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MINERAL ADORNMENTS AT CHALCOLITHIC SITES IN INLAND IBERIA: VARISCITE BEADS AT VALLE DE LAS HIGUERAS (HUECAS, TOLEDO) SPAIN

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ABSTRACT

The study of adornments found in the necropolis at Valle de las Higueras (Huecas, Toledo) has determined the morphotypology and mineral composition of one quadrangular pendant and 341 stone beads. Most of the beads are short (length ≤ 5 mm), but within this regularity series can be differentiated that might be the result of standardised fabrication processes and different times of acquisition. Portable X-ray fluorescence (p-XRF) and X-ray diffraction (XRD) analysis identified the use of phyllosilicates as sepiolite and clinochlore, and above all variscite, a mineral that became especially important for adornments in the Iberian Peninsula in the 3rd millennium BC. The inland location of the necropolis, distant from source areas, certifies its remote origin, as far away as northwest Zamora according to the chronological framework. It is still not possible to determine for sure the source of the variscite at Valle de las Higueras. However, the inland location of the necropolis, distant from source areas, certifies its remote origin. The chronology suggests that it might have come from the north-west, in the area of Zamora. Archaeological and chronological data obtained in tombs in the necropolis, together with other inland sites, contribute to understanding variscite circulation in the Iberian Peninsula in the Chalcolithic. It was restricted to a few individuals, both adults and children, who wore necklaces and bracelets. Distance did not condition the arrival of variscite, but the small amounts suggest it was traded together with other ostentation elements, such as sea shells, cinnabar and amber. The heterogeneous regional panorama displays differences in the demand, use and acquisition of variscite depending on the socioeconomic organisation and connection to exchange networks.

KEYWORDS: Western Europe, Iberian Peninsula, Copper Age, necropolis, adornments, mineralogical analysis, variscite

1. INTRODUCTION

Prehistoric adornments were aesthetic, symbolic and socioeconomic elements. They were worn on the body, in the hair or attached to clothing. Their manufacture, raw materials and use reveal information about past societies and their signs of social expression (Vanhaeren, 2005; Kuhn and Stiner, 2007; Baysal, 2019; Mărgărit and Boroneanț, 2020). One of the raw materials employed for adornments was variscite, a green hydrated aluminium phosphate with a general formula [$MPO_4 \cdot 2H_2O$], where M = Al^{3+}, Fe^{3+}, Cr^{3+}, V^{3+}. Variscite's colour ranges from yellow to green hues and massive variscite usually has a waxy, lustrous turquoise-green colour. Its attractive colour meant that it was made into pendants and beads that were widely used in Western Europe from the 6th to the 3rd millennia BC (Herbaut and Querré, 2004; Odriozola et al., 2016a).

The current consensus about the sources of the adornments made from variscite found in Europe maintains that the raw materials came either from the north-west (Zamora), south-west (Encinasola) or north-east (Gavà) of the Iberian Peninsula (Figure 1), from where they were exchanged massively across the whole of Western Europe (Herbaut and Querré, 2004; Querré et al., 2008; Odriozola et al., 2010; Odriozola, 2014). This hypothesis about long-distance trade is based on the wide distribution of personal adornments made from green phosphates in Europe and the scarcity of the mineral in the continent.

Several studies have examined variscite extraction, transformation, consumption and distribution networks (Noain, 1996; Blasco et al., 1996; Bueno Ramírez et al., 2005; Odriozola et al., 2010, 2013a, 2013b, 2016b, 2017; Thomas, 2011; Villalobos García and Odriozola, 2016; Fábregas and Rodríguez-Rellán, 2017; Oliva, 2015). The use of variscite in the Iberian Peninsula began in the 5th millennium, coinciding with the spread of Alpine jade axes across Western Europe. In the late 5th and during the 4th millennia BC, an increase is seen in the number of sites where variscite and such other green stones as mica, serpentine and talc have been found. During the first half of the 3rd millennium BC, variscite use reaches its apogee and start to decline in the middle of the millennium. This coincided with an increase in 'exotic' raw materials, of distant provenance, such as ivory and amber (Borrell et al., 2015, 73; Villalobos García and Odriozola, 2016; Odriozola et al., 2016b, 2020).

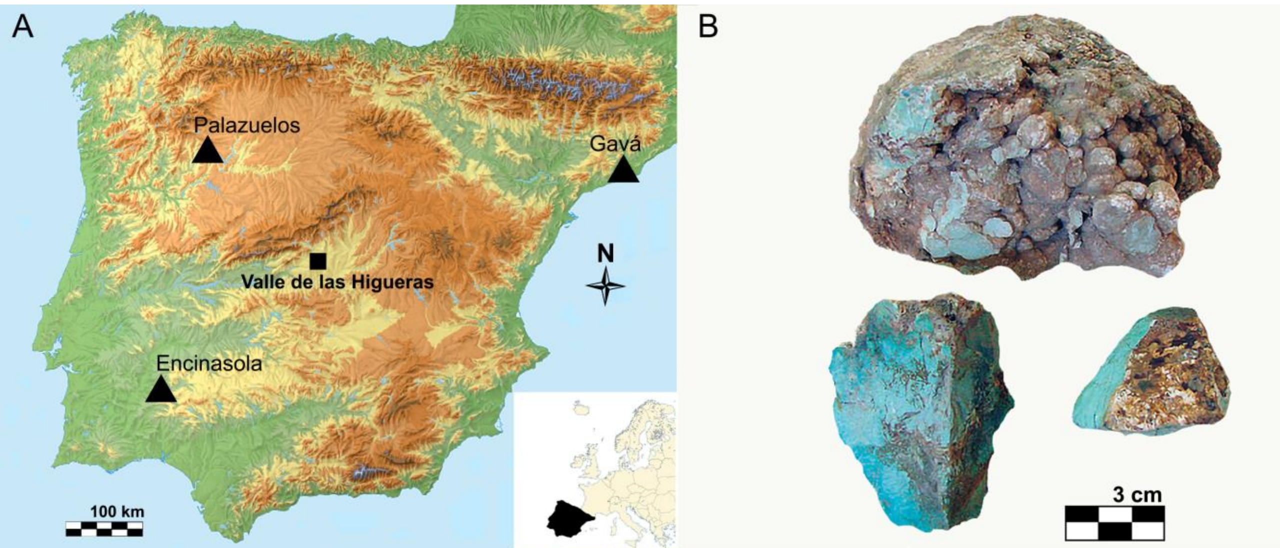

Figure 1: A) Map of the Iberian Peninsula with the location of variscite mines and the site studied here. B) Samples of variscite from Encinasola Mine, after Odriozola et al., 2010: Fig. 2.

The intensive use of variscite in the Chalcolithic is a characteristic of Iberia. The mostly Neolithic attribution of deposits at megalithic sites in Brittany (Herbaut and Querré 2004; Paulsson et al., 2019) contrasts with the range of sites dated in the Chalcolithic in the peninsula. Variscite adornments were made at 3rd millennium workshops, like the one at Las Peñas de Quiruelas (Villalobos García and Odriozola, 2016; Villalobos García et al., 2018). They are found at domestic sites (Jiménez 1995; Odriozola et al., 2013a) and also in funerary deposits (Odriozola et al., 2010, 2016a, 2016b), like the one described here. Changes in social and economic organisation during the Chalcolithic (Berrocal et al., 2013) led to greater demand for materials that were exchanged over long distances, such as ivory (García Sanjuán et al., 2013), amber (Murillo Barroso et al., 2018; Odriozola et al., 2019) and cinnabar (Bueno Ramírez et al., 2019; Rodríguez et al., 2020), as well as variscite. The fabrication of personal items, the quality of the production and the deposition as grave goods reveal their important social role.

The aim of this paper is to analyse one of the largest Chalcolithic green bead assemblages in the Iberian Peninsula, Valle de las Higueras (henceforward VdH). The site is one of a series of Bell-Beaker necropolises in the centre of the Iberian Peninsula (Bueno Ramírez et al., 2012, 2016; Barroso et al., 2014; Blasco Bosqued et al., 2011) and their tombs are an excellent closed and well-dated context (Bueno Ramírez et al., 2005, 2008, 2012) to study the ornaments associated with the buried individuals. The morpho-typological features of the beads have been analysed in order to determine the kind of production and its use. In turn, the chemical and mineralogical characterisation of this set of adornments has been performed to determine consumption and circulation of regional and exogenous raw material. This significant assemblage of green beads from VdH allows us to discuss the distribution and exchange networks of the different beads mineralogy in the region and provide data for a better understanding of beads consumption patterns in the Iberian Peninsula during the Chalcolithic.

2. ARCHAEOLOGICAL CONTEXT OF THE ADORNMENTS: THE NECROPOLIS OF VALLE DE LAS HIGUERAS

VdH is a necropolis formed by artificial caves dug in the upper part of the limestone hill (Figure 2). It is in a valley in the basin of the River Tagus, which connects inland Iberia with the Atlantic. The different domestic and mortuary sites known in the valley (Bueno Ramírez et al., 1999, 2005, 2008, 2009, 2012; Barroso et al., 2015) indicate the long occupation of the area in the 4th, 3rd and 2nd millennia BC.

Figure 2: A) Location of Valle de las Higueras in the Iberian Peninsula and aerial view of the hill with the necropolis; B) Topographic of the hill showing the position of the caves studied here.

The hill with VdH necropolis occupies a central position in the valley. The first construction in the group of tombs is a burial mound (TVH1) dated in the first half of the 3rd millennium BC. Its chamber with stone walls held at least four individuals buried with plain pottery, flint arrowheads, copper and beads made of limestone and nacre (Bueno Ramírez et al., 2012). On the upper part of the hill, at least eight caves were opened, differing in size, shape and number of burials. Radiocarbon dates (Barroso et al. 2014) support the use of the necropolis between 2865-1500 cal. BC. (IntCal20- 2σ) (Reimer et al., 2020).

Cave 1: Located in the western area, it consists of a chamber with a small niche and ante-chamber connected to it. The only remains was recovered from the original level in the chamber. Bell Beaker pottery, copper, flint arrowheads and some beads were found *in situ*. A radiocarbon date was obtained from the human bone (Beta-145275: 3890 ± 40 BP) (Bueno Ramírez et al., 2005). Cave 1 provided 246 stone beads. Amber beads and a small copper ring were also found (Figure 3).

Cave 3: This is located in the central area and consists of an ante-chamber, chamber and three niches in its walls. It contained at least 30 individuals. The beads formed part of the grave goods in the chamber and ante-chamber, but were absent in the niches, where Bell Beaker pottery and bone adornments were found (Niche 3a) (Bueno Ramírez et al., 2005).

Ante-chamber (3b) held at least 12 burials, some of which were secondary. Plain pottery, pieces of copper, flint arrowheads, bone pins, an amber bead, over a hundred shell beads (*Trivia arctica*) and 31 stone beads formed the grave goods. The adornments were concentrated next to two adults and a child. One of the individuals was dated by radiocarbon (Beta-157732: 3830 ± 40 BP) (Bueno Ramírez et al., 2005).

The annex chamber (3c) contained 11 individuals grouped on two oval-shaped stone floors and covered by cinnabar. The collective grave goods included a 12 plain pottery vessels, flint arrowheads and copper awls. An adult female located at the base (M-9) had 43 green beads in the area of her neck and a shell (*Margarita auricularia*) next to her hand. From her was obtained a date (Beta-205141: 3860 ± 40 BP) (Figure 4).

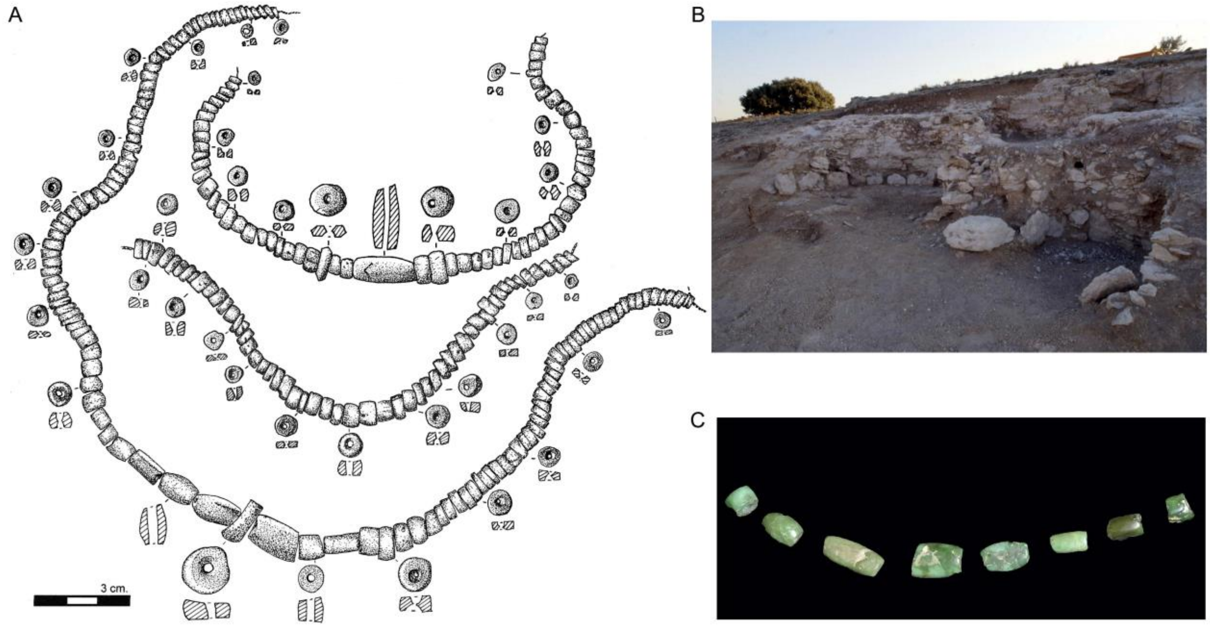

Figure 3: A) Stone beads from Cave 1 in Valle de las Higueras. B) View of Cave 1 at Valle de las Higueras; C) Selection of beads from Cave 1.

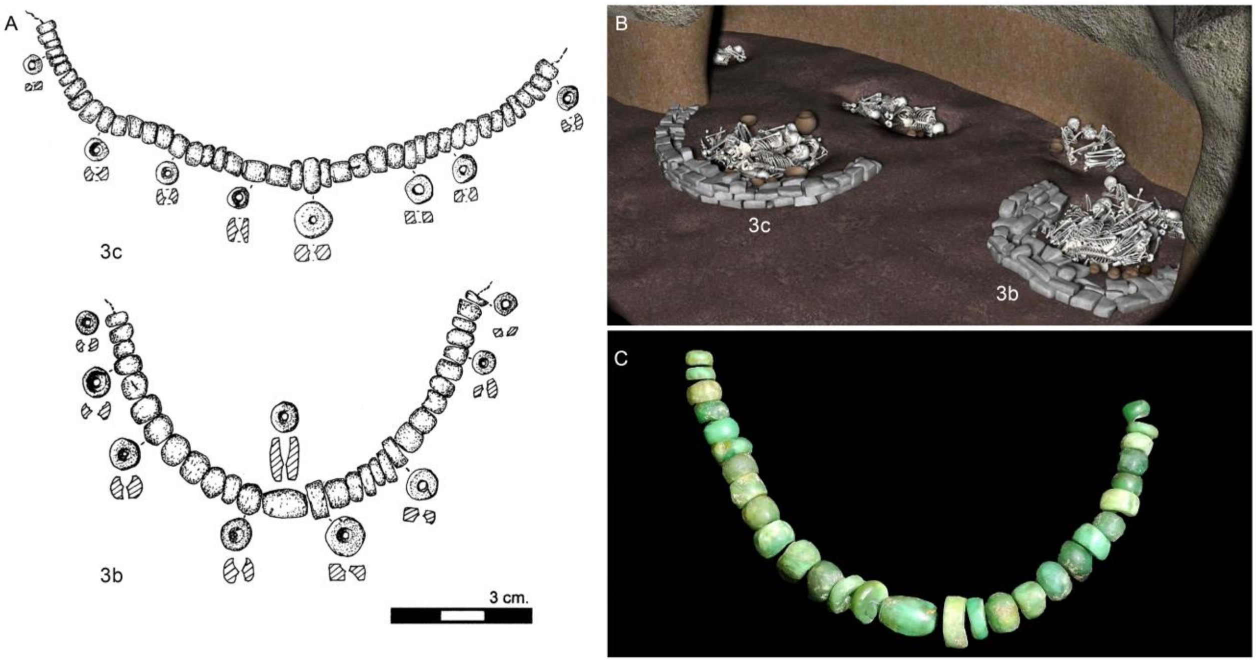

Figure 4: A) Stone beads from the chamber (3c) and ante-chamber (3b); B) Recreation of Cave 3 at Valle de las Higueras; C) Green beads from the ante-chamber in Cave 3.

