CHAPTER 5
GEOLOGICAL CONTEXT AND PROCUREMENT ZONES

This chapter describes the geological context or Upper Pleistocene natural landscape in which prehistoric human groups found themselves, and in which they had to search for shelter and raw material resources. The relevant details of the geological composition of Belgium, in reference to prehistoric human needs, are summarized, primarily based on Aubouin, Brousse and Lehman (1978). The second section defines and discusses the procurement zones as conditioned by the uneven distribution of flint in this region. Appendix 1 contains a descriptive summary of the lithic reference collections while Appendix 2 contains lists and descriptions of raw material types found at each site.

GEOLOGICAL CONTEXT

Two major periods (Carboniferous and Cretaceous) during the geological history of Belgium were responsible for producing rock used prehistorically for shelter and lithic raw material. During subsequent periods, loess and sand covered limestone and Cretaceous flint in many parts of the Brabant and Hesbaye Plateaus, while dissolution processes produced caves in Carboniferous limestone along the northern flanks of the Ardennes.

Due to its geological history, karstic systems in which caves suitable for shelter are found only in certain parts of Belgium. Specifically, they are found along the Meuse and its tributaries. The original limestone deposits were formed during the Lower Carboniferous Period of the Upper Paleozoic Era, and were subsequently exposed to various natural processes which produced caves.

Likewise, flint is not evenly distributed across the landscape. Instead, it is found in an interrupted band of chalk across Middle Belgium, roughly from Mons to Maastricht, with the main flint-rich regions at each end: the Hainaut Basin in the west and the Maastricht Basin in the east (see Fig. 4.1). On the Brabant and Hesbaye Plateaus, flint is available, but is generally less accessible due to Tertiary deposits which covered many or most flint sources.

Primary or Paleozoic Era

Lower Paleozoic

According to Otte (1979:203-205), phtanite was formed during the Cambrian Period of the Lower Paleozoic (~570-500 mya), with a good quality variant being highly localized near Ottignies-Mousty (Caspar 1982, 1984). Phtanite is a homogeneous, isotropic material with no inclusions, and is similar in quality to flint. Poorer variants, which were rarely if ever exploited, are found in upland regions south of the Meuse and Sambre. The good quality variant was used prehistorically, but is never very common at EUP sites. It becomes much more common during the Neolithic when it was used to make polished adzes.

Upper Paleozoic

The karstic system of limestone was formed during the Lower Carboniferous, Dinantian and Viséen stages of the Upper Paleozoic between 340 and 325 mya (Ek 1976).

