VALLONIA RANOVI N. SP. FROM THE PLEISTOCENE OF SOUTHERN TAJIKISTAN (GASTROPODA: PULMONATA: VALLONIIDAE)

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Abstract *During the analyses of terrestrial gastropods from loess containing Palaeolithic archaeological remains in Southern Tajikistan, a new species of valloniid, here described as* Vallonia ranovi *n. sp., was encountered at a site at Khonako near Khovaling. The new species occurs in interglacial stages of the upper Middle Pleistocene and also near the lower boundary of the Upper Pleistocene (transition to MIS 5e). Two shells of presumed Holocene age and a single modern shell, all collected 20 km north of Khonako, are also assigned to* V. ranovi *n. sp.*

Key words *Valloniidae,* Vallonia ranovi, *new species, Pleistocene, Tajikistan*

INTRODUCTION

In 2002, Prof. Dr. V. A. Ranov (Archaeological Institute, Academy of Sciences of Tajikistan, Dushanbe) and Dr. J. Schäfer (Chair for Prehistory and Early History, Humboldt University, Berlin) participated in an archaeological expedition to investigate Palaeolithic remains within the loess in Southern Tajikistan. Terrestrial gastropods from the same loess sequences were sampled and analyzed by one of the authors (SM), the investigations focusing on the Palaeolithic site of Khonako III near Khovaling (fig. 1). In addition, samples taken from the same profile by the Archaeological Institute of Dushanbe in 1996 were also studied.

Southern Tajikistan's hilly loess landscape is situated at the northeastern edge of the Afghan-Tajik Depression, which lies between the mountains of the Tian Shan-Alai System in the North, the Pamir in the East, and the Hindukush in the South (fig. 1). Loess accumulation is widespread in this region and occurs at altitudes up to 2500 m (Dodonov *et al.*, 1995; Frechen & Dodonov, 1998). The loess deposits are up to 200 m thick, within which up to 40 palaeosols have developed. Biostratigraphic (large mammals) and palaeomagnetic evidence suggest that the earliest loesses are up to 2.5 ma old (Dodonov *et al.*, 1995). Apart from the loesses of China, the loess-palaeosol sequences of Southern Tajikistan are among the most complete Quaternary sequences worldwide (Dodonov *et al.*, 1995), and therefore constitute important palaeoclimatic and palaeoenvironmental archives.

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The Tajik loess sequences (fig. 6) are divided into palaeosol complexes (PC) with horizons of intense soil development formed within the loess (L). While loesses represent glacial, arid periods, the soils of PCs formed during interglacial periods when conditions were warmer and wetter. In addition, interstadial phases (LI), representing less pronounced temperate conditions, resulted in weaker soil development. Gastropod shells occur in loess, in interstadial soils, in the transitional phases of the palaeosol-complexes and in their intercalated layers that represent periods of less intense soil formation. The full-interglacial soils are virtually devoid of shells due to the effects of intensive soil formation processes, including decalcification.

The chronostratigraphy of loesses in Southern Tajikistan is based on magnetic susceptibility measurements (Forster & Heller, 1994) and luminescence dating (Frechen & Dodonov, 1998), supported by the archaeology (Dodonov *et al.*, 1995). Correlations with the Chinese loess stratigraphy and with the Marine Oxygen Isotope Stages (MIS) have been proposed (Schäfer *et al.*, 1996; Schäfer *et al.*, 1998; Frechen & Dodonov, 1998). Thus PC2 can be correlated with MIS 7 (250 to 190 ka BP), PC1 equates with MIS 5 (126 to 70 ka BP), whereas the lower soil horizon of PC1 (=PC1c) has been correlated with the last interglacial (MIS 5e) or its equivalents, respectively (Frechen & Dodonov, 1998; Schäfer *et al.*, 1998).