Cave 4: It had been destroyed at the time of the excavation. A small copper dagger, plain pottery and 2 green beads were found out of their original position.

Cave 7. It consisted of two chambers dug on different heights. The East chamber contained a plain Bell Beaker pot with a burial dated to 3970±40 BP (Beta-216245) (Bueno Ramírez et al., 2008). At the back of the chamber osseous remains from a previous burial were associated with 2 flint arrowheads, a quadrangular stone pendant, nearly twenty black and white beads, and a fragment of copper.

The West chamber/niche contained plain ware, a Bell Beaker fragment, chipped and polished stone artefacts and six beads. Remains of at least 2 individuals were found close to them, an adult and a child. From the adult was obtained a date (Beta-218062) of 3330 ± 40 BP (Bueno Ramírez et al., 2008) (Figure 5).

The grave goods at VdH include elements of diverse provenance. The study of the ware and Bell Beaker pottery supported local production (Barroso et al., 2015). Equally, the lithic industry and bone and metal objects utilised local or regional raw materials (Barroso et al., 2003; Bueno Ramírez et al., 2005). The case of the cinnabar is different as its source is further away (at least 150 km) from the site (Bueno Ramírez et al. 2019), like the raw materials of many of the adornments. At VdH and other sites of the valley, evidence of the local production of lithic and metal objects such as cores, knapping waste and copper-smelting vessels has been found (Bueno Ramírez et al., 1999). However, VdH has not provided any signs of production of the mineral beads.

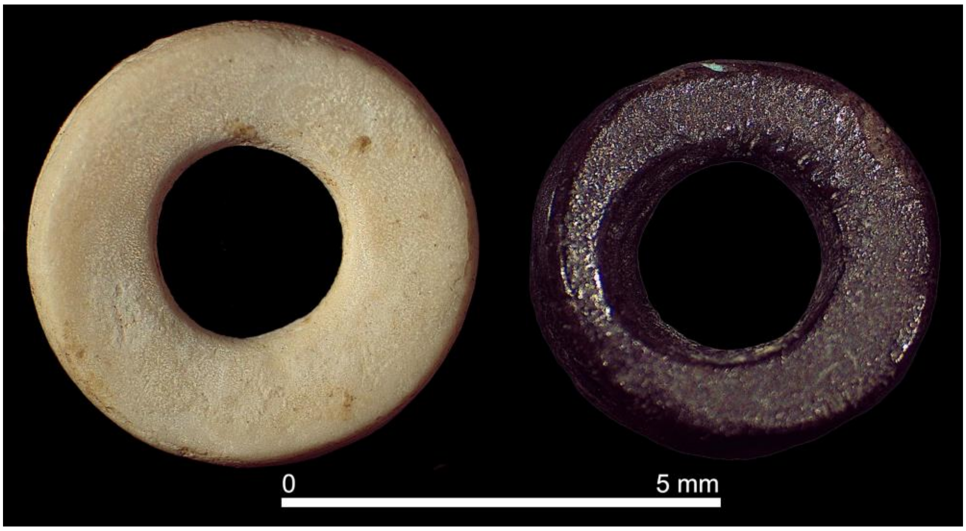

Figure 5: Discoidal and short barrel beads from Cave 7, made with calcite and quartz.

3. MATERIALS AND METHODS

All the unbroken stone adornments found in the VdH necropolis have been studied: a quadrangular pendant and 341 beads.

For the morphological criteria we have followed the typological system of Beck (1928), which is still valid, and a recent proposal (Villalobos García, 2015) that simplifies the typology and adapts it to the variability seen in the Iberian Peninsula. Following Villalobos García (2015), we have used two parameters to construct the typological classification: the proportion and the shape.

The shape is determined by the assimilation of the cross-section and long-section of the bead to geometric forms. Four forms (circle, ellipse, triangle and rhombus) are considered in both sections. This results in eight basic shapes.

In turn, the proportion is defined by the relationship between the length (distance between the two ends of the perforation in the beads) and the diameter (the maximum width between two points aligned perpendicularly to the length. Following Beck (1928) and Villalobos García (2015), four thresholds are established in the length-diameter proportion, which determines four categories: discoidal, short, standard and long beads. Discoidal beads are those in which the length is less than 1/3 of the diameter. In the case of short beads, the length is more than 1/3 and less than 9/10 of the diameter. Standard beads have a length more than 9/10 and less than 11/10 of the diameter. Finally, long beads are those in which the length is more than 11/10 of the diameter (Figure 6).

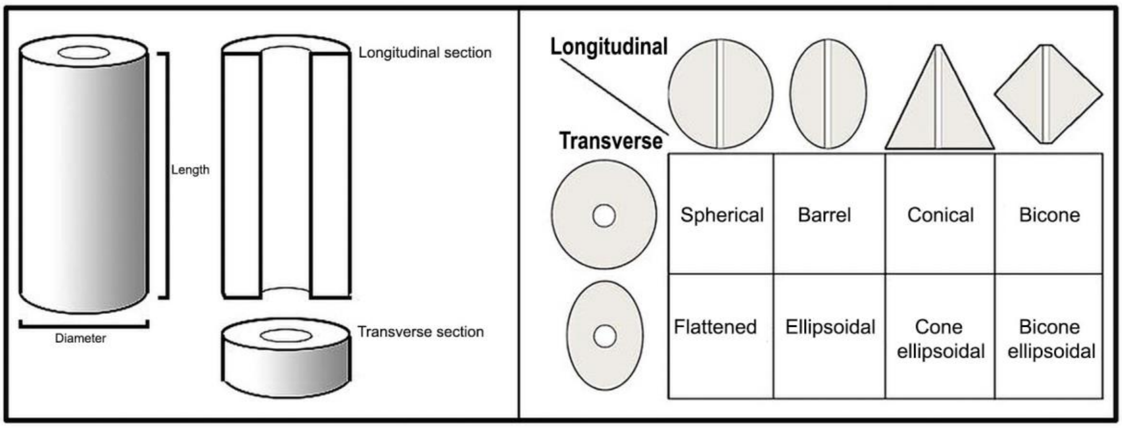

Figure 6: Representation of the typological system employed in the present study.

The morphometric study has also considered the difference in the size of the perforations, between the outline and the interior hole. Several studies have been taken into account for technological aspects (Gwinnett and Gorelick, 1998; Noain, 1996; Rodière, 2011; Bains, 2012; Oliva, 2015; Viola et al., 2017) although we have not carried out our own experimentation. All the beads have been examined with a stereomicroscope at 20x magnification and 40% of them with a Leica MZ12.5 microscope at 100x with an Olympus UC30 camera added for the photographs.

The raw materials have been determined by means of a portable X-ray fluorescence (p-XRF) device by X-ray diffractometer (XRD). The former equipment was an Oxford Instruments X-MET 7500 with a silicon drift detector (SDD) and an automatic loader with five filters. XRF was measured directly and without prior treatments of the sample by placing the flattest bead face over the sample holder. The measurement is per-formed on a surface of 9 mm^2. The quantification of the elemental composition has been performed using the Fundamental Parameters (FP) method. This method is most appropriate when an empirical method cannot be counted, either because the number of elements to be quantified is significantly large or because there are no appropriate certified patterns (Beckhoff et al., 2006). The quantification of the results of the XMET-7500 has been carried out by FP using the factory certified SOILS-LE calibration program, after performing the corresponding calibration test with the crm043 and GBM306-12 certified standards (Figure 7) (see SUPPLEMENTARY TABLES with p-XRF data).

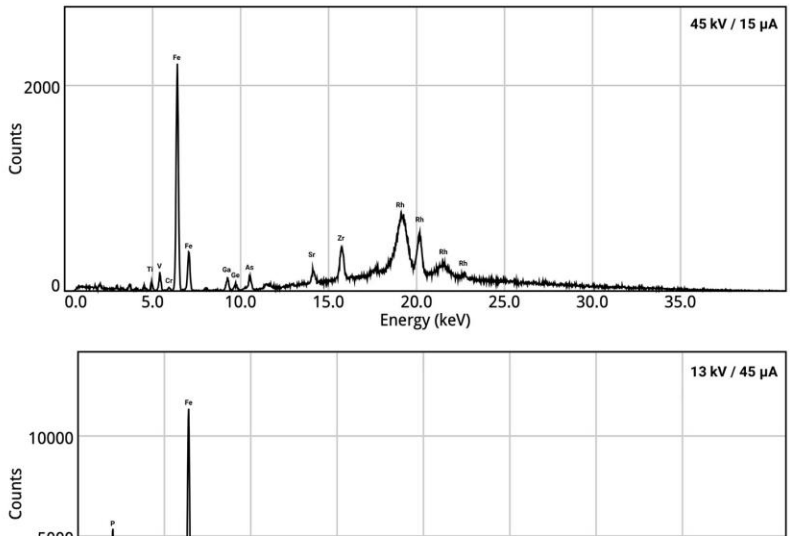

Figure 7: Typical spectra recorded by the p-XRF device to quantify (sample VH01/3C/50)

XRD was performed with a θ/θ Panalytical X'Pert Pro diffractometer with Cu Kα (1.5406 Å) radiation operating at 45 kV and 40 mA, equipped with a PixCel detector and parabolic mirrors with incident light. The diagrams were obtained after positioning the bead directly and without prior treatments in the sample holder of the device, with a 0.026° 2θ pass between 10° and 70° 2θ, and an acquisition time of 247s per pass at room temperature (25°C). The identification of the mineral phases in the beads with performed by comparison with the Powder Diffraction File 4 (PDF4) database of the International Centre for Diffraction Data (ICDD), using the Panalytical X'Pert Highscore 3.0 software.

Bead provenance is determined traditionally by comparison of the elemental composition of the beads with that of geological control groups following the provenance postulate (Bishop et al., 1988; Weigand et al., 1977). Most current provenance classification systems show distrustful because the size of the control groups does not cover the deposits chemical and mineralogical variability. The high composition and mineralogical variability of phosphate deposits compromises most of the existing provenance classification systems as they are tremendously dependent on the creation of the control groups used to classify the origin of the beads. This control groups should by no means neglect the chemical variability of the deposits. Therefore, while this task is not completed when it comes to provenances, more weight should be given to archaeological criteria than to any chemometric model.

4. RESULTS

In the VdH assemblage, discoidal beads are more numerous than the other categories (Table 1). Most of the beads are of the short barrel type (64.1%) (Table 2).

Table 1: Percentage of the proportions of the studied beads

Short	Discoidal	Long	Standard
83.3	11.9	2.0	2.6

Table 2: Frequencies and percentages of the different morphotypes

	Flattened	Barrel	Bicone	Ellipsoidal	Spherical
Short	2 / 0.5%	220/ 64.1%	2 / 0.5%	0 / 0.0%	62 / 18.0%
Discoidal	0 / 0.0%	33 / 9,6%	0 / 0.0%	0 / 0.0%	8 / 2,3%
Long	0 / 0.0%	3 / 0,8%	0 / 0.0%	4 /1,1%	0 / 0.0%
Standard	0 / 0.0%	9 / 2.6%	0 / 0.0%	0 / 0.0%	0 / 0.0%

Table 3: Frequencies of the different morphotypes in the different caves at Valle de las Higueras

Shape	**Context**	**Proportion**			
		Short	Disc	Long	Standard
Flattened	Cave 1	2	-	-	-
Barrel	Cave 1	174	28	2	6
	Cave 3 – chamber 3b	12	-	1	1
	Cave 3 – chamber 3c	15	1	-	2
	Cave 4	2	-	-	-
	Cave 7 – chamber	15	-	-	-
	Cave 7 - Niche	2	4	-	-
Bicone	Cave 1	2	-	-	-
Ellipsoidal	Cave 1	-	-	4	-
Spherical	Cave 1	21	7	-	-
	Cave 3 – chamber 3b	17	-	-	-
	Cave 3 – chamber 3c	24	1	-	-

According to the results in Table 3, Cave 1 is the only context with morphotypological variety. In the others, the short barrel and short sphere beads predominate. The other types are very scarce.

The perforations are mostly centred and were made by a concentric rotary movement. They are biconical and made from both sides with slightly eccentric holes in many of the beads. Only 5.8% of the perforations are straight and in seven cases the beads were so thin that it was not necessary to pierce them from the second side. Conical drills with more rounded ends may have been responsible for the different sections observed in the perforations of the beads. Holes were corrected as many as three times and some beads were shortened owing to a fault in the perforation (Figure 8).

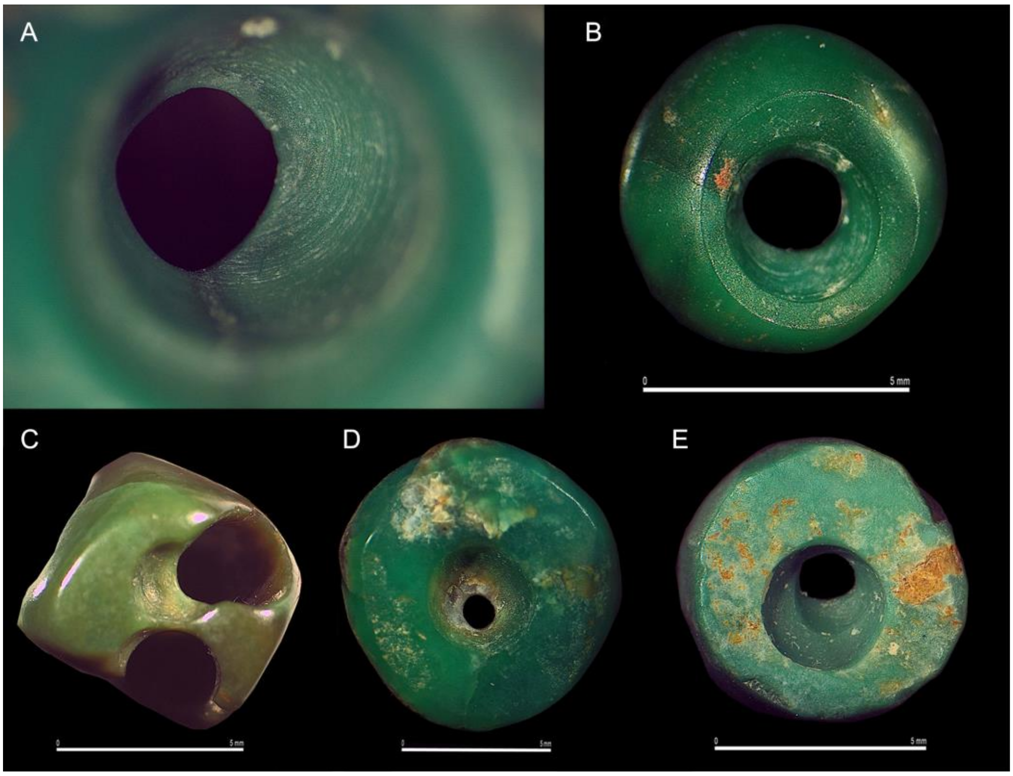

Figure 8: Valle de las Higueras A) Photo of perforation marks with concentric striations taken using an optical microscope. B-E) Examples of variscite beads showing different perforation sizes. C) Bead with three attempts at perforation (the linear scale represents 5mm).