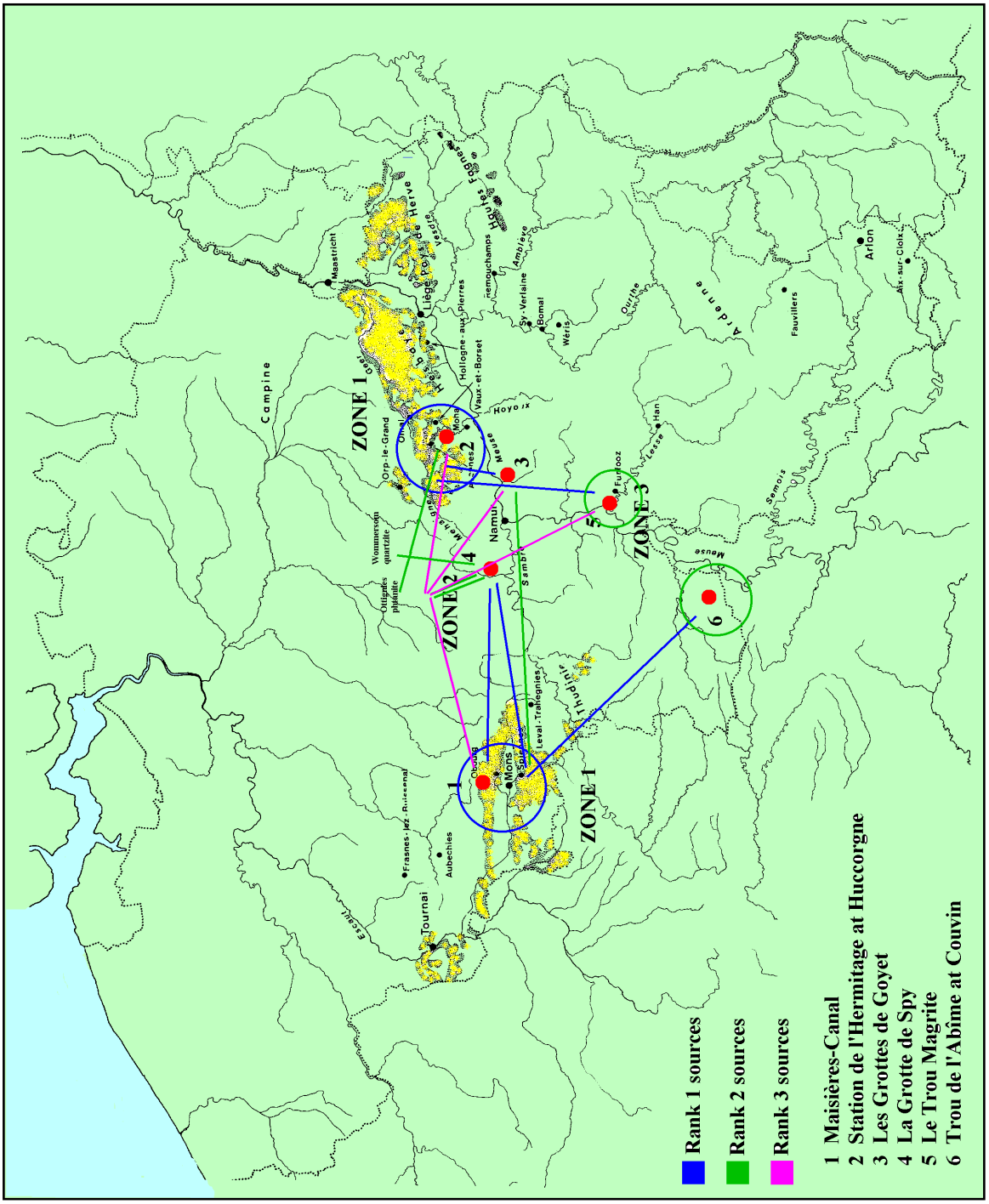

Figure 5.1. Map showing estimated distances to sources for study sites.

Caves forming later within this system include Le Trou Magrite, and were utilized prehistorically for shelter. This Viséen limestone includes the black limestone used at Le Trou Magrite as lithic raw material for toolmaking.

Secondary or Mesozoic Era
Cretaceous

Flint formation occurred during the Senonian stage, Coniacian-Santonian-Campanian-Maestrichtian sub-stages of the Upper Cretaceous ~88-65 mya, during the marine transgression which covered Belgium north of the Meuse. During this stage, thick chalk deposits were laid down on the sea floor, intercalated with layers of flint formed from diatomaceous or siliceous organisms deposited on the sea floor at various times (Aubouin *et al.* 1978).

Flint in Belgium was deposited primarily during the Maestrichtian stage, but also during the Campanian in the western region. According to Otte (1979:203-205), the black Obourg flint is Campanian, while the gray Spiennes flint found nearby is of Maastrichtian age. In the Lower Cretaceous, most of Belgium was exposed, but was covered again by sea during the Upper Cretaceous, when flint formation occurred.

Tertiary or Cenozoic Era

Eocene

At the beginning of the Eocene, Montien stage (Paléogène), the limestone of Mons was deposited, as the so-called Tertiary flint was formed (Aubouin *et al.* 1978). This flint was also used prehistorically, but has a much more localized distribution than the Cretaceous flint.

During the Middle Eocene, Bruxellian stage, Brussels sandstone was formed, ~49-43 mya. This was used prehistorically and has a localized distribution on the Brabant Plateau near Brussels.

DEFINITION OF PROCUREMENT ZONES

The uneven distribution of flint across the landscape of Belgium makes it possible to identify three zones of procurement on the basis of variable access to flint sources at each site. As summarized in Chapter 4, for sites found in Zone 1, flint sources are local, within 5 km of the site, in Zone 2, between 5 and 50 km distant, and in Zone 3, at least 50 km distant (see map, Fig. 5.1).

Zone 1 contains the two main regions of flint in primary geological context: the Bassin de Hainaut in the west (including the Obourg Chalk and Spiennes sources) and the Maastricht region in the east (including various proveniences mined during the Neolithic and flint sources found in modern quarries). It extends south to the Vesdre river valley, with the cave sites of Fond de Fôret and the Grotte Walou, where flint can be found locally. In addition to such primary sources in the Maastricht region, flint can be readily found in secondary context, eroding out of chalk formations and found near the primary source and also redeposited on ancient Meuse river terraces. According to Bosinski *et al.* (1995:834):

> "The Meuse has eroded these nodules from the Cretaceous chalk and reincorporated them in river gravels, where they become rolled and battered. This flint has a worn pebble cortex and is known as Meuse gravel flint. It can be found in the Rhine and Meuse terraces, which are widely distributed along the left (western) bank of the Lower Rhine region.

