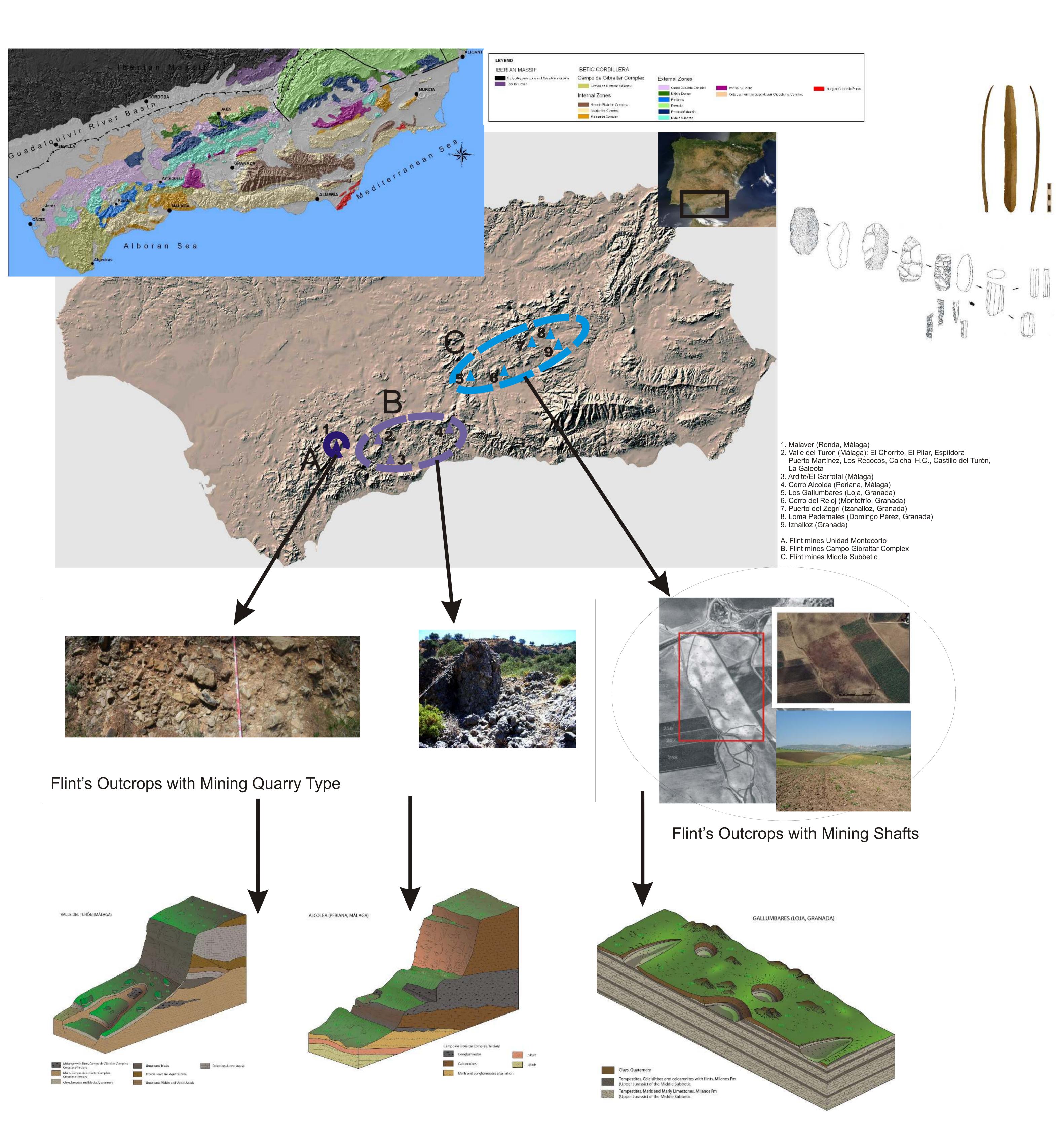
Geological Factors of Flint Mining in the Betic Cordillera (Spain, IV-III mill. BC.) The Case of Large Blades Production

Antonio MORGADO and José Antonio LOZANO Departamento de Prehistoria y Arqueología, Universidad de Granada, Spain



A variety of outcrops of silicified detrital sedimentary rocks are located throughout the Betic Cordillera (Southern Spain). These resources were used by human groups in the Late Neolithic and Copper Ages for the purposes of manufacturing large flint blades (Morgado *et al.* 2008). The extractive and manufacturing activities in flint outcrops and lithic workshops have left a number of archaeological pieces in this area. However, no systematic archaeological excavation has ever been conducted. Neolithic mining in Southern Spain has been approached solely through archaeological survey.

The diversity of geological structures in which flint outcrops are found in Southern Spain prompted several approaches to flint exploitation. This study presents a preliminary classification of exploitation techniques based on the fifteen flint mining sites linked to blade production located by our team.

The Betic Cordillera is composed of three major geological units: External Zones, Internal Zones and Campo de Gibraltar Complex. The External Zones are made of Mesozoic and Cenozoic sedimentary materials that settled toward the South of the continental margin of the Iberian plate. On the other hand, allochthonous flysch sediments of the Campo de Gibraltar Complex laid toward the west between the External and Internal zones during the Tertiary Age. The External Zones (Middle Subbetic) and the Campo de Gibraltar Complex have several flint mining sites that were used for specialized blade production. The geological features of flint-rich areas determined how readily raw materials could be found, therefore affecting the mining technique of choice. Specifically, the differential tectosedimentary features in the Middle Subbetic area and the Campo de Gibraltar Complex required different mining systems. These systems are summarized below.

A. Malaver mining site (External Zones, Western Betic). Flint nodules originated in a shore area or shallow platform in the Early Jurassic Age (Liassic stage). Oolits are found frequently. The exploitation of large flint cores was favored by the eroding processes active in the inclined slopes of these mountains. Mining involved the extraction of large flint nodules from quaternary piedmont deposits and from rocky canyons through stone quarry works.

B. Campo de Gibraltar Complex sites. The area is composed of Cenozoic sedimentary materials deposited over the ancient oceanic crust (sites: Cerro Alcolea, Ardite/El Garrotal and Valle del Turón -La Galeota, Castillo de Turón, Espíldora, Cachal H. Carnero, Chorrito, Reconcos, El Pilar-). Flint was obtained from conglomerates (most of them melange rocks) resulting from the erosion and collapse of Frontal Units in the Internal Zones. Therefore, mining techniques were restricted to stone quarries and trenches, as no continuous layers of flint were available.

C. Middle Subbetic sites (External Zones, Central Betic). Mining sites took the flint from the Milanos Formation (sites: Gallumbares, Puerto del Zegri, Cerro del Reloj, Iznalloz and Loma de los Pedernales). The Milanos Formation (Molina and Vera 1996; Vera and Molina 1998) presents layers of limestone and marl originated on a pelagic platform during the Late Jurassic period (Malm: Kimmeridgian-Tithonic). The strata preservation and the abundant flint nodules and flint-rich layers available in the Milanos Formation made it easy for human communities to exploit them through shafts and galleries.

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