The outline of the perforations has a mean diameter of 2.20 ± 0.47mm (in 81% of the beads it is less than 2.50mm) and the coefficient of variation (CV) is 0.21. The hole is smaller in the middle of the perforations (minimum diameter) with a mean of 0.82 ± 0.44mm and a minimum diameter of 0.12mm, which means that the bead could only have been strung on a very fine thread. Two modes exist in the diameter of the hole, a main one and a secondary one, but not so clearly in the diameter of the outline of the perforation. These modes are assumed to be uncorrelated with the diameter or height of the beads (Figure 9).

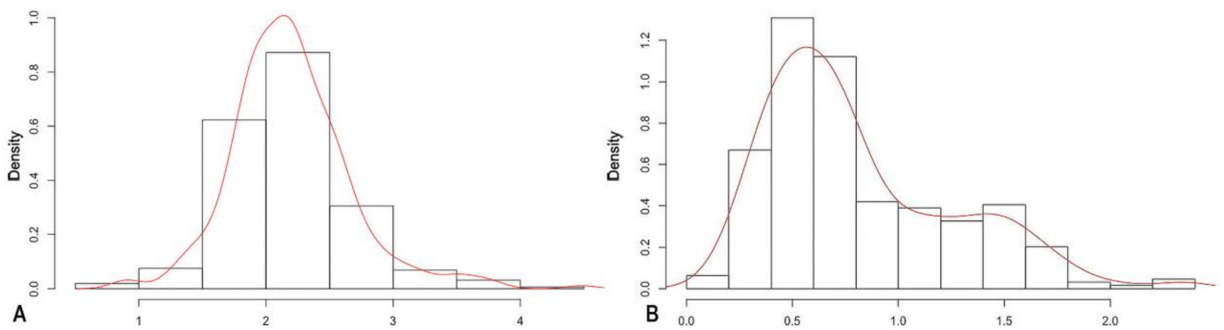

Figure 9: Histogram with the maximum (A) and minimum (B) diameters of the perforation. The kernel density is shown in red.

Use-wear is normally visible around the perforation (Figure 10) and the linear striations left by polishing the beads are seen more on the sides of the beads than on their flat faces (Figure 11).

The large number of short beads seems to indicate homogeneity but in fact some peculiarities can be detected. Bright patinas are limited to the few long beads which, possibly because of their larger size, were polished more intensely. 2.78% of the discoidal beads in Cave 1 possess a polygonal outline because the edges of the initial mineral were not removed completely. In contrast, the beads from Chamber 3b have rounded, well-worked sides that suggest they were shaped together in a line, as proposed for production of beads at Gavà (Bosch and Estrada, 2002). They are similar in diameter (~6.9 ± 1 mm) as the larger and smaller beads are missing. Their large perforations (1.9 – 3.2mm) and holes about 1.4mm in diameter, larger than the average, created some of the beads with the thinnest walls in the assemblage.

Figure 10: Valle de las Higueras. Variscite beads with use-wear around the perforation (the linear scale represents 5mm).

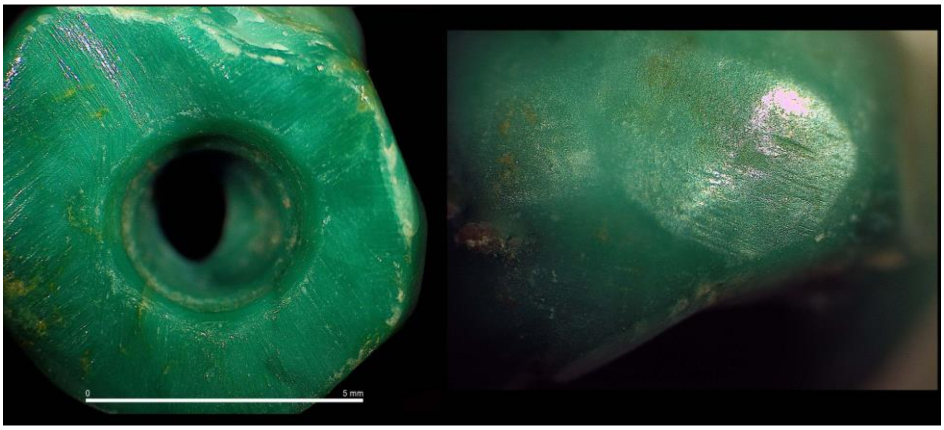

Figure 11: Valle de las Higueras. Images of the marks left by polishing the variscite beads taken using an optical microscope (the linear scale represents 5mm).

The XRD analysis (Table 4) has determined that most of the beads at VdH were made with variscite (82.1%), although the use of other minerals, such as clinochlore (0.5%), calcite (0.8%), quartz (1.1%) and sepiolite (3.5%) has also been detected (Figure 12). It is significant that the use of sepiolite, a tri-octahedral phyllosilicate rich in Mg in the palygorskite-sepiolite group (Guggenheim and Kreekeler, 2011), was restricted to the beads in Cave 7; additionally, all those beads possess a straight perforation.

Table 4: Frequencies of the minerals in relation to the cave where they were found. ND refers to beads in which the identification of the mineral by XRD was not possible for technical reasons.

	Calcite	Clinochlore	Lignite	ND	Quartz	Sepiolite	Variscite
Cave 1			1	26	3		216
Chamber 3b		1		4			26
Chamber 3c				8			35
Σ (Cave 3)		**1**		**12**			**61**
Cave 4							2
Chamber 7	3	1				12	
Niche				1	1		2
Σ (Cave 7)	**3**	**1**		**1**	**1**	**12**	**2**
Σ (Total %)	**0.87**	**0.58**	**0.29**	**11.40**	**1.16**	**3.50**	**82.16**

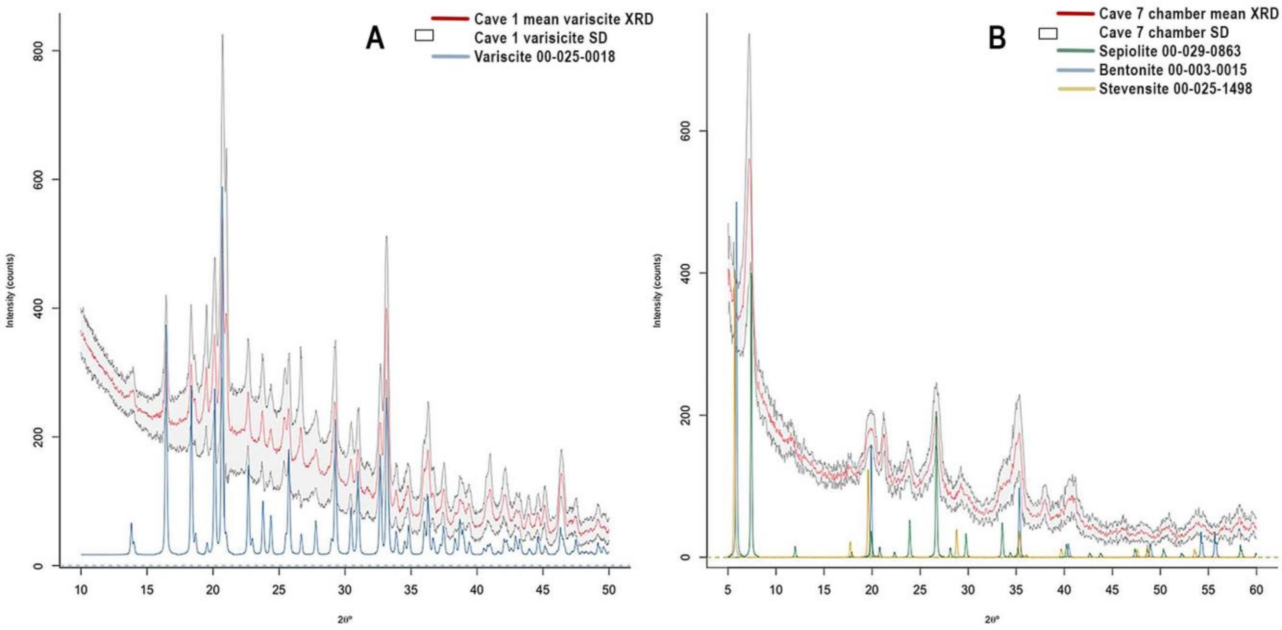

Figure 12: A) Variscite from Cave 1. Mean diffractogram of all the samples identified as variscite and SD (± one standard deviation) together with the identified mineral phase. B) Sepiolite from Cave 7, Chamber. Mean diffractogram of all the samples identified as sepiolite and SD (± one standard deviation) together with the identified mineral phases.

5. DISCUSSION

Mineral and animal raw materials (bone, amber, shells and stones) were used to make the adornments found at VdH. The importance of ornaments from distant sources is clearly shown by the Sicilian amber (Murillo Barroso et al., 2018), the variscite beads (57.8%) and those made of the shells of *Trivia arctica* (27.9%), which can be collected on the Atlantic coast. Local resources were used less.

The use of phyllosilicates is not surprising. Beads in such different varieties as muscovite, phlogopite, talc and clinochlore have been recorded in the whole of later prehistory in the Iberian Peninsula. Muscovite and talc are the most common. It is not the first time that the use of sepiolite to make necklace beads has been recorded in Iberia, although it is less frequent. It is a soft mineral (1-2 on the Mohs scale) with optical characteristics very similar to the other phyllosilicates and variscite, appearing in a wide range of colours, including green as is the case.

The procurement of minerals different from variscite is commonly considered a local model. The proximity of the Vallecas-Vicálvaro-Yunclillos sepiolite deposits (Murray et al., 2011) to VdH, would support, based on the mineral characterisation of the beads, a local procurement model for Cave 7 set of beads. Although the sepiolite in this area is generally very pure (sepiolite >80%, smectite 15%, calcite and dolomite 2%, quartz <2% and feldspars <1%), some sepiolite is associated with bentonite rich in magnesium and clays rich in kerolite-stevensite in the Yunclillos-Cabañas de la Sagra sector (Murray et al., 2011). In this regard, the presence of bentonite and stevensite could indicate that the beads in Cave 7 came from that sector, as we suggest in the map in Figure 16.

Sepiolite was not the only local resource. The clinochlore in Chamber 3b and the pendant from Cave 7 may have come from the hinterland of VdH. While Domínguez Bella (2010: 279) proposed a provenance for this mineral in the metamorphic deposits in the Sierra de Guadarrama, we are inclined to situate its source to the south of VdH, either in the area of Las Ventas with Peña Aguilera or in Las Urdes in the Toledo Mountains, where clinochlore has been documented with muscovite (Menéndez et al., 2018). The identification of clinochlore and muscovite (Figure 13) in the pendant from the chamber in Cave 7 suggests it came from the south of Toledo and not from the north of Madrid. On the other hand, the absence of variscite in the Cave 7 chamber might be due to chronological or social factors, since sepiolite and clinochlore are local minerals.

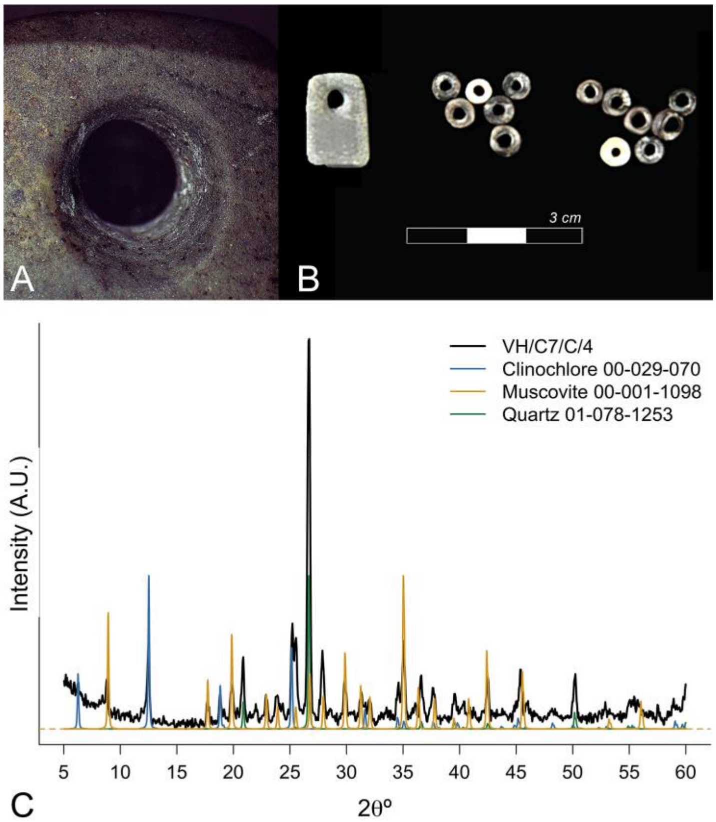

Figure 13: A- B) Pendant and beads from the chamber in Cave 7, with a detail of the perforation in the clinochlore pendant. C) XRD pattern of pedant VHC7/C/4 from chamber Cave 7 and patterns of the minerals identified (clinochlore, muscovite and quartz).

A significant assemblage of variscite beads has been found in VdH. Since the 1970s, many scientific papers have attempted to determine which of the three Iberian mines is the geographic source of the variscite beads. Several chemometric models have been proposed. The most popular one claims that a geographic origin can be traced by using a series of 'discriminating elements'. For example, the team headed by Edo i Benaiges affirmed that they had detected a combination of chemical characteristics that can be used to trace the source of the beads: Fe, Cr, Ca and Si (Blasco et al., 1996; Edo i Benaiges et al., 1995a, 1995b, 1997, 2005; Blanco Majado et al., 1996; Rojo Guerra et al., 1996; Edo i Benaiges and Fernández Turiel, 1997). In turn, Odriozola and colleagues (Odriozola et al., 2010, 2016a; Odriozola, 2014) proposed the use of the atomic relation of P to Al together with Si and Ca in a ternary diagram to discriminate between deposits. Finally, Querré and Domínguez Bella (Querré et al., 2015, 2019) have recently posited the use of eight elements (Fe, Cr, V, U, Zr, As, Ca and Si) in an iterative model based on the comparison of ternary and binary diagrams (ternary diagram Fe-Cr-V and binary diagrams U-Zr, (Cr+V)-As and Ca-Si) to determine the provenance of the beads. The application of the method to 14 beads from VdH suggested that they came from Palazuelos de las Cuevas (Domínguez Bella et al., 2019: 271).

Although all these methods are claimed to be successful, the precision of the model does not lie so much in the chemometric model in itself but on the empirical base on which it is built. That is, the quality and size of the control groups forming the geological collections with which the differences at element level are identified and quantified and which then are the basis of the chemometric model. To date, 192 samples from five different sources have been used for provenance analyses since the early 1970s. This is a small number of samples that is unable to represent the full chemical variability of the deposits and thus compromises the creation of significant and reliable control groups and the success of the provenance determination.

When the proposed models are tested with 1,057 geological samples from three deposits (including the five sources cited above), they are all seen to fail in the discrimination of the deposits as the natural variability of the sources increases and the differences appreciated before become more diffuse (Figure 14).

The variscite at VdH undoubtedly came from a distant source. However, considering that: 1) no consensus exists about the most accurate model; 2) the control groups that have been analysed are small, which compromises their precision; and 3) when the number of samples is enlarged, the variability increases and erases any kind of differentiation between the deposits, it does not seem appropriate to establish the source using a chemometric model of which the degree of accuracy cannot be established.