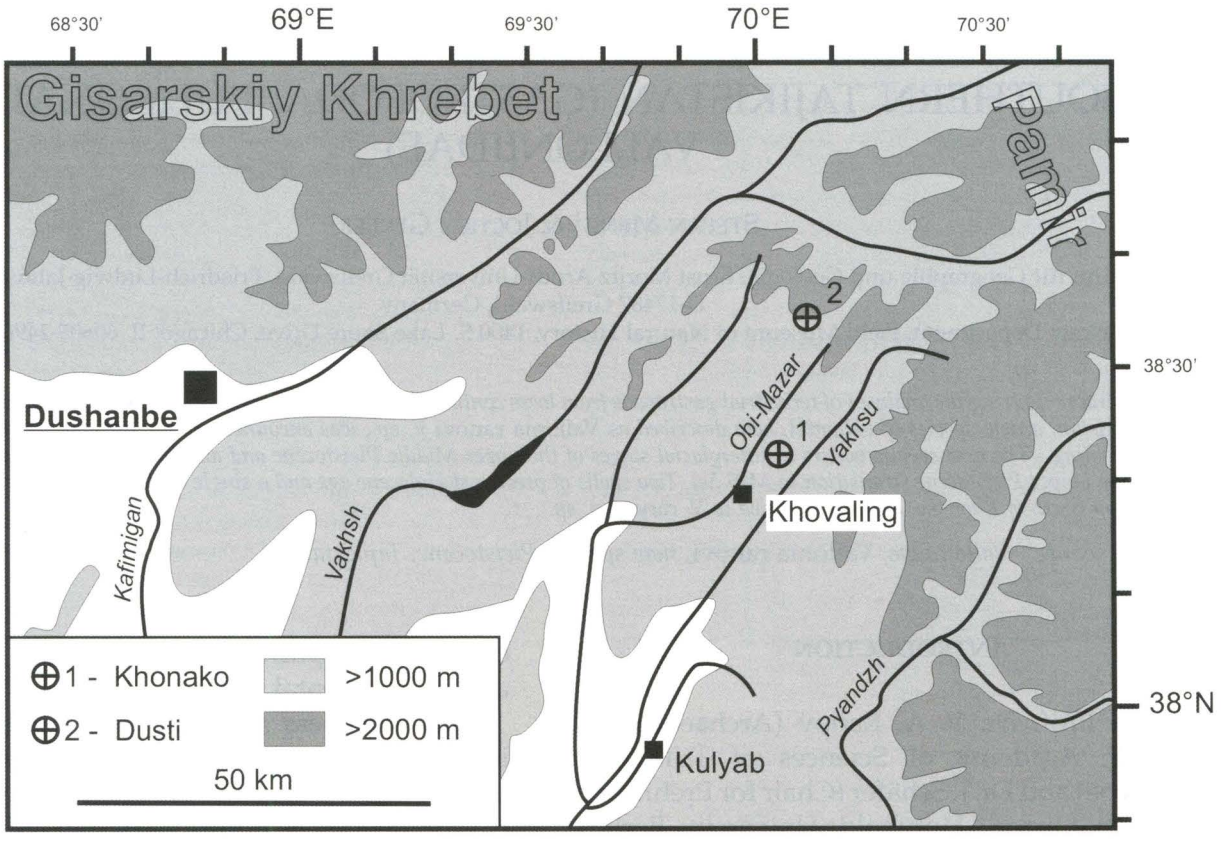


Figure 1 Localities with *V. ranovi* n. sp. in southern Tajikistan.

In the extensive investigations carried out on the loesses of Southern Tajikistan (e.g. Bronger *et al.*, 1995; Dodonov *et al.*, 1995; Schäfer *et al.*, 1998; Schäfer *et al.*, 2003; Ranov, 2003) palaeontological evidence has not been considered to any larger extent. This is regrettable because the interpretation of fossil gastropod communities is a valuable tool for the reconstruction of palaeoenvironments (e.g. Ložek, 1964) which could potentially shed considerable light on the environments of early humans in Southern Tajikistan (cf. Dodonov *et al.*, 1995; Schäfer *et al.*, 1998; Schäfer *et al.*, 2003).