> During the Tertiary, the Tertiary ocean also eroded the chalk formations of the Meuse region. Meuse flint was redeposited on the beaches of this ocean in a highly rolled and reduced state. These Maaseier ("Meuse eggs") beach pebbles can be found on the remnants of these ancient shores in the Eifel foothills and the Bergisches Land. At a later date many of these Maaseier found their way into the gravels of the Meuse and Rhine."

Geneste (1985:164-167), among others, found it analytically useful to make a distinction between flint sources in primary and secondary position. Sources in primary position are those found *in situ* in the original geological formations (e.g., as veins and nodules in Cretaceous chalks and in limestone). Sources in secondary position are further subdivided into two groups. Sources in secondary position close to the original source (*position sécondaire proche*) are found not more than a few dozen meters from their initial geological position, for example, flint eroding out of chalk formation and found on nearby scree slopes. "Leur cortex est encore intact et crayeux et, dans ce cas, ils ne sont ni roulés, ni altérés, ni brisés, si ce n'est pas par des phénomènes périglaciaires en général d'âge quaternaire[1]" (Geneste 1985:166). Secondary sources in more distant position (*position sécondaire éloignée*) have been commonly transported by water and are found on alluvial terraces and in littoral deposits. "Leur cortex est alors totalement érodé, les formes émoussées et arrondies, ils peuvent être recouverts d'un néocortex ou d'une surface piquetée et étoilée sur les galets[2]" (Geneste 1985:167).

In Zone 1, sources in the Bassin de Hainaut are in primary position and nearby secondary position. Flint could be readily obtained from erosional slopes and eroding surface outcrops; we have no evidence for mining during the Early Upper Paleolithic, although there is an extensive series of Neolithic mines at Spiennes (Hubert 1992, among others). In the Liège-Aachen region (or the Lower Belgian/Upper Dutch Meuse Region), we have a series of sources in primary position, extensively mined during the Neolithic (e.g., Ryckholt mines on the Ryckholt Plateau), as well as in nearby secondary position. Sources in more distant secondary position are found on the Meuse terraces, but these do not appear to have been exploited in Belgian sites during the EUP. In general, as will be seen, flint utilized in the study sites has fresh cortex, indicating procurement most probably in secondary position near primary sources.

The study sites clearly in Zone 1 are Maisières-Canal in the Hainaut Basin, found within 4 km of the Obourg source and within 7 km of the Spiennes source, and Huccorgne, located in the Méhaigne Valley where the Méhaigne river cut through Cretaceous deposits, exposing good quality flint sources. A good dozen cave sites have been found clustered along the Méhaigne river valley (cave sites of Grotte du Docteur, Trou Sandron, Grotte de l'Hermitage, etc.) (Fraipont and Tihon 1889; Tihon 1890-91), as well as the open-air site of Huccorgne.

Zone 2 is the region where the majority of Early Upper Paleolithic sites are found, mainly due to the availability of caves for shelter along the Meuse and its tributaries, and where the nearest flint sources are between 5 and 50 km distant, more commonly near the more distant end of the range. Zone 2 is divided into 2a and 2b, divided by the Meuse. Zone 2a includes the Brabant Plateau and the extreme western part of the Hesbaye Plateau, where one finds phtanite, Wommersom quartzite, and rare Tertiary flint (E. Teheux, pers. comm.).

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1 "Their cortex is still intact and chalky and, in this case, neither rolled, nor altered, nor broken, except possibly by general periglacial phenomena during the Quaternary."

2 "Their cortex is totally eroded, and their forms are smoothed and rounded; they can be recovered with a neocortex or have a pecked and shattered cobble surface."

The relative lack of shelter in caves in the plateau regions contributes to the paucity of sites in Zone 2a. It is more probable that if sites were to be found in this zone, apart from the well-known cave site of Spy, they would have been logistical sites aimed at specific subsistence activities than for residence. This plateau region would have contained subsistence resources, with rare, localized lithic resources.

A further distinction can be made between Aurignacian and Gravettian settlement patterns: while Aurignacian and Gravettian components are both found in cave sites, the only open-air sites found are Gravettian (Maisières-Canal and Huccorgne). While the rarity of sites precludes one from drawing firm conclusions, it is possible that the pattern reflects a change in procurement strategies, with Maisières-Canal as a probable special purpose extraction site.