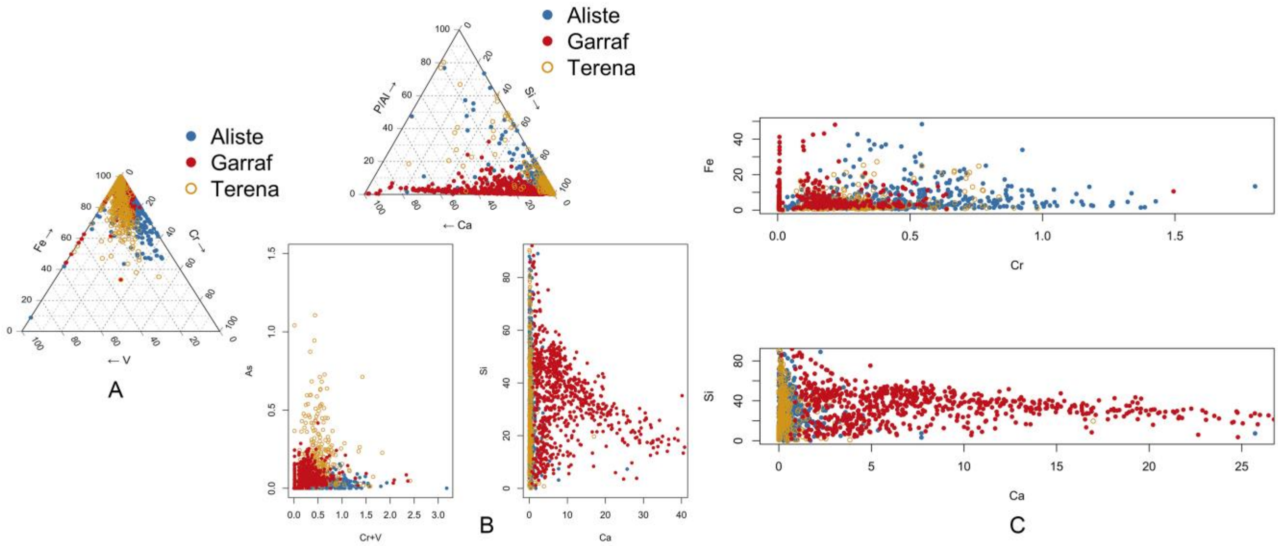

Figure 14: A) Chemometric model of Odriozola et al.; B) Chemometric model of Querrè et al.; C) Chemometric model of Edo et al. Aliste (all the outcrops in the Aliste-Palazuelo de las Cuevas synform), Terena (all the outcrops in the Terena-Pico Centeno synform) and Garraf (outcrops in the Garraf Massif-Can Tintorer). Elements are expressed as atomic percentage.

In inland Iberia, variscite personal adornments are not limited to VdH. They have been found at several sites in the upper and middle Tagus (Odriozola et al., 2017) together with beads in other organic and inorganic materials, such as silicates, limestone, shells, bone, copper, gold and ivory. At several sites with green beads, the raw material has not been analysed (Arribas, 2010; Baquedano et al., 2010; Valiente, 2001), but at others the variscite has been securely identified (Ríos and Liesau, 2011; Odriozola et al., 2017). VdH stands out because of the number of adornments, but resembles the other sites in its Chalcolithic chronology, because no Neolithic dates are known for variscite in the region. However, only three sites are well determined archaeologically and chronologically (Figure 15).

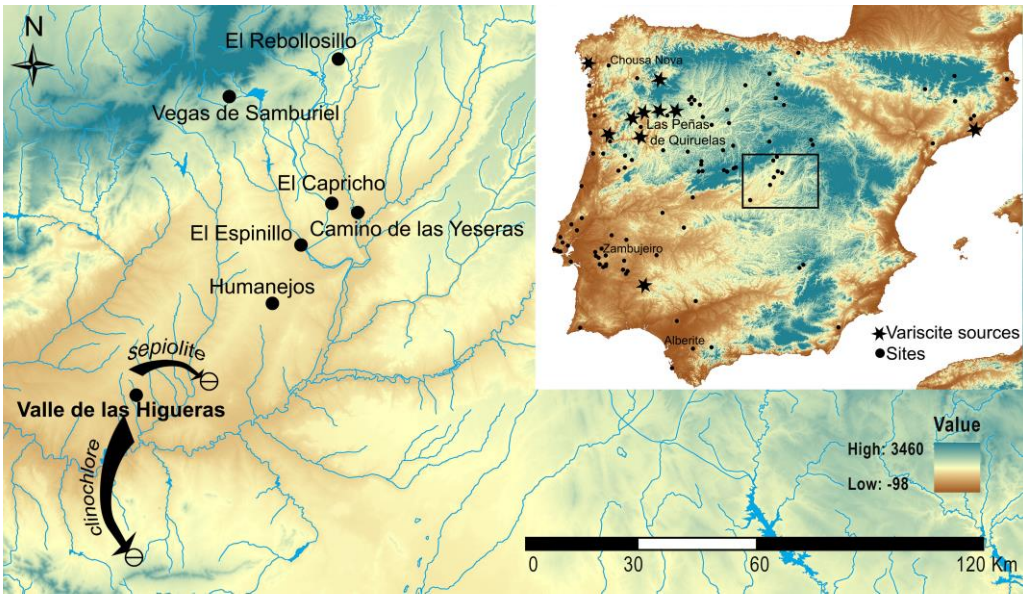

Figure 15: Distribution map of Iberian variscite with sites mentioned in the text. Detail of the sites with variscite in the area around Valle de las Higueras and a proposal for the source of the clinochlore and local sepiolite. Source: DEM (Digital Elevation Model). Value range (meters). Map based on SRTM-NASA.

At the site of Camino de las Yeseras in Madrid, a variscite bead and plaque (SU204) and three beads of aluminium silicate (SU330) formed part of the fill in a large organic pit in the central part of the site. A date (Ua-39321: 3991 ± 30 BP) was obtained for one of its units (SU506) (Ríos, 2011: 435) but we do not know the stratigraphic distance between C14 date and variscite.

At Rebollosillo, four of the six beads found are made of variscite. They probably correspond to 'Homo 2', with a date of CNA4007: 4004 ± 30 BP and a single necklace, together with two beads made of phyllosilicates. The radiocarbon dates obtained for 16 of the 21 secondary inhumations indicate a funerary use between 2700 and 2230 cal BC (Intcal13, 2σ) (Díaz del Rio et al., 2017a).

At the site of Humanejos, we currently know tombs with variscite beads and others where the adornments were mainly made from other minerals like clinochlore. Variscite is present in at least four tombs with an outstanding ensemble of 61 beads in the double burial 826. The multiple burial in Tomb 1166 contained a young female and three children accompanied by necklaces, plain vessels and metal. 17 beads, four of them variscite, were found around the neck and arm of a child of 4 years ± 12 months of age. A date was obtained for one of the female's bones (UA-40221: 3959 ± 34 BP) (Odriozola et al., 2017).

As Humanejos, the special character of variscite at VdH is reflected in its differential presence in the necropolis. It has been found in four caves, and at least in Cave 3 it was clearly dissociated from the burials with Bell Beaker pottery, indicating a known mortuary formula. Variscite is also restricted to specific individuals. In the chamber of Cave 3 the beads were associated with an adult female (M9), out of the ten individuals (at least two males and two females) in the chamber. The variscite beads were around her neck, whereas the rest of the collective grave goods were deposited around the burials. The 43 threaded beads, with an overall length of 14cm, would only cover the central part of the necklace unless there were some knots or organic elements between them. The situation in the ante-chamber was different as the association was more generic, with a group of three individuals and the combination of amber, Trivia, clinochlore and variscite (Figure 16).

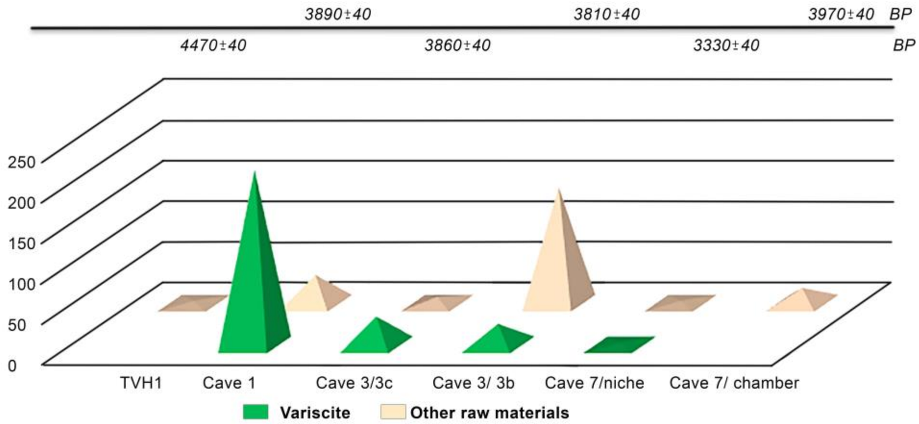

Figure 16: Proportion of variscite adornments and other raw materials in each cave in Valle de las Higueras.

Radiocarbon dates available for sites in the middle and upper Tagus valley show that the variscite appeared at the time of the peak production at the production locus of Las Peñas de Quiruelas (Zamora) (Villalobos García and Odriozola, 2016). At VdH, this was in the mid-3rd millennium BC, when several caves had been dug open in the necropolis and Beakers were present. As the Summed Probability Distribution of the variscite caves at VdH shows, the maximum density is slightly displaced to more recent dates than in the deposits with variscite at Humanejos or Rebollosillo (Figure 17).

Unfortunately, no morphometric study has been made of the variscite adornments in the Tagus valley because it would be interesting to know not only the number but also the amount of raw material. The study carried out at VdH shows some differences and similarities regarding other assemblages of variscite beads in Iberia. It differs from the large Neolithic adornments at Chousa Nova (Domínguez Bella and Boveda, 2011) and Alberite (Domínguez Bella, 1996) sites or the Chalcolithic ones at Anta Grande do Zambujeiro, which weigh an average of 20g (Odriozola et al. 2012: 139), whereas the mean weight of the beads at VdH is less than 2g. However, it displays such similarities as the association of variscite and amber (Odriozola et al., 2019) which might indicate that they used the same supply chain for exotic raw materials. Combinations in the same necklaces are certainly frequent.

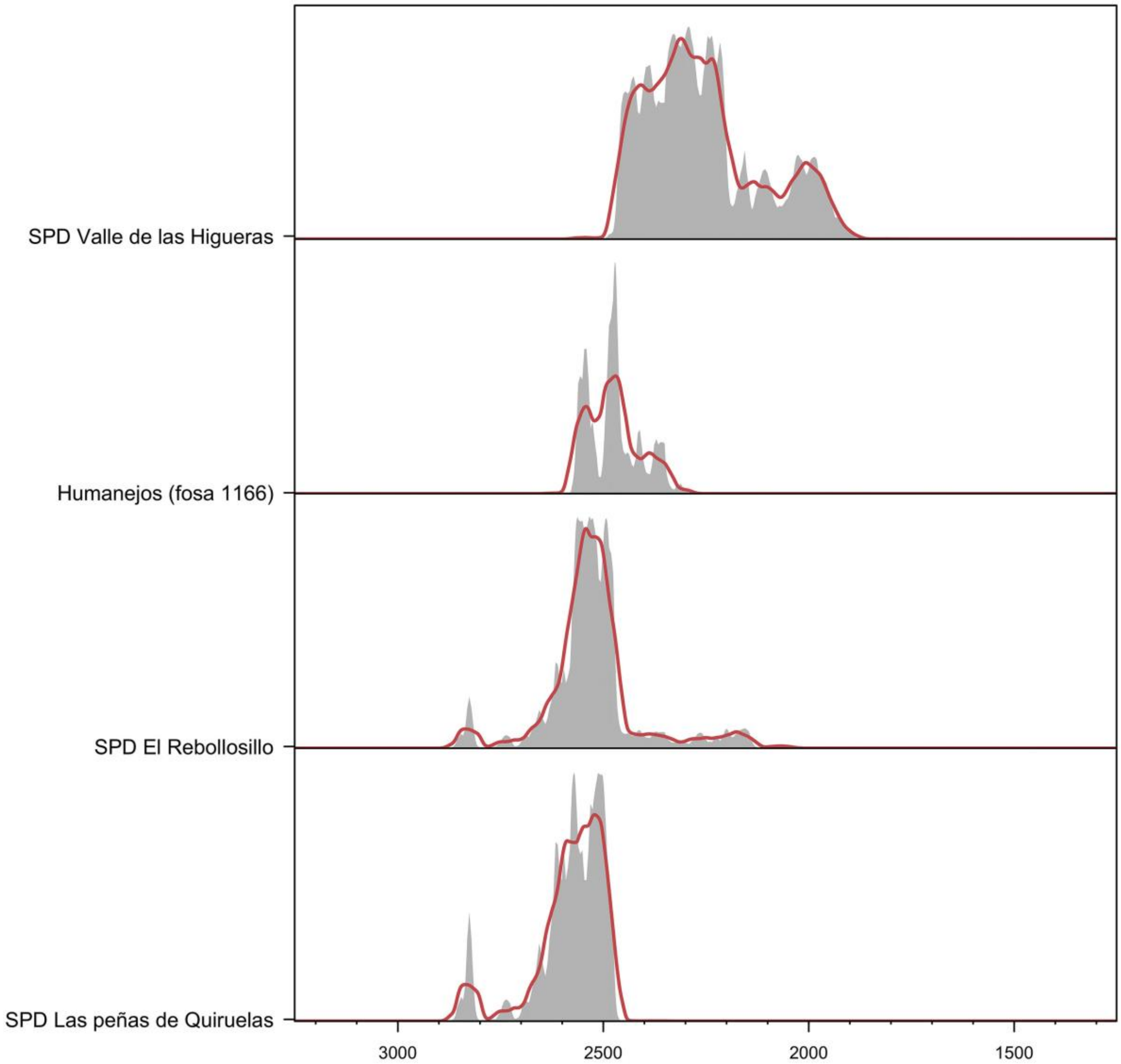

Figure17: Summed probability distributions (SPDs) of radiocarbon dates of studied area sites with variscite beads and the variscite production locus of Las Peñas de Quiruelas (Zamora).

Plaques of variscite beads in the first fabrication stages have been confirmed at several sites in the Iberian Peninsula dated in both the Neolithic and Chalcolithic (Villalobos García and Odriozola, 2016; Odriozola et al., 2016b; Fábregas and Rodríguez-Rellán, 2017). In the area of study, the only case is Camino de las Yeseras. The plaque might be evidence of the local fabrication of adornments, as the site also contained lithic and metal production workshops (Ríos, 2011: 391). However, the evidence is scanty and the context imprecise. Artefacts and unmanufactured raw material could possess the same value. Unworked variscite was collected and added to grave goods in several Iberian funerary monuments (Valera, 2013; Oliva, 2015: 378). Therefore, it seems reasonable to propose the arrival of manufactured products in inland Iberia although they later had their own biography. Use-wear is normally visible around the perforation, clearly showing that the beads from VdH were worn before being deposited as grave goods. The striations due to the polishing process are predominantly found on the sides, which suggests their production as necklace elements. Variability is observed in the finishing of the beads. Larger beads were polished until they were shiny while other small beads kept an irregular outline, however uniformity is also noticeable when a necklace can be identified, as in the case of Cave 3. This would suggest the existence of batches with a normalised productive process and necklaces that were acquired ready-made.

The location of VdH and Humanejos over 250km from the sources of variscite suggests a supply of manufactured products through exchange networks. These networks were operating from the 4th millennium BC, as the chronologies of Alberite and Chousa Nova show (Domínguez Bella and Bóveda, 2011; Domínguez Bella, 1996). Furthermore, the greater mobility of products than of people fits the pattern of low migration in the region identified through isotopic analyses (Díaz del Río et al., 2017b).

Other select products arrived together with the variscite. Many elements circulated between western and inland Iberia, even implicating fortified sites near the Atlantic coast (Odriozola et al., 2013a). Pottery with symbolic decoration, limestone recipients and idols connect western and interior sites in the Iberian Peninsula (Villalobos García, 2015). The interior was also linked to the Atlantic circuits for copper, gold (Barroso et al., 2003; Blasco Bosqued et al., 2016) and ivory (Schuhmacher and Banerjee, 2012; Liesau, 2016). At VdH it is reasonable to imagine the joint arrival of variscite and seashells. The association of *Trivia* and mineral beads in the same necklace is well known at European sites and is interpreted as the symbolic association of terrestrial and marine resources (Jeunesse, 2002).