METHODS

Sampling for gastropod analysis was carried out in the well-stratified loess profile Khonako III (fig. 6), already investigated geologically and archaeologically (Schäfer *et al.*, 1998). From each of the sampled units 10 litres of sediment were disaggregated in water, sieved to 0.5 mm, and the molluscan remains extracted. In 2002, the main focus of study was the interval from PC2 to PC1, in other words the equivalents of the Saalian (penultimate cold stage) to the Weichselian (last cold stage). Details of these analyses will be presented elsewhere but here we draw attention to the occurrence of a new species of *Vallonia*, which we describe and name formally.

Measurements were taken as described in Gerber (1996). Abbreviations for measurements (in mm except for α, R and U):

- α inclination of the aperture against the shell axis, in degrees
- D largest shell diameter
- d smallest shell diameter
- E largest diameter of embryonic shell
- H shell height
- I distance between the insertions of the peristome
- MB width of aperture
- MH height of aperture
- N width of umbilicus
- R number of ribs on the 3rd whorl
- U number of whorls

Institutional Abbreviations:

FMNH Mollusk Collection, Division of Invertebrates, Field Museum of Natural History, Chicago

IQW Forschungsstation für Quartärpaläontologie, Forschungsinstitut Senckenberg, Weimar

MES S. Meng collection, Rostock

Systematics

Pulmonata
Pupilloidea
Valloniidae

Vallonia ranovi n. sp.

Holotype FMNH 308492

Paratypes Locus typicus, stratum typicum (4 sh, FMNH 308493; 4 sh, IQW 2007/29139 (S-Tad. 28301)). Locus typicus, unit Ch III/25, Pleistocene, upper boundary of PC2, 29.5 m below surface (5 sh, FMNH 308494; 6 sh, IQW 2007/29140 (S-Tad. 28302)).

Type locality Tajikistan, Palaeolithic site of Khonako III, ca. 6 km northeast of Khovaling, near the village Tijun, in the mountain chain (1850-1900 m elevation) between Obi-Mazar und Jachsu rivers, 38°21'36" N, 70°03'12" E.

Typestratum Unit Ch III/20, Pleistocene, interstadial LI2a, between PC2 and PC1, 26 m below surface.

Material examined PLEISTOCENE: Locus typicus, unit Ch III/5, base of PC2, 45 m below surface (3 sh, MES). Locus typicus, stratum typicum (78 sh, MES). Locus typicus, unit Ch III/24, upper boundary of PC2, 29 m below surface (1 sh, MES). Locus typicus, unit Ch III/25, upper boundary of PC2, 29.5 m below surface (16 sh, MES). Locus typicus, unit Ch III/31, base of PC1c, 16 m below surface (6 sh, MES). Palaeolithic site of Khonako IV (next to Khonako III), unit Ch IV/31, base of PC1, 6-7 m below surface (1 sh, MES).

HOLOCENE: Tajikistan, Palaeolithic site of Dusti, 25 km NNE of Khovaling, 38°33' N, 70°05' E, Holocene slope deposit, close to surface, potentially redeposited (2 sh, MES).