Zone 2b includes the region south of the Meuse, including the Condroz Plateau and extending south to the Lesse Valley, and east to the Hoyoux river, a tributary of the Meuse (thus including the site of Trou Al'Wesse). West of the Meuse, it includes the Couvin region (and the study site of Couvin, Trou de l'Abîme). The Condroz Plateau and the Ardennes region in general lack flint sources in either primary or secondary context. One can find poorer quality materials (chert, quartzite and limestone) but flint must be obtained by crossing the Meuse or following it to the Maastricht region, adding a degree of difficulty in obtaining non-local flint that is not a problem in Zone 2a. Zone 2b, however, includes the Meuse River and its tributaries, with the karstic system providing shelter in caves, and it is in Zone 2b that the majority of sites are found (study site Goyet on the Samson river and sites along the Meuse between Namur and Dinant, such as Bois Laiterie).

Zone 3 is defined by the lack of flint sources in the region and the distance from the nearest flint sources (> 50 km). The site of Le Trou Magrite, in the Lesse river valley, is located in Zone 3. Geographically, Zone 3 includes the southernmost part of Belgium, starting with the Lesse valley - the high Ardennes region - and continues into Luxembourg. During the Early Upper Paleolithic, at least, most of Zone 3 appears to be beyond the distance threshold for occupation, although it could have been exploited for subsistence resources from sites such as Trou Magrite. As discussed in more detail in chapter 12, EUP sites are rare or absent in southern Belgium, and there are only five sites (mostly in disturbed open-air contexts, and mostly Gravettian) in Luxembourg (Ziesaire 1994). It will be argued that existing procurement strategies and the need for good quality flint imposed a distance threshold on prehistoric groups, beyond which regions were not occupied. Later, for example, beginning in the Magdalenian, a change in strategies to include longer distance transport permitted this threshold of >40 km to be transcended. The absence of flint sources in Zone 3 was compensated by longer distance transport and exploitation of a previously unexploited source of silicified limestone near Cherleville-Mézières in the Champagne region of France (Miller *et al.* 1998).

In sum, the procurement zone of a given site is identified by its proximity to flint sources, whether or not these flint sources were actually used. The study sites have been selected to represent the range of variability in access to flint and thus the different zones defined, as summarized in Table 5.1.

Zone	**Site**	**Location**
Zone 1	Maisières-Canal	Bassin de Hainaut
Zone 1	Huccorgne	Hesbaye Plateau, Mehaigne River
Zone 2a	Spy	Brabant Plateau, Orneau River
Zone 2b	Goyet	Condroz Plateau, Samson River
Zone 2b	Couvin, Trou de l'Abîme	Couvin, Famenne
Zone 3	Trou Magrite	Ardennes, Lesse River

Table 5.1. Study sites and their raw material procurement zones.

Distances have been estimated from each site to source of each raw material source, where known or probable, by measuring "as the crow flies" (Table 5.2). Topographic variability has not entirely been taken into account, and actual transport or mobility routes probably followed rivers and valleys. For sources probably on the Hesbaye Plateau or in the Liège-Aachen region, where exact provenience is unknown, three estimates of distance have been given: a minimum which is the distance to the nearest part of the Hesbaye Plateau (with or without currently known flint sources), a distance to the Méhaigne river valley where flint sources are found, and a maximum distance to the Liège-Aachen region.

Site	**Maisières Canal**	**Huccorgne**	**Spy**	**Goyet**	**Le Trou Magrite**	**Couvin, Trou de l'Abîme**
Zone / **Material**	**1**	**1**	**2a**	**2b**	**2b**	**2b**
1 - Obourg flint	1	85-90	50	75	75	60
2 - Spiennes flint	7	85-90	50	75	70	55
3 - Hesbaye flint	(80+)	1-5	20-35-75	5-20-60	35-40-80	(65-75-120)
4 - phtanite	49	45	25	40	55	(70)
5 - Wommersom quartzite	(85)	(30)	45	40	(65)	(90)
6 -tan flint	-	-	?	?	-	-
7 - black flint	-	?	?	?	-	-
8 - gray flint	?	-	?	?	?	-
9 - brown flint	?	-	-	?	-	-
10 - chert	local	local	local	local	local	-
11 - quartzite	-	local	local	local	local	-
12 - sandstone*	-	50	35	local?	65	?
13 - limestone	-	local	local	-	local	local?
14 – quartz	-	-	-	-	local	-
15 – chalcedony	-	-	?	-	-	-
16 – jasper	-	-	?	-	-	-
17 - olive-green flint	?	-	-	-	-	-

- not found at site, provenience unknown ? found at site, provenience unknown

( ) not found at site

* When material can be identified as Brussels sandstone, a distance estimate has been given.

Table 5.2. Distance table for raw materials found at each study site.