The cultural and spatial proximity of the sites of VdH and Camino de las Yeseras, about 80km from one another, and Humanejos, located between them, delimits an area with resources in common. Within this area, similar material records might be expected but there are differences. Variscite stands out at VdH together with amber, but the gold and ivory at Humanejos and Camino de las Yeseras is missing. It seems that over and above any centralised supra-organisation, the differences in acquiring variscite are due to the political and socioeconomic strategies at each site.

Finally, regarding the question of what was exchanged for those exogenous materials, salt is a possibility to consider. The drop in the production on the coast of the Iberian Peninsula coincided with an increase in inland production (Valera, 2017), which was particularly important in the mid-3rd millennium BC (Barroso et al., 2017). Since its value is not only economic but also social and symbolic, it is coherent to propose new distribution areas of salt from the interior, using the same circulation networks as for personal ornaments.

6. CONCLUSION

VdH demonstrates the importance of variscite in inland Iberian during the Chalcolithic. Domestic and funerary sites in the Tagus valley have yielded adornments in the course of their Neolithic and Chalcolithic occupation. However, it was in the mid-3rd millennium when the beads acquired a major role in the grave goods at VdH. Variscite beads together with beads made of shells from the Atlantic and Sicilian amber amount to a distant provenance of 86% of the adornments in the necropolis and the positioning of its communities in large exchange circuits.

The information from Cave 3, in accordance with such other sites in the Tagus valley as Humanejos (Odriozola et al., 2017), indicates the access of a few individuals to variscite, its association with plain ware and metal, and its dissociation from Bell Beaker pottery. In Cave 3, beakers are limited to the burials in the niches annexed to the chambers with variscite. The variscite adornments in VdH necropolis were strictly selected and codified by the communities and were the only adornments attributed individually to the deceased in collective or multiple burials. However, it is difficult to know the criteria for its inclusion. Both adults and children were worthy of variscite and wore the beads in necklaces and bracelets. The radiocarbon analyses date the variscite trade in the area in the second half of the 3rd millennium BC.

We do not know the production process for the beads at VdH so they would have arrived as manufactured products. The morphological study has determined a majority of discoidal and short beads. The quantitative expansion of exchange networks that characterises the Chalcolithic may have encouraged the production of objects as these adornments were easily transported over long distances.

It is not possible to determine a definite geological source for the variscite at VdH, although Zamora is the most plausible provenance because its presence in the Tagus valley coincides with the time of peak production at the variscite workshop of Las Peñas de Quiruelas (Zamora). At VdH its consumption took place at a slightly more later time, in a variation from what might be regarded as the regional pattern according to the radiocarbon dates. It might be posited that this difference is owing to a change in the regional socioeconomic dynamics and the pre-eminence of the individuals buried at VdH. In any case, the time of greatest activity in the mines often fails to coincide exactly with the archaeological deposits (Rodríguez-Rellán and Fábregas, 2019), possibly because information is still quite limited at our sites.

Whatever the geological source, the mineral must have arrived from outside the local and regional catchment areas. Variscite was therefore included in a complex exchange network but its small volume means that it is unlikely that it monopolised the trade routes. The exchanges must have simultaneously implied other distant raw materials which, at VdH, would include seashells, variscite, cinnabar and amber, equally related to ostentation in burials. The association of red, white and green colours in those different elements would not have occurred by chance but have been intentional.

Distances are not a conditioning factor in the acquisition of all kinds of symbolic and distinctive items but we know little about the process of their acquisition. The study of the variscite trade and distribution around the Iberian Peninsula shows the long distances it travelled and significant differences in its importance compared with local and regional resources. This heterogeneous panorama suggests an irregular supply and different ways of procuring, using and valuing variscite depending on the socioeconomic organisation of each site and its connection to the exchange networks.

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Supplementary Information: p-XRF results of the beads at Valle de las Higueras.

ID	Mg	Al	Si	P	S	Cl	K	Ca	TI	V	Cr	Mn	Fe	Co	Cu	Zn	As	Rb	Sr	Zr
Cave 1																				
VH99/c1/SR/18	0	26,37	45,72	0,30	0	0	0,37	0,88	0,71	0,02	0,01	0,15	25,32	0	0,02	0,02	0,01	0,05	0,01	0,02
VH99/C1/SR/19	0	23,30	54,68	14,76	0	0	1,56	4,13	0,16	0,14	0,27	0,01	0,93	0	0,01	0,01	0,02	0	0,01	0
VH99/C1/SR/21	0	26,99	43,82	24,85	0	0	1,70	0,95	0,20	0,06	0,15	0	1,21	0	0,02	0,01	0,02	0	0,01	0
VH99/C1/SR/22	0	31,65	31,20	34,73	0	0	0,75	0,68	0,06	0,07	0,15	0	0,64	0	0,01	0	0,03	0,01	0	0
VH99/C1/SR/24	0	27,25	44,76	25,32	0	0	1,00	0,80	0,09	0,13	0,17	0	0,42	0	0,01	0,01	0,01	0	0	0,01
VH99/C1/SR/25	0	28,15	42,03	26,38	0	0	0,78	1,76	0,19	0,10	0,22	0	0,32	0	0,01	0,01	0,02	0	0,01	0,01
VH99/C1/SR/26	0	29,66	36,16	30,49	0	0	0,84	0,95	0,11	0,09	0,17	0	1,45	0	0,01	0	0,06	0	0	0,01
VH99/C1/SR/27	0	27,02	44,82	24,93	0	0	0,60	1,54	0,14	0,11	0,17	0	0,63	0	0,01	0	0,01		0	0,01
VH99/C1/SR/28	0	26,35	46,35	24,11	0	0	0,29	1,93	0,15	0,11	0,18	0	0,46	0	0,01	0	0,01		0	0
VH99/C1/SR/29	0	25,48	50,83	18,93	0	0	0,83	3,07	0,09	0,06	0,20	0	0,44	0	0,01	0	0,02		0	0
VH99/C1/SR/30	0	28,90	40,16	28,24	0	0	0,45	1,16	0,08	0,10	0,20	0	0,66	0	0,01	0	0,01		0	0,01
VH99/C1/SR/31	0	30,24	34,90	32,27	0	0	0,66	0,95	0,09	0,08	0,12	0	0,64	0	0,01	0	0,01		0	0
VH99/C1/SR/33	0	29,71	39,02	28,69	0	0	0,46	1,67	0,03	0,04	0,09	0	0,25	0	0	0,01	0,01	0	0	0
VH99/C1/SR/34	0	31,01	32,77	33,92	0	0	0,34	0,95	0,15	0,09	0,11	0	0,61	0	0,01	0	0,02		0	0
VH99/C1/SR/35	0	27,65	44,67	24,81	0	0	0,80	1,40	0,06	0,11	0,17	0	0,27	0	0,01	0,01	0,01	0	0,01	0
VH99/C1/SR/36	0	29,93	37,45	30,60	0	0	0,59	0,99	0,02	0,04	0,17	0	0,15	0	0,01	0,01	0,01	0	0	0,01
VH99/C1/SR/37	0	30,94	33,40	32,75	0	0	0,76	1,19	0,08	0,09	0,30	0	0,41	0	0,01	0,01	0,02	0	0,02	0
VH99/C1/SR/38	0	23,99	48,95	18,86	0	0	0,46	1,90	0,25	0,07	0,16	0,01	5,27	0	0,02	0,01	0,02	0	0,01	0,01
VH99/C1/SR/39	0	27,12	44,71	24,56	0	0	0,82	1,34	0,13	0,11	0,25	0	0,89	0	0,01	0	0,02	0	0	0
VH99/C1/SR/40	0	29,56	36,86	30,49	0	0	0,39	1,44	0,13	0,13	0,24	0	0,68	0	0,01	0,01	0,01	0	0,01	0,01
VH99/C1/SR/41	0	28,44	41,89	26,78	0	0	0,36	1,71	0,08	0,07	0,16	0	0,46	0	0,01	0,01	0,01	0	0,02	0,01
VH99/C1/SR/42	0	32,40	23,73	39,55	0	0	0,19	0,88	0,14	0,18	0,28	0	2,57	0	0,01	0	0,02	0	0	0,02
VH99/C1/SR/43	0	28,67	41,59	27,38	0	0	0,68	1,19	0,04	0,09	0,08	0	0,24	0	0,01	0,01	0,01	0	0	0
VH99/C1/SR/44	0	32,03	29,92	35,61	0	0	0,19	0,66	0,18	0,05	0,24	0	1,05	0	0,01	0,01	0,02	0	0	0,01
VH99/C1/SR/45	0	29,94	36,05	31,70	0	0	0,23	1,05	0,07	0,07	0,06	0	0,77	0	0,01	0,01	0,02	0	0	0
VH99/C1/SR/46	0	25,79	47,72	24,27	0	0	0,46	1,26	0,04	0,07	0,15	0	0,22	0	0,01	0	0,01	0	0	0
VH99/C1/SR/47	0	22,86	56,53	14,02	0	0	0,79	1,89	0,19	0,03	0,23	0	3,34	0	0,01	0,01	0,04	0	0	0,01
VH99/C1/SR/48	0	28,87	39,85	29,02	0	0	0,36	1,10	0,07	0,08	0,06	0	0,54	0	0,01	0	0,01	0	0	0,01
VH99/C1/SR/49	0	29,73	37,19	29,85	0	0	0,42	1,38	0,24	0,11	0,25	0	0,75	0	0,01	0	0,01	0	0,01	0,03
VH99/C1/SR/50	0	30,12	35,53	31,63	0	0	0,62	1,63	0,03	0,09	0,08	0	0,24	0	0	0,01	0,01	0	0	0
VH99/C1/SR/51	0	34,45	25,07	38,92	0	0	0,45	0,68	0,03	0,06	0,13	0	0,16	0	0,01	0,01	0,01	0	0	0
VH99/C1/SR/52	0	34,73	23,58	39,23	0	0	0,50	0,82	0,05	0,08	0,08	0	0,89	0	0,01	0,01	0,01	0	0	0,01
VH99/C1/SR/53	0	32,35	30,97	34,48	0	0	0,39	0,84	0,15	0,11	0,20	0	0,45	0	0,01	0,01	0,01	0	0	0
VH99/C1/SR/54	0	35,57	21,86	40,66	0	0	0,25	0,79	0,04	0,13	0,14	0	0,51	0	0,01	0,01	0,01	0	0	0,01
VH99/C1/SR/55	0	34,27	23,11	40,62	0	0	0,30	1,07	0,08	0,07	0,22	0,01	0,21	0	0,01	0,01	0,01	0	0,01	0
VH99/C1/SR/56	0	25,07	52,68	18,18	0	0	0,51	2,14	0,27	0,05	0,20	0	0,82	0	0,01	0	0,01	0	0	0,01
VH99/C1/SR/57	0	26,71	43,79	24,47	0	0	0,80	1,64	0,25	0,13	0,29	0	1,85	0	0,01	0,01	0,01	0	0	0,02
VH99/C1/SR/58	0	29,66	38,51	29,40	0	0	0,36	1,20	0,09	0,07	0,14	0	0,51	0	0,01	0	0,01	0	0	0,01
VH99/C1/SR/59	0	30,35	36,24	30,60	0	0	0,30	1,32	0,13	0,07	0,13	0	0,80	0	0,01	0	0,02	0	0	0,01
VH99/C1/SR/60	0	29,86	37,84	30,22	0	0	0,52	1,11	0,05	0,07	0,14	0	0,14	0	0,01	0,01	0,01	0	0	0,01
VH99/C1/SR/61	0	28,26	43,39	26,19	0	0	0,63	1,00	0,04	0,09	0,15	0	0,21	0	0,01	0,01	0,01	0	0	0

VH99/C1/SR/62	0	36,64	20,68	41,52	0	0	0,15	0,57	0,03	0,11	0,14	0	0,14	0	0,01	0	0	0	0	0,01
VH99/C1/SR/63	0	21,65	64,58	9,27	0	0	0,93	2,48	0,17	0,05	0,20	0,01	0,57	0	0,01	0,01	0,02	0	0,01	0,01
VH99/C1/SR/64	0	29,25	38,00	29,57	0	0	0,46	1,02	0,11	0,10	0,10	0	1,32	0	0,01	0,01	0,02	0	0,01	0
VH99/C1/SR/65	0	29,97	37,01	30,36	0	0	0,59	0,94	0,05	0,14	0,27	0	0,62	0	0,01	0,01	0,01	0	0	0
VH99/C1/SR/66	0	32,42	30,30	34,69	0	0	0,32	1,33	0,09	0,07	0,15	0,01	0,56	0	0,01	0,01	0,01	0	0,01	0
VH99/C1/SR/67	0	28,31	40,58	28,40	0	0	0,51	1,29	0,09	0,11	0,12	0	0,54	0	0,01	0,01	0,01	0	0	0
VH99/C1/SR/68	0	32,75	29,72	35,19	0	0	0,09	1,30	0,12	0,10	0,28	0	0,38	0	0,01	0	0,01	0	0,01	0,02
VH99/C1/SR/69	0	26,14	40,67	27,90	0	0	0,29	1,21	0,22	0,12	0,25	0	3,14	0	0,01	0	0,01	0	0	0,01
VH99/C1/SR/70	0	29,46	37,43	29,94	0	0	0,57	1,37	0,14	0,12	0,24	0	0,70	0	0,01	0	0,01	0	0	0,01
VH99/C1/SR/71	0	19,13	60,07	15,84	0	0	0,59	3,15	0,12	0,09	0,15	0	0,80	0	0,01	0	0,01	0	0,01	0,01
VH99/C1/SR/72	0	30,66	37,91	28,82	0	0	0,39	1,36	0,11	0,06	0,09	0	0,56	0	0,01	0	0,01	0	0,01	0
VH99/C1/SR/73	0	25,68	51,95	18,93	0	0	0,43	1,97	0,15	0,11	0,12	0	0,60	0	0,01	0	0,02	0	0,01	0,01
VH99/C1/SR/74	0	32,38	30,07	35,33	0	0	0,33	1,08	0,05	0,15	0,12	0	0,46	0	0,01	0,01	0,01	0	0	0,01
VH99/C1/SR/75	0	31,82	31,15	34,40	0	0	0,25	1,12	0,14	0,11	0,20	0	0,74	0	0,01	0	0,01	0	0,01	0,01
VH99/C1/SR/76	0	29,97	35,46	31,77	0	0	0,25	1,41	0,11	0,05	0,14	0	0,77	0	0,01	0	0,02	0	0,01	0,01
VH99/C1/SR/77	0	32,42	30,18	35,39	0	0	0,49	0,91	0,05	0,13	0,21	0	0,18	0	0,01	0,01	0,01	0	0	0,01
VH99/C1/SR/78	0	34,33	22,12	41,45	0	0	0,18	0,67	0,10	0,04	0,18	0	0,87	0	0,01	0	0,02	0	0	0,01
VH99/C1/SR/79	0	27,37	43,99	24,41	0	0	0,51	1,90	0,07	0,07	0,15	0	1,46	0	0,01	0	0,03	0	0	0
VH99/C1/SR/80	0	27,47	44,98	24,83	0	0	0,48	1,73	0,04	0,12	0,10	0	0,23	0	0	0	0,01	0	0	0
VH99/C1/SR/81	0	27,31	44,35	25,77	0	0	0,62	1,18	0,04	0,11	0,22	0	0,37	0	0,01	0,01	0,01	0	0	0
VH99/C1/SR/82	0	23,05	56,59	14,81	0	0	0,47	3,54	0,25	0,07	0,10	0	1,06	0	0,01	0,01	0,01	0	0,01	0
VH99/C1/SR/83	0	29,40	37,70	31,00	0	0	0,27	0,84	0,06	0,10	0,19	0	0,37	0	0,01	0,01	0,02	0	0	0,01
VH99/C1/SR/84	0	25,68	43,34	24,55	0	0	0,44	1,37	0,17	0,09	0,23	0,01	4,01	0	0,02	0	0,06	0,01	0,01	0,01
VH99/C1/SR/85	0	29,31	38,87	29,68	0	0	0,37	1,04	0,05	0,13	0,29	0,01	0,22	0	0,01	0	0,01	0	0	0
VH99/C1/SR/86	0	28,83	37,85	29,27	0	0	0,71	0,84	0,18	0,07	0,16	0	2,02	0	0,02	0	0,02	0	0	0
VH99/C1/SR/87	0	29,02	35,18	31,87	0	0	0,24	1,00	0,18	0,08	0,21	0	2,16	0	0,01	0	0,01	0	0	0,02
VH99/C1/SR/88	0	29,16	38,04	29,59	0	0	0,45	1,09	0,10	0,08	0,21	0	1,23	0	0,01	0,01	0,01	0	0	0
VH99/C1/SR/89	0	30,07	36,00	30,73	0	0	0,44	1,03	0,22	0,08	0,15	0	1,22	0	0,01	0,01	0,02	0	0	0,01
VH99/C1/SR/90	0	31,29	33,35	33,11	0	0	0,38	0,94	0,05	0,08	0,26	0	0,48	0	0,01	0,01	0,01	0	0	0
VH99/C1/SR/91	0	32,99	29,44	35,52	0	0	0,45	0,84	0,03	0,11	0,17	0	0,41	0	0,01	0	0,01	0	0	0
VH99/C1/SR/92	0	31,81	31,00	34,17	0	0	0,41	0,91	0,17	0,09	0,19	0	1,19	0	0,01	0,01	0,01	0	0	0,01
VH99/C1/SR/93	0	31,56	32,34	34,15	0	0	0,52	0,73	0,04	0,11	0,21	0	0,29	0	0,01	0,01	0,01	0	0	0,01
VH99/C1/SR/94	0	26,60	44,84	23,87	0	0	0,26	1,53	0,10	0,09	0,16	0	2,50	0	0,01	0	0,02	0	0,01	0,01
VH99/C1/SR/95	0	28,90	41,78	26,71	0	0	0,24	1,72	0,05	0,08	0,10	0	0,37	0	0,01	0	0,01	0	0,01	0
VH99/C1/SR/96	0	32,34	31,28	34,10	0	0	0,19	0,86	0,08	0,06	0,13	0	0,91	0	0,01	0	0,03	0	0	0,01
VH99/C1/SR/97	0	27,85	44,63	25,01	0	0	0,25	1,64	0,06	0,06	0,12	0	0,34	0	0,01	0,01	0,01	0	0	0,01
VH99/C1/SR/98	0	33,97	26,66	37,67	0	0	0,34	0,61	0,08	0,08	0,17	0	0,32	0	0,01	0	0,02	0	0,01	0
VH99/C1/SR/99	0	31,00	31,57	34,53	0	0	0,28	1,48	0,15	0,06	0,29	0	0,57	0	0,01	0,01	0,01	0	0	0,02
VH99/C1/SR/100	0	29,99	34,28	32,64	0	0	0,26	1,98	0,09	0,08	0,24	0	0,40	0	0,01	0,01	0,01	0	0	0
VH99/C1/SR/101	0	23,69	52,03	19,40	0	0	0,45	2,36	0,25	0,11	0,16	0	1,46	0	0,01	0,01	0,01	0	0,02	0,02
VH99/C1/SR/102	0	30,44	33,60	32,69	0	0	0,25	0,83	0,14	0,14	0,21	0	1,65	0	0,01	0,01	0,01	0	0	0,01
VH99/C1/SR/103	0	33,40	28,54	36,51	0	0	0,39	0,71	0,07	0,07	0,07	0	0,21	0	0,01	0	0,01	0	0,01	0
VH99/C1/SR/104	0	34,68	25,01	38,70	0	0	0,34	0,57	0,15	0,07	0,17	0	0,26	0	0,01	0	0,02	0	0	0
VH99/C1/SR/105	0	26,78	43,18	27,57	0	0	0,36	1,15	0,06	0,14	0,30	0	0,42	0	0,01	0	0,01	0	0,01	0,01
VH99/C1/SR/106	0	26,52	45,15	25,26	0	0	0,46	1,24	0,12	0,10	0,26	0	0,83	0	0,01	0,01	0,01	0	0,01	0

