et al. Uso de sistemas basados en escáner 3D para digitalización y estudio del patrimonio arqueológico. Virtual Archaeology Review, [S.l.], v. 1, n. 1, p. 99-102, apr. 2010. ISSN 1989-9947. Available at: <https://polipapers.upv.es/index.php/var/article/view/5128>. Date accessed: 31 jan. 2019. doi.org/10.4995/var.2010.5128

[2] [2] Ismael García-Gómez, Miren Fdez. De Gorostiza López de Viñaspre y Amaia Mesanza Moraza. Láser escáner y nubes de puntos. Un horizonte aplicado al análisis arqueológico de edificios. Arqueología de la Arquitectura nº 8, enero-diciembre 2011 Madrid/Vitoria. ISSN: 1695-2731. doi 10.3989/arqarqt.2011.10019

[3] [3] Antonio Ruiz, Juan; Garcés, Simón; Gambús Saiz, Mercè; Mas, Catalina; Perales, Francisco; Ponseti, Xisco. (2012). La capacidad prospectiva y de visualización del escáner láser 3D aplicado al plan de conservación preventiva del conjunto cerámico, piedra y hierro de Antoni Gaudí y Josep María Jujol en la catedral gótica de Mallorca. Virtual Archaeology Review. 3. Número 5. ISSN: 1989-9947. 77. 10.4995/var.2012.4528.

[4] [4] Marambío, A y García, P.(2006): “Escáner laser: modelo 3D y ortimagenes arquitectónicas de la iglesia de Santa Maria del Mar en Barcelona”, ACE: architecture, city and evironment, nº2, pp. 178-187.