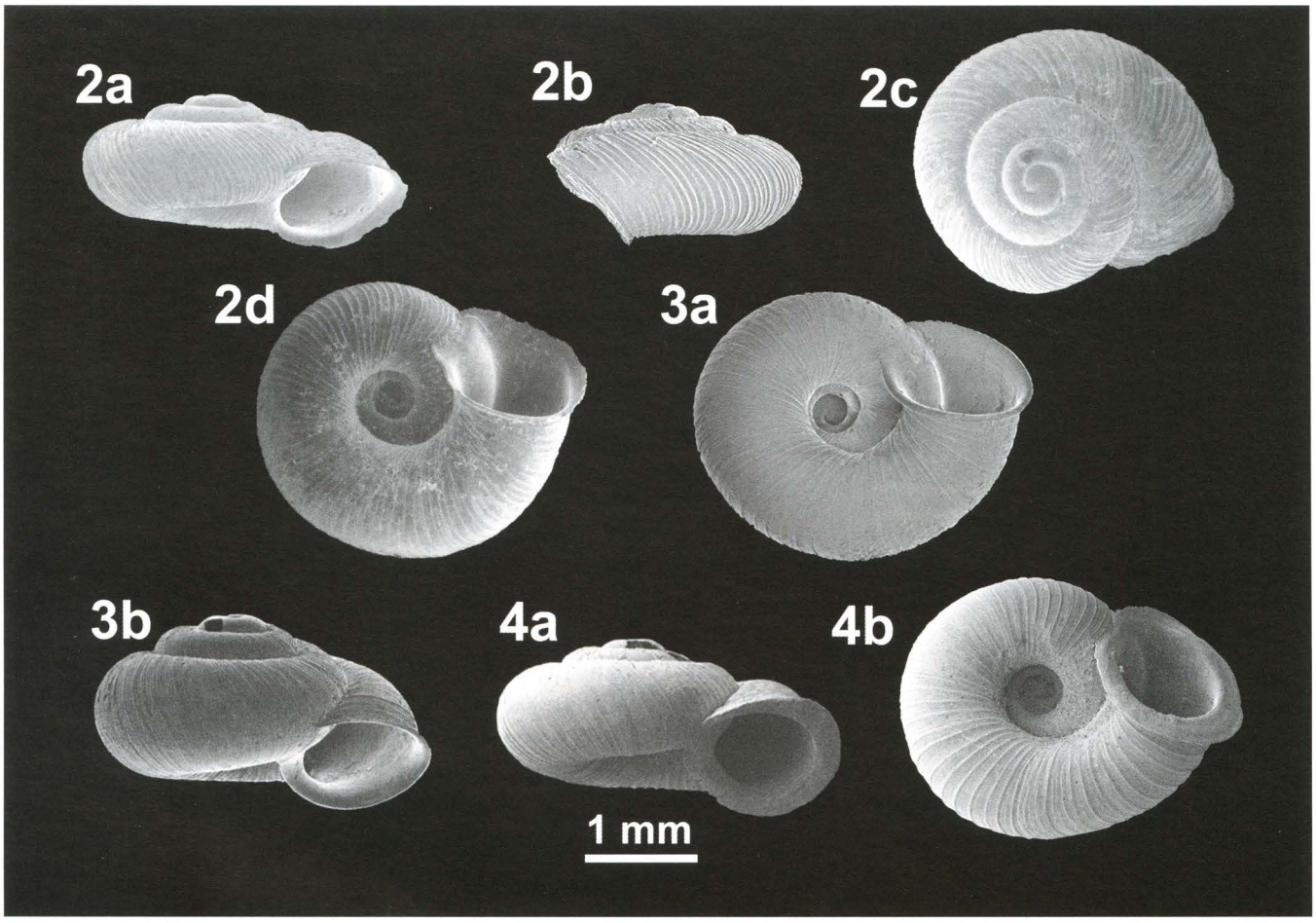
RECENT: Tajikistan, near the Palaeolithic site of Dusti, 25 km NNE of Khovaling, 38°33' N, 70°05' E, 4 Oct. 2002, leg. S. Meng (1 sh, MES 3932).

Description Shell large for the genus, with rather thick and firm shell walls; strongly depressed, but the low-conical spire always raised markedly above the body whorl. 3-3.6 whorls, of which 1.2-1.35 are made up by the embryonic shell. Whorls increasing regularly and relatively rapidly, separated by sutures of moderate depth. Upper and lower surface of the whorls comparatively weakly rounded, periphery of whorls thus strongly arched in cross-section (yet periphery rounded, not angled). Umbilicus width ca. 27-30% of largest shell diameter; umbilicus increasing regularly in width, of nearly circular shape, not or hardly more dilated at the end. Viewed from the side, the last whorl descends gradually and gently, in a straight line or elongated arc, towards the aperture. Aperture strongly inclined in relation to the shell axis, at an angle of ca. 40°. Aperture large, significantly broader than high, elliptical, its insertions approaching each other moderately, connected by a thin, hardly perceptible, medially retracted callus. Peristome almost straight near the

	D	d	E	H	N
Holotype	3.15	2.50	0.85	1.50	0.90
Range (n=6)	2.88-3.71	2.20-2.98	0.80-0.90	1.40-1.81	0.80-1.08
Mean	3.16	2.54	0.85	1.57	0.91

	MB	MH	I	α	U	R
Holotype	1.53	1.25	0.45	41	3.4	74
Range (n=6)	1.28-1.65	1.08-1.48	0.43-0.50	36-44	3.0-3.6	68-80
Mean	1.45	1.26	0.46	40.33	3.32	72.5

Table 1 Measurements of the holotype and 5 paratypes (FMNH 308493, 308494) of *V. ranovi* n. sp.