VH99/C1/SR/107	0	30,42	31,49	34,56	0	0	0,36	0,82	0,14	0,10	0,18	0	1,86	0	0,02	0,01	0,01	0	0	0,02
VH99/C1/SR/108	0	32,52	29,78	35,67	0	0	0,33	0,69	0,10	0,11	0,21	0	0,51	0	0,03	0,01	0,02	0	0,01	0
VH99/C1/SR/109	0	28,32	39,35	30,04	0	0	0,33	0,94	0,10	0,13	0,20	0	0,53	0	0,01	0,01	0,02	0	0,01	0
VH99/C1/SR/110	0	31,12	35,20	31,87	0	0	0,40	0,97	0,02	0,13	0,05	0	0,19	0	0,01	0,01	0,01	0	0	0
VH99/C1/SR/111	0	26,74	44,24	23,34	0	0	0,57	1,42	0,19	0,15	0,22	0	3,07	0	0,01	0	0,01	0	0	0,01
VH99/C1/SR/112	0	31,45	33,17	33,30	0	0	0,33	1,12	0,06	0,04	0,09	0	0,40	0	0,01	0,01	0,02	0	0	0
VH99/C1/SR/113	0	28,52	36,55	31,00	0	0	0,76	0,85	0,26	0,10	0,26	0	1,61	0	0,02	0	0,04	0	0	0,01
VH99/C1/SR/114	0	32,78	29,59	35,25	0	0	0,32	1,08	0,06	0,09	0,32	0	0,47	0	0,01	0	0,01	0	0,01	0
VH99/C1/SR/115	0	20,55	65,09	8,28	0	0	0,52	3,67	0,12	0,10	0,32	0,01	1,29	0	0,01	0,01	0,02	0	0,01	0
VH99/C1/SR/116	0	31,29	32,54	33,63	0	0	0,24	1,01	0,05	0,13	0,28	0	0,77	0	0,02	0	0,02	0	0	0
VH99/C1/SR/117	0	30,90	32,56	33,78	0	0	0,43	1,66	0,09	0,08	0,25	0	0,22	0	0,01	0,01	0,01	0	0	0
VH99/C1/SR/118	0	33,48	27,16	37,46	0	0	0,47	0,79	0,11	0,05	0,17	0	0,27	0	0,01	0,01	0,01	0	0	0
VH99/C1/SR/119	0	21,82	52,26	16,34	0	0	0,37	2,29	0,21	0,10	0,17	0,01	6,34	0	0,02	0	0,02	0	0	0,01
VH99/C1/SR/120	0	35,52	21,46	41,54	0	0	0,33	0,50	0,04	0,16	0,17	0	0,25	0	0	0	0,01	0	0	0
VH99/C1/SR/121	0	32,29	29,87	35,23	0	0	0,22	1,36	0,13	0,07	0,21	0	0,54	0	0,01	0,01	0,02	0	0	0
VH99/C1/SR/122	0	25,39	43,55	25,32	0	0	0,51	0,88	0,25	0,11	0,26	0,01	3,61	0	0,02	0,01	0,04	0	0	0,01
VH99/C1/SR/123	0	44,54	5,62	38,43	0	0	0,14	0,31	0,06	0	0,04	0	3,15	0	7,57	0,09	0,01	0	0,01	0,01
VH99/C1/SR/124	0	30,81	33,61	33,16	0	0	0,61	1,15	0,05	0,07	0,17	0	0,31	0	0,02	0,01	0,01	0	0	0
VH99/C1/SR/125	0	26,36	47,09	22,80	0	0	0,40	2,25	0,13	0,19	0,25	0	0,49	0	0,01	0,01	0	0	0,01	0,01
VH99/C1/SR/126	0	31,39	33,41	33,51	0	0	0,49	0,63	0,03	0,07	0,14	0	0,26	0	0,01	0	0,02	0	0	0
VH99/C1/SR/127	0	30,73	35,51	31,82	0	0	0,13	1,31	0,02	0,06	0,07	0	0,30	0	0,01	0,01	0,01	0	0	0
VH99/C1/SR/128	0	34,31	25,06	38,48	0	0	0,16	1,14	0,08	0,08	0,08	0	0,56	0	0,01	0,01	0,01	0	0,01	0
VH99/C1/SR/129	0	28,02	40,58	28,41	0	0	0,15	2,30	0,05	0,10	0,11	0	0,23	0	0,01	0,01	0,01	0	0	0
VH99/C1/SR/130	0	28,84	39,71	28,59	0	0	0,32	1,22	0,05	0,13	0,08	0	0,98	0	0,02	0,01	0,01	0	0	0,02
VH99/C1/SR/131	0	33,23	27,63	37,23	0	0	0,38	0,87	0,05	0,11	0,16	0	0,30	0	0,01	0	0,01	0	0	0
VH99/C1/SR/132	0	26,85	45,82	24,00	0	0	0,58	1,94	0,09	0,12	0,20	0	0,37	0	0,01	0,01	0,01	0	0,01	0
VH99/C1/SR/133	0	28,51	39,86	28,23	0	0	0,75	1,61	0,15	0,07	0,19	0	0,57	0	0,01	0	0,02	0	0	0,01
VH99/C1/SR/134	0	34,61	24,21	39,04	0	0	0,33	0,48	0,09	0,09	0,20	0	0,86	0	0,01	0	0,04	0	0	0
VH99/C1/SR/135	0	29,77	34,19	32,58	0	0	0,66	1,68	0,06	0,14	0,16	0	0,69	0	0,01	0,01	0,01	0	0,01	0,02
VH99/C1/SR/136	0	27,32	44,84	24,23	0	0	0,45	1,76	0,15	0,18	0,39	0,01	0,60	0	0,02	0,01	0,01	0	0	0,01
VH99/C1/SR/137	0	29,60	38,29	29,49	0	0	0,57	1,22	0,05	0,10	0,20	0	0,43	0	0,01	0	0,02	0	0	0
VH99/C1/SR/138	0	32,44	25,95	39,04	0	0	0,66	0,62	0,14	0,08	0,31	0	0,66	0	0,03	0,01	0,03	0	0	0,01
VH99/C1/SR/139	0	31,89	29,59	35,58	0	0	0,16	1,55	0,11	0,11	0,17	0	0,78	0	0,01	0,01	0,01	0	0,01	0,01
VH99/C1/SR/140	0	21,44	61,91	10,56	0	0	0,50	3,93	0,14	0,15	0,12	0	1,16	0	0,02	0,01	0,02	0	0,02	0,01
VH99/C1/SR/141	0	31,98	29,97	35,50	0	0	0,59	1,16	0,03	0,11	0,19	0	0,42	0	0,01	0	0,03	0	0	0
VH/C1/P1/15	0	28,51	42,90	25,64	0	0	0,81	1,39	0,07	0,10	0,22	0	0,32	0	0,01	0,01	0,01	0	0	0,01
VH/C1/P1/16	0	29,08	38,09	29,58	0	0	0,57	1,78	0,08	0,08	0,14	0	0,55	0	0,01	0	0,03	0	0	0
VH/C1/P1/17	0	25,40	47,54	22,52	0	0	0,89	1,07	0,38	0,13	0,30	0,01	1,64	0	0,01	0	0,02	0	0	0,03
VH/C1/P1/18	0	27,89	41,51	27,57	0	0	0,72	1,82	0,08	0,07	0,13	0	0,16	0	0,01	0,01	0,01	0	0	0
VH/C1/P1/19	0	29,65	35,85	31,59	0	0	0,26	1,38	0,11	0,13	0,22	0	0,74	0	0,01	0	0,01	0	0	0
VH/C1/P1/20	0	23,13	49,14	19,39	0	0	0,23	1,97	0,28	0,06	0,24	0,01	5,46	0	0,02	0	0,04	0,01	0	0,01
VH/C1/P1/21	0	25,76	47,68	23,59	0	0	0,39	1,38	0,11	0,06	0,26	0	0,73	0	0,01	0	0,01	0	0	0
VH/C1/P1/22	0	25,21	53,99	16,97	0	0	1,27	1,29	0,16	0,09	0,19	0,01	0,75	0	0,01	0,01	0,01	0	0,01	0
VH/C1/P1/23	0	28,95	37,84	30,29	0	0	0,40	1,19	0,15	0,04	0,09	0	0,98	0	0,01	0,01	0,02	0	0	0,01
VH/C1/C1/I/22	0	24,38	51,24	19,93	0	0	0,88	1,66	0,14	0,19	0,11	0	1,38	0	0,02	0,01	0,01	0	0,02	0,01

VH/C1/C1/I/23	0	25,34	50,88	20,81	0	0	0,71	1,51	0,10	0,10	0,11	0	0,42	0	0,01	0	0,01	0	0	0
VH/C1/C1/I/24	0	26,36	50,39	19,47	0	0	0,20	2,60	0,26	0,05	0,26	0	0,36	0	0,01	0	0,01	0	0,01	0,01
VH/C1/C1/I/25	0	26,96	44,83	23,89	0	0	0,29	1,98	0,29	0,06	0,21	0	1,42	0	0,02	0	0,02	0	0	0,01
VH/C1/C1/I/26	0	28,31	40,03	27,74	0	0	0,21	2,02	0,16	0,08	0,23	0	1,16	0	0,01	0	0,01	0	0,01	0,01
VH/C1/C1/I/27	0	27,02	44,82	24,93	0	0	0,60	1,54	0,14	0,11	0,17	0	0,63	0	0,01	0	0,01	0	0,01	0,01
VH/C1/C1/I/28	0	26,35	46,35	24,11	0	0	0,29	1,93	0,15	0,11	0,18	0	0,46	0	0,01	0	0,01	0	0	0,01
VH/C1/C1/I/29	0	25,48	50,83	18,93	0	0	0,83	3,07	0,09	0,06	0,20	0	0,44	0	0,01	0	0,02	0	0	0
VH/C1/C1/I/30	0	28,90	40,16	28,24	0	0	0,45	1,16	0,08	0,10	0,20	0	0,66	0	0,01	0	0,01	0	0,01	0
VH/C1/C1/I/31	0	33,14	23,11	40,69	0	0	0,33	0,36	0,21	0,05	0,39	0	1,65	0	0,01	0	0,01	0	0	0,01
VH/C1/C1/I/32	0	30,24	34,90	32,27	0	0	0,66	0,95	0,09	0,08	0,12	0	0,64	0	0,01	0	0,01	0	0	0
VH/C1/C1/I/33	0	29,04	40,56	27,34	0	0	0,58	1,98	0,06	0,09	0,10	0	0,23	0	0,01	0	0,01	0	0	0
VH/C1/C1/I/34	0	31,01	32,77	33,92	0	0	0,34	0,95	0,15	0,09	0,11	0	0,61	0	0,01	0	0,02	0	0	0,01
VH/C1/C1/I/35	0	25,81	46,62	22,47	0	0	1,34	2,80	0,16	0,06	0,19	0	0,46	0	0,01	0	0,03	0	0,01	0,01
VH/C1/C1/I/36	0	21,24	63,36	10,30	0	0	0,19	3,43	0,19	0,14	0,27	0	0,82	0	0,01	0,01	0,01	0	0,01	0,01
VH/C1/C1/I/37	0	26,42	44,80	25,53	0	0	0,35	1,15	0,23	0,12	0,26	0,01	1,05	0	0,01	0	0,03	0	0	0,01
VH/C1/C1/I/38	0	26,54	42,98	25,31	0	0	0,43	1,20	0,06	0,10	0,12	0	3,22	0	0,01	0	0,01	0	0,01	0
VH/C1/C1/I/39	0	28,79	41,36	27,11	0	0	0,34	1,39	0,18	0,08	0,23	0	0,45	0	0,02	0	0,01	0	0,01	0,01
VH/C1/C1/I/40	0	31,63	30,23	35,23	0	0	0,11	1,09	0,13	0,06	0,21	0	1,26	0	0,01	0	0,01	0	0,01	0,01
VH/C1/C1/I/41	0	25,67	51,69	18,71	0	0	1,48	1,27	0,19	0,08	0,23	0	0,61	0	0,01	0	0,02	0	0	0
VH/C1/C1/I/42	0	30,53	32,49	34,12	0	0	0,35	1,23	0,21	0,11	0,21	0	0,69	0	0,01	0	0,01		0	0
VH/C1/C1/I/43	0	23,11	56,23	15,16	0	0	1,41	2,02	0,21	0,11	0,38	0,01	1,30	0	0,01	0	0,02	0	0,01	0,01
VH/C1/C1/I/44	0	29,40	37,00	30,78	0	0	0,47	0,89	0,19	0,11	0,25	0	0,83	0	0,01	0	0,03	0	0	0,01
VH/C1/C1/I/45	0	28,13	39,45	28,85	0	0	0,23	1,54	0,12	0,06	0,26	0	1,31	0	0,01	0	0,01	0	0	0
VH/C1/C1/I/46	0	27,01	43,29	23,89	0	0	0,70	1,56	0,10	0,07	0,34	0,01	2,98	0	0,01	0	0,02	0	0,01	0,01
VH/C1/C1/I/47	0	34,78	24,02	39,54	0	0	0,21	0,94	0,04	0,06	0,14	0	0,23	0	0,01	0	0,01	0	0	0
VH/C1/C1/I/48	0	31,16	30,53	35,51	0	0	0,17	2,06	0,06	0,07	0,11	0	0,28	0	0,01	0	0,01		0	0
VH/C1/C1/I/49	0	25,58	52,01	18,84	0	0	1,43	1,17	0,10	0,09	0,13	0	0,61	0	0,01	0	0,01		0	0
VH/C1/C1/I/50	0	31,27	31,83	35,61	0	0	0,15	0,70	0,02	0,06	0,13	0	0,18	0	0,01	0	0,01	0	0	0
VH/C1/C1/I/51	0	28,09	42,96	25,64	0	0	0,54	1,73	0,07	0,15	0,22	0	0,55	0	0,01	0	0	0	0,01	0,01
VH/C1/C1/I/53	0	25,36	46,45	24,44	0	0	0,37	1,64	0,16	0,04	0,11	0	1,36	0	0,01	0	0,03	0	0,01	0
VH/C1/C1/I/54	0	29,58	38,36	29,73	0	0	0,61	1,06	0,07	0,07	0,16	0	0,32	0	0	0	0,01		0	0
VH/C1/C1/I/55	0	27,73	39,35	29,78	0	0	0,23	1,02	0,16	0,15	0,21	0	1,32	0	0,01	0,01	0,02		0	0,01
VH/C1/C1/I/56	0	32,65	29,30	35,87	0	0	0,26	1,33	0,04	0,07	0,15	0	0,27	0	0,01	0	0,01	0	0,01	0,01
VH/C1/C1/I/57	0	26,74	47,55	21,03	0	0	0,96	2,54	0,11	0,07	0,09	0	0,87	0	0,01	0	0,01		0	0,01
VH/C1/C1/I/58	0	29,60	36,58	30,79	0	0	0,38	1,25	0,13	0,09	0,18	0	0,94	0	0,01	0	0,01		0	0
VH/C1/C1/I/59	0	29,87	36,17	31,45	0	0	0,28	0,94	0,11	0,09	0,17	0	0,83	0	0,01	0,01	0,01		0	0,01
VH/C1/C1/I/60	0	23,38	56,50	13,91	0	0	1,29	3,70	0,13	0,06	0,21	0	0,74	0	0,01	0,01	0,02		0	0,01
VH/C1/C1/I/61	0	24,08	51,77	20,31	0	0	0,67	1,40	0,20	0,08	0,18	0	1,23	0	0,01	0	0,02		0	0
VH/C1/C1/I/62	0	30,51	34,99	31,74	0	0	0,29	1,56	0,10	0,07	0,14	0	0,55	0	0,01	0,01	0,01	0	0	0
VH/C1/C1/I/63	0	26,50	46,74	23,65	0	0	0,43	1,60	0,06	0,05	0,12	0	0,80	0	0,01	0	0,03	0	0	0
VH/C1/C1/I/64	0	31,18	33,46	32,47	0	0	0,46	1,60	0,08	0,08	0,22	0	0,41	0	0,01	0	0,02	0	0	0
VH/C1/C1/I/65	0	29,44	38,61	28,88	0	0	0,40	1,77	0,05	0,09	0,19	0	0,53	0	0,01	0	0,01	0	0	0,01
VH/C1/C1/I/66	0	31,63	34,13	32,56	0	0	0,54	0,54	0,05	0,05	0,18	0	0,28	0	0,01	0	0,01		0	0
VH/C1/C1/I/67	0	23,40	57,47	14,60	0	0	0,77	2,00	0,09	0,05	0,17	0	1,39	0	0,01	0	0,04		0	0
VH/C1/C1/I/68	0	26,15	47,07	23,21	0	0	0,22	1,37	0,17	0,09	0,15	0	1,50	0	0,01	0	0,01		0	0

VH/C1/C1/I/69	0	33,20	28,58	36,51	0	0	0,19	0,75	0,07	0,18	0,16	0	0,32	0	0,01	0	0,01		0	0
VH/C1/C1/I/70	0	29,58	38,38	29,22	0	0	0,44	1,20	0,06	0,08	0,15	0	0,78	0	0,01	0	0,09	0	0	0,01
VH/C1/C1/I/71	0	25,47	53,50	14,92	0	0	0,99	3,46	0,16	0,06	0,16	0,01	1,19	0	0,02	0,01	0,02		0	0
VH/C1/C1/I/72	0	28,23	41,21	27,65	0	0	0,49	1,53	0,04	0,12	0,21	0	0,48	0	0,01	0	0,01	0	0	0
VH/C1/C1/I/73	0	16,12	50,50	5,01	0	0	2,26	23,52	0,29	0,04	0,24	0	1,92	0	0,01	0,01	0,02	0	0,02	0,01
VH/C1/C1/I/74	0	22,36	55,58	15,59	0	0	0,41	2,57	0,23	0,09	0,21	0	2,85	0	0,01	0	0,03	0	0,01	0,02
VH/C1/C1/I/75	0	29,27	38,20	29,72	0	0	0,33	1,87	0,08	0,09	0,10	0	0,30	0	0,01	0	0,01	0	0	0
VH/C1/C1/I/76	0	30,53	34,30	32,46	0	0	0,40	0,95	0,16	0,11	0,23	0	0,78	0	0,01	0	0,03	0	0	0
VH/C1/C1/I/77	0	29,32	39,98	27,83	0	0	0,37	1,68	0,09	0,10	0,19	0,01	0,38	0	0,01	0	0,02	0	0	0,01
VH/C1/C1/I/78	0	28,90	39,95	28,22	0	0	0,29	1,60	0,11	0,09	0,19	0	0,59	0	0,01	0	0,01		0	0,01
VH/C1/C1/I/79	0	30,11	36,41	31,08	0	0	0,13	1,37	0,05	0,06	0,18	0	0,58	0	0,01	0	0,01	0	0	0
VH/C1/C1/I/80	0	30,07	36,22	30,91	0	0	0,19	1,93	0,08	0,09	0,08	0	0,40	0	0,01	0	0,01	0	0	0
VH/C1/C1/I/81	0	22,11	62,69	9,53	0	0	1,99	2,04	0,26	0,07	0,15	0,01	1,04	0	0,02	0,01	0,03		0	0
VH/C1/C1/I/82	0	31,67	31,40	34,81	0	0	0,28	0,71	0,23	0,08	0,32	0	0,40	0	0,01	0,01	0,01	0	0,01	0
VH/C1/C1/I/83	0	31,81	32,33	33,98	0	0	0,29	0,66	0,17	0,09	0,19	0	0,41	0	0,01	0	0,01		0	0
VH/C1/C1/II/12	0	42,01	4,21	51,98	0	0	0,13	0,09	0,01	0,09	0,04	0	1,30	0	0,10	0,01	0,02	0	0	0
VH/C1/C1/II/13	0	31,80	29,25	36,21	0	0	0,23	1,27	0,13	0,17	0,23	0	0,67	0	0,01	0	0,01	0	0	0
VH/C1/C1/II/14	0	26,89	45,59	23,16	0	0	0,58	2,87	0,14	0,05	0,12	0	0,54	0	0,01	0,01	0,01	0	0,01	0
VH/C1/C1/II/15	0	32,94	27,41	37,39	0	0	0,18	0,84	0,07	0,13	0,13	0	0,85	0	0,02	0,01	0,01	0	0	0
VH/C1/C1/II/16	0	33,80	25,38	38,73	0	0	0,17	0,96	0,06	0,11	0,16	0	0,57	0	0,01	0,01	0,01	0	0	0
VH/C1/C1/II/17	0	33,04	27,41	38,06	0	0	0,17	0,81	0,08	0,08	0,08	0	0,24	0	0,01	0	0,01	0	0	0
VH/C1/C1/II/18	0	31,80	31,16	34,22	0	0	0,39	1,03	0,25	0,08	0,12	0	0,88	0	0,01	0	0,01	0	0	0
VH/C1/C1/II/19	0	29,93	38,49	29,21	0	0	0,26	1,24	0,09	0,09	0,32	0,01	0,33	0	0,01	0	0	0	0	0,01
VH/C1/C1/II/20	0	29,77	34,51	32,40	0	0	0,11	1,10	0,10	0,11	0,20	0	1,64	0	0,01	0,01	0,01	0	0	0,01
VH/C1/C1/II/21	0	33,61	25,83	38,21	0	0	0,12	1,11	0,23	0,15	0,16	0	0,51	0	0,01	0,01	0,01	0	0,01	0,01
VH/C1/P1/II/22	0	30,48	33,85	32,59	0	0	0,14	1,26	0,06	0,18	0,18	0	1,18	0	0,02	0	0,02	0	0	0
VH/C1/P1/II/23	0	24,32	50,80	19,11	0	0	0,28	2,19	0,15	0,13	0,18	0	2,77	0	0,01	0	0,03	0	0,01	0,01
VH/C1/C1/II/24	0	32,41	32,61	33,28	0	0	0,43	0,64	0,04	0,12	0,15	0	0,28	0	0,01	0	0,01	0	0	0
VH/C1/C1/II/25	0	28,29	41,38	26,67	0	0	0,08	1,91	0,20	0,08	0,10	0	1,24	0	0,01	0	0,01	0	0,01	0,02
VH/C1/C1/II/26	0	18,63	48,26	21,48	0	0	0,20	1,11	0,29	0,05	0,28	0,01	9,54	0	0,03	0	0,06	0,01	0,01	0,01
VH/C1/C1/II/27	0	28,78	41,08	27,65	0	0	0,34	1,32	0,05	0,11	0,13	0	0,49	0	0,01	0	0,02	0,01	0	0,01
VH/C1/C1/II/28	0	25,24	46,64	22,89	0	0	0,14	1,52	0,12	0,10	0,23	0,01	3,04	0	0,02	0,01	0,01	0	0,01	0,01
VH/C1/C1/II/29	0	20,95	57,93	15,37	0	0	0,44	2,51	0,37	0,07	0,19	0	2,04	0	0,02	0,01	0,03	0,01	0,02	0,02
VH/C1/C1/II/30	0	27,84	44,35	24,49	0	0	0,74	1,33	0,10	0,07	0,21	0	0,78	0	0,01	0	0,03	0,01	0,01	0
VH/C1/C1/II/31	0	21,85	57,36	13,12	0	0	0,54	2,95	0,11	0,06	0,16	0	3,79	0	0,02	0	0,01	0	0,01	0
VH/C1/C1/II/32	0	33,25	27,89	36,83	0	0	0,18	1,06	0,08	0,06	0,10	0	0,51	0	0,01	0	0,01	0	0,01	0,02
VH/C1/C1/II/33	0	23,82	56,41	15,50	0	0	0,83	2,18	0,15	0,09	0,13	0	0,82	0	0,01	0	0,02	0	0	0,02
VH/C1/C1/II/34	0	34,81	24,63	39,31	0	0	0,21	0,58	0,04	0,12	0,08	0	0,18	0	0,01	0	0,01	0	0	0
VH/C1/C1/II/35	0	28,51	38,45	29,32	0	0	0,33	0,68	0,13	0,06	0,27	0	2,20	0	0,01	0	0,01	0	0	0,01
VH/C1/C1/II/36	0	26,52	47,67	23,11	0	0	0,40	1,36	0,10	0,06	0,18	0	0,54	0	0,01	0	0,02	0	0,01	0
VH/C1/C1/II/37	0	32,28	30,02	35,08	0	0	0,28	1,22	0,13	0,08	0,18	0	0,67	0	0,01	0,01	0,01	0	0,01	0,01
VH/C1/C1/II/38	0	28,71	38,37	30,57	0	0	0,19	1,05	0,21	0,07	0,13	0	0,65	0	0,01	0	0,02	0	0,01	0,01
VH/C1/P1/II/39	0	26,35	48,16	21,47	0	0	0,22	2,51	0,13	0,06	0,14	0	0,89	0	0,01	0	0,02	0	0,01	0
VH/C1/C1/II/40	0	29,56	39,69	27,67	0	0	1,11	1,25	0,06	0,09	0,10	0	0,40	0	0,03	0	0,01	0	0,01	0,01
VH/C1/C1/II/41	0	30,33	34,25	32,68	0	0	0,33	1,39	0,11	0,05	0,09	0	0,72	0	0,01	0,01	0,01	0	0,01	0

VH/C1/C1/II/42	0	27,44	41,24	27,74	0	0	0,77	1,28	0,08	0,11	0,09	0	1,19	0	0,01	0,01	0,01	0	0,01	0
VH/C1/C1/II/43	0	33,66	26,93	37,33	0	0	0,51	0,69	0,07	0,13	0,27	0	0,37	0	0,01	0	0,01	0	0,01	0,01
VH/C1/P1/II/44	0	31,32	31,74	34,76	0	0	0,37	1,15	0,08	0,09	0,26	0	0,19	0	0,01	0	0,01		0	0
VH/C1/C1/II/45	0	25,32	51,62	19,25	0	0	0,78	2,56	0,06	0,09	0,04	0	0,26	0	0,01	0	0,01	0	0,01	0
VH/C1/C1/II/46	0	31,06	32,25	33,45	0	0	0,38	0,89	0,14	0,09	0,16	0	1,53	0	0,01	0	0,01	0	0	0,01
VH/C1/P1/II/47	0	27,31	40,58	27,15	0	0	1,51	2,31	0,19	0,08	0,23	0	0,56	0	0,01	0	0,02		0	0,01
VH/C1/C1/II/48	0	33,84	22,61	40,62	0	0	0,57	1,18	0,05	0,07	0,14	0	0,86	0	0,01	0	0,02	0	0,01	0,01
VH/C1/C1/II/49	0	30,64	32,16	34,02	0	0	0,73	0,90	0,14	0,07	0,18	0	1,04	0	0,03	0,01	0,04	0	0,01	0
VH/C1/C1/II/50	0	28,64	38,66	29,52	0	0	0,68	1,03	0,14	0,10	0,22	0	0,93	0	0,02	0	0,02	0	0	0
VH/C1/C1/II/51	0	28,26	41,90	26,76	0	0	0,74	1,46	0,08	0,09	0,20	0	0,46	0	0,01	0,01	0,02	0	0	0
VH/C1/C1/II/52	0	26,12	38,37	28,33	0	0	0,16	1,54	0,20	0,06	0,25	0,01	4,77	0	0,02	0,01	0,11	0	0,01	0,01
VH/C1/Pi/2	0	29,76	35,78	31,38	0	0	1,30	0,79	0,09	0,11	0,14	0	0,57	0	0,01	0	0,02	0	0,01	0,01
VH/C1/Pi/3	0	25,61	46,21	23,70	0	0	0,37	2,94	0,11	0,06	0,16	0	0,78	0	0,01	0	0,02	0	0	0
VH/C1/Pi/4	0	24,72	52,02	19,70	0	0	0,47	2,73	0,03	0,09	0,05	0	0,16	0	0,01	0	0,01	0	0	0
VH/C1/Pi/5	0	25,38	47,76	22,70	0	0	0,87	2,24	0,11	0,13	0,45	0,01	0,30	0	0,01	0,01	0,01	0	0	0
VC/C1/C3/8	0	35,01	7,15	53,77	0	0,49	1,784	0	1,085	0,04	0	0	0,024	0,61	0	0,67	075	0	0	0,47
VC/C1/C3/9	0	31,75	7,03	56,1	0,57	0,39	1,864	0	1,549	0,05	0	0	0,026	0,62	0	0,85	0,0156	0	0	0,54
VH01/C1/C3/10	0	28,3	43,69	18,3	0,32	2,436	0,84	3,937	0,18	0,17	0,7	0	1,08	0	0	0	0,01	0	0,71	0,86
VH01/C1/C3/11	0	29,3	49,25	14,3	0,33	1,539	0,81	2,866	0,25	0	0,5	0	0,78	0	0	0	0,02	0	0,87	0,28
VH01/C1/C3/12	0	26,0	51,88	10,8	0,52	3,076	1,43	4,35	0,24	0	0,3	0	1,31	0	0	0	0	0	0,011	0,012
VH01/C1/C3/13	0	24,6	60,49	2,84	0,36	2,159	1,89	4,292	0,4	0,23	0,8	0	1,84	0	0	0	0	0	0,064	0,027
Cave 3																				
VH01/3B/31	0	30,58	35,61	31,40	0	0	0,35	1,53	0,04	0,07	0,16	0,01	0,23	0	0	0	0,01	0	0	0
VH01/3B/32	0	23,39	57,06	15,57	0	0	1,72	1,20	0,18	0,09	0,23	0,01	0,50	0	0,01	0	0,01	0	0,01	0
VH01/3B/33	0	31,80	29,49	36,44	0	0	0,46	1,28	0,04	0,08	0,10	0	0,25	0	0,01	0,01	0,03	0,01	0	0,01
VH01/3B/34	0	33,40	26,19	38,66	0	0	0,43	0,54	0,07	0,18	0,16	0	0,34	0	0	0	0,01	0	0	0,01
VH01/3B/35	0	28,43	40,25	28,18	0	0	0,54	1,34	0,17	0,11	0,16	0	0,76	0	0,01	0	0,01	0	0,01	0,01
VH01/3B/36	0	24,11	48,77	23,48	0	0	0,79	1,99	0,07	0,13	0,20	0	0,40	0	0,01	0	0,01	0	0	0,01
VH01/3B/37	0	31,67	25,60	38,14	0	0	0,45	2,82	0,19	0,10	0,17	0,01	0,77	0	0,01	0	0,03	0	0,01	0,01
VH01/3B/38	0	33,75	25,83	38,71	0	0	0,36	0,45	0,07	0,11	0,22	0	0,46	0	0,01	0	0,01	0	0	0,01
VH01/3B/39	0	29,37	36,55	32,24	0	0	0,43	0,66	0,07	0,07	0,16	0	0,39	0	0,01	0	0,02	0	0,01	0,01
VH01/3B/40	0	27,56	40,22	28,86	0	0	0,64	0,86	0,18	0,15	0,20	0	1,26	0	0,01	0,01	0,02	0	0	0
VH01/3B/41	0	26,30	41,29	27,95	0	0	0,27	1,65	0,31	0,10	0,19	0	1,84	0	0,02	0	0,01	0	0,02	0,02
VH01/3B/42	0	26,77	40,81	30,71	0	0	0,31	0,67	0,05	0,14	0,20	0	0,30	0	0	0	0,01	0	0	0
VH01/3B/43	0	31,80	30,96	35,31	0	0	0,48	0,60	0,09	0,12	0,20	0	0,39	0	0,01	0	0,01	0	0	0,01
VH01/3B/44	0	30,42	32,04	35,10	0	0	0,36	0,58	0,17	0,06	0,19	0	1,03	0	0,01	0	0,01	0	0	0,01
VH01/3B/45	0	28,10	38,89	28,56	0	0	0,78	1,71	0,26	0,10	0,27	0	1,26	0	0,01	0,01	0,02	0	0	0
VH01/3B/46	0	30,97	32,35	34,36	0	0	0,56	0,54	0,13	0,07	0,16	0	0,81	0	0,01	0	0,01	0	0,01	0
VH01/3B/47	0	36,20	20,52	41,65	0	0	0,35	0,30	0,07	0,13	0,24	0	0,49	0	0,01	0	0,01	0	0	0,01
VH01/3B/48	0	24,01	57,01	13,84	0	0	0,69	2,35	0,29	0,05	0,19	0	1,49	0	0,01	0	0,02	0,01	0,01	0
VH01/3B/49	0	26,45	42,75	26,65	0	0	0,47	2,37	0,11	0,09	0,15	0	0,91	0	0,01	0	0,02	0	0,01	0
VH01/3B/50	0	33,12	26,75	37,79	0	0	0,38	0,78	0,06	0,06	0,14	0	0,87	0	0,01	0	0,02	0	0,01	0
VH01/3B/51	0	32,74	27,52	37,48	0	0	0,43	0,88	0,17	0,12	0,26	0	0,35	0	0,01	0	0,01	0	0	0,01
VH01/3B/52	0	32,57	27,11	38,23	0	0	0,34	0,49	0,10	0,09	0,22	0	0,78	0	0,01	0	0,03	0	0	0,01
VH01/3B/53	0	18,34	65,12	12,57	0	0	1,77	1,59	0,05	0,06	0,15	0	0,30	0	0,01	0	0,01	0,01	0	0,01

VH01/3B/54	0	30,60	33,64	33,53	0	0	0,31	0,74	0,15	0,06	0,29	0	0,60	0	0,01	0	0,01	0	0,01	0,02
VH01/3B/55	0	25,34	48,30	21,59	0	0	1,05	1,45	0,25	0,08	0,23	0	1,64	0	0,01	0	0,01	0	0,01	0
VH01/3B/56	0	25,43	45,07	25,11	0	0	0,59	0,88	0,21	0,05	0,20	0	2,35	0	0,02	0	0,02	0	0,01	0
VH01/3B/57	0	34,17	24,83	38,84	0	0	0,29	0,76	0,15	0,16	0,26	0	0,48	0	0,01	0	0,01	0	0	0,01
VH01/3B/58	0	28,03	40,09	28,76	0	0	0,51	1,45	0,11	0,10	0,23	0	0,69	0	0	0	0,01	0	0	0,01
VH01/3B/60	0	31,77	31,63	35,00	0	0	0,36	0,60	0,06	0,09	0,11	0	0,33	0	0,01	0	0,01	0	0	0,01
VH01/3B/61	0	30,74	34,10	32,72	0	0	0,52	0,38	0,22	0,10	0,18	0	0,99	0	0,01	0	0,02	0	0	0,01
VH/3C/21	0	33,4	37,07	24,8	0,13	0,922	0	1,232	0,18	0,07	0,4	0	1,85	0	0	0	0,03	0	097	055
VH/3C/22	0	29,3	44,89	14,9	0,56	2,608	1,02	2,401	0,36	0	0,6	0	3,31	0	0	0	0,01	0	0,0133	097
VH/3C/23	0	27,8	47,82	14,4	0,44	1,945	1,66	3,511	0,33	0,1	0,6	0	1,41	0	0	0	0,02	0	0,0191	059
VH/3C/24.	0	25,4	40,87	17,9	0,59	2,541	1,27	2,332	0,27	0,13	0,6	0	2,24	0	0	0	0,01	0	086	0,0157
VH/3C/25	0	25,6	50,6	13,4	0,7	1,661	1,46	4,651	0,26	0,13	0,4	0	1,13	0	0	0	0,02	0	0,0131	019
VH/3C/26	0	31,2	42,24	18,9	0,44	1,626	0,98	1,614	0,26	0,11	0,5	0	2	0	0	0	0,03	0	0,0165	0,0104
VH/3C/27	0	29,9	40,07	22,7	0,22	1,238	1,03	1,727	0,24	0	0,3	0	2,62	0	0	0	0,01	0	0,0177	019
VH/3C/28	0	37,9	29,86	23,6	0,64	4,626	1,32	0,847	0,14	0	0,3	0	0,65	0	0	0	0,01	0	023	091
VH/3C/29	0	34,3	30,09	30,7	0,17	1,353	0	1,496	0,07	0,06	0,4	0	1,25	0	0	0	0,11	0	066	033
VH/3C/30	0	34,7	33,61	25,7	0,48	2,355	0	1,697	0,14	0	0,6	0	0,74	0	0	0	0,01	0	0,0122	023
VH/3C/31	0	32,2	43,32	16,2	0,29	1,606	0	2,157	0,2	0	0,9	0	3,16	0	0	0	0,03	0	0,0185	066
VH/3C/32	0	32,3	32,17	27,9	0,17	1,145	0,72	1,084	0,29	0,15	0,6	0	3,55	0	0	0	0,03	0	032	035
VH/3C/33	0	32,8	36,59	26,1	0,17	1,191	0	1,688	0,16	0	0,5	0	0,77	0	0	0	0,01	0	077	02
VH/3C/34	0	34,4	32,19	27,9	0,39	1,931	0	2,096	0,11	0	0,6	0	0,31	0	0	0	0,01	0	0,0158	041
VH/3C/35	0	35,8	29,54	29	0,27	1,531	0	1,565	0,22	0	0,4	0	1,62	0	082	0	0,01	0	042	016
VH/3C/36	0	29,5	36,76	20,2	0,58	2,133	0,93	1,553	0,23	0,16	0,8	0	3,06	0	0	0	0,08	0	0,0143	0,0111
VH/3C/37	0	31,7	32,86	26,9	0,56	2,985	0,88	1,393	0,25	0,11	0,5	0	1,88	0	0	0	0,02	0	065	087
VH/3C/38	0	27,5	38,44	21	0,53	5,294	0,83	2,924	0,41	0	1	0	1,99	0	0	0	0,01	0	0,0315	085
VH/3C/39	0	35,5	34,12	25,4	0,24	1,935	0	1,11	0,14	0	0,7	0	0,79	0	0	0	0,01	0	045	041
VH/3C/40	6,922	26,6	45,47	13,7	0,5	1,525	1,08	2,046	0,2	0,14	0,5	0	1,22	0	0	0	0,01	0	0,0187	029
VH/3C/41	0	34,9	32,83	27	0,29	2,260	0	1,239	0,11	0	0,6	0	0,71	0	056	0	0,02	0	0,0165	063
VH/3C/42	0	36,1	26,53	27,6	0,48	5,360	1,15	0,731	0,11	0	0,9	0	0,99	0	0	0	0,01	0	0	029
VH/3C/43	0	34,5	31,56	27,3	0,37	1,869	1,19	1,024	0,17	0,08	0,5	0	1,36	0	0	0	0,04	0	051	093
VH/3C/44	0	33,3	34,56	24,7	0,41	1,926	1,28	1,326	0,07	0,15	0,6	0	1,67	0	0	0	0,01	0	085	029
VH/3c/45	0	26,3	52,74	13,8	0,44	1,836	1,24	2,037	0,3	0	0,6	0	0,74	0	0	0	0,01	0	0,0166	045
VH/3C/46	8,638	26,6	39,2	12,5	0,68	3,579	0,85	2,294	0,25	0	0,5	0	4,81	0	0	0	0,02	0	0,0342	0,0167
VH/3C/47	0	32,2	35,59	25,4	0,44	1,889	1,28	1,165	0,08	0,14	0,7	0	1,05	0	0	0	0,01	0	083	027
VH/3C/48	0	32,2	36,71	23,6	0,31	2,013	0,76	1,57	0,29	0	1,1	0	1,32	0	0	0	0,01	0	0,0188	0,0112
VH/3C/49	0	34,6	34,68	24,6	0,36	2,522	0,79	1,099	0,14	0	0,4	0	0,79	0	0	0	0,01	0	019	098
VH/3C/50	0	34,3	28,54	29,8	0,44	1,940	0	1,224	0,22	0,27	0,4	0	2,77	0	0	0	0,02	0	099	0,0238
VH/3C/51	4,724	24,5	48,37	9,82	0,34	1,529	0,78	2,537	0,32	0	0,4	0	6,67	0	0	0	0,01	0	0,0225	0,017
VH/3C/52	0	31,2	41,62	19,7	0,4	2,464	0,82	1,637	0,24	0	0,3	0	1,64	0	0	0	0,02	0	056	03
VH/3C/53	4,712	31,3	35,77	22,2	0,44	2,221	0	1,512	0,13	0,14	0,6	0	0,94	0	0	0	0	0	0,0166	026
VH/3C/54	0	33,8	32,59	26	0,3	2,844	0,93	1,374	0,19	0	0,5	0	1,38	0	0	0	0,01	0	0,0138	0,0167
VH/3C/55	0	33,7	36,12	24,2	0,43	1,814	0	1,888	0,37	0	0,3	0	1,12	0	036	0	0,03	0	0,0121	02
VH/3C/56	0	30,5	41,13	15,8	1,08	3,959	1,05	2,944	0,24	0	0,5	0	2,7	0	0	0	0,01	0	0,0359	088
VH/3C/57	0	32,6	40,24	21,8	0,44	2,597	0	1,36	0,1	0	0,4	0	0,4	0	0	0	0,01	0	03	04
VH/3C/58	0	29,4	45,13	18,8	0,47	2,102	0,74	1,706	0,15	0,08	0,6	0	0,83	0	0	0	0	0	0,0177	058

VH/3C/59	0	39	27,37	26,9	0,38	3,645	0	0,753	0,17	0	0,6	0	1,12	0	0	0	0,01	0	055	062
VH/3C/61	0	31,5	39,8	21,1	0,46	2,594	0,97	1,875	0,15	0,13	0,5	0	0,87	0	0	0	0,01	0	052	083
VH/3C/62	3,159	33	33,65	23	0,51	1,993	0,9	1,05	0,22	0	0,3	0	2,05	0	0	0	0,06	0	031	0,0109
VH/3C/63	0	33,4	40,17	20,7	0,32	2,028	0	1,646	0,2	0	0,5	0	1,02	0	0	0	0,01	0	0,0266	0,0168
Cave 4																				
VH04/6/C4/S/2	0	26,49	45,25	24,33	0	0	0,30	1,82	0,11	0,12	0,27	0	1,25	0	0,01	0,01	0,01	0	0,01	0,01
VH04/6/C4/S/3	0	34,70	23,55	39,92	0	0	0,57	0,47	0,09	0,10	0,10	0	0,45	0	0,01	0,01	0,01	0	0	0
Cave 7																				
VH/C7/C/4	2,641	27,7	54,06	0	0,22	0,925	6,31	1,172	0,69	0	0	0,063	6,17	0	0	0,010	0	0,01	0,010	082
VH/C7/C/5	34,91	10,3	48,81	0	0,48	2,930	0,85	0,708	0,05	0	0	0	0,89	0	081	094	0	0	051	0
VH/C7/C/6	31,04	8,1	56	0,23	0,35	2,021	0	1,467	0,07	0	0	0,021	0,66	0	075	0,010	0	0	06	0
VH/C7/C/7	32,97	9,63	51,45	0,67	0,35	3,108	0	1,176	0,03	0	0	0,019	0,56	0	076	096	0	0	043	0
VH/C7/C/10	28,93	8,52	55,97	0	0,46	3,314	0,86	1,069	0,04	0	0	0,02	0,76	0	0,013	084	0	0	038	0
VH/C7/C/11	0	41	42,16	0,16	0,3	1,633	12,9	0,744	0,13	0	0	0,015	0,55	0	0	02	0	0,41	054	0
VH/C7/C/13	22,83	8,46	55,75	0,38	1,93	5,271	1,49	2,474	0,1	0	0	0,033	1,23	0	0,013	0,018	0	0	089	0