Figures 2-4 **2a-d** *V. ranovi* n. sp., holotype (FMNH 308492). **3a-b** *V. tenuilabris*, Recent, Mongolia, Uvs aimak, drift of river Baruunturuun gol at Baruunturuun, 49°22'48"N 94°14'24"E (FMNH 308496). **4a-b** *V. asiatica*, Tajikistan, Khonako III, Pleistocene, unit Ch III/40, loess above PC1b, 12 m below surface (FMNH 308495).

upper insertion, markedly expanded distally and basally, the expansion being abrupt, almost perpendicular. Peristome expansion on the columellar side broad, plate-like. Peristome thin, without callous thickening. Shell with numerous, densely and somewhat irregularly set, commarginal ribs; ribs quite coarse, the interstices between them ca. 2-3 times as broad as the ribs, each interstice with about one or two wrinkle-like growth lines.

Measurements See table 1.

Additional remarks In the only modern shell currently assigned to *V. ranovi* n. sp. the periostracum appears to be partly preserved. The shell is semi-transparent with a light yellowish-brown tinge. The shell surface has a microscopic, shagreen-leather-like texture as is typical in *Vallonia*. There are neither microscopic periostracal ridges overriding the shagreen, as e.g. in *V. costata* (O.F. Müller, 1774), nor periostracal extensions of the calcareous ribs as they occur in most ribbed *Vallonia* species. Whether the lack of periostracal sculptural elements is a characteristic of *V. ranovi* n. sp. or merely the result of bad preservation can only be clarified when additional modern material becomes available.

Derivation of name The new species is dedicated to the late Prof. Vadim A. Ranov († 2006), the archaeologist who for decades tirelessly investigated the loesses of Southern Tajikistan. Ranov also led the expedition in 2002.

Ecology The studied profiles represent a depositional zone predominantly characterized by aeolian sediments that accumulated on plateau surfaces (Dodonov *et al.*, 1995). Since the habitats were relatively dry, only terrestrial gastropod faunas have been preserved. Consequently, the species inventories are somewhat restricted, with only 9-10 species being recorded. However, in

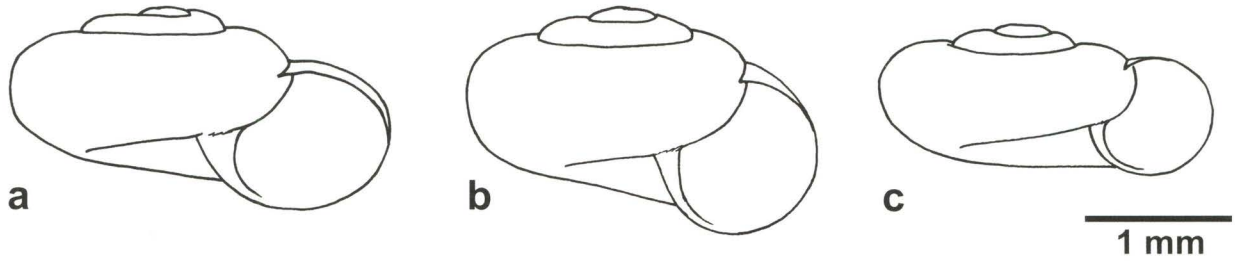


Figure 5 Juvenile shells of three Central Asian *Vallonia* species. **5a** *V. ranovi* n. sp., 3.25 whorls (FMNH 308494). **5b** *V. tenuilabris*, 3 whorls, Mongolia (FMNH 308496). **5c** *V. mionecton*, 3.25 whorls, Turkmenistan, Kopetdag Mountains (Zoological Museum, Moscow State University Lc-25725).

spite of this relatively low diversity, the faunas show clear climatic preferences.

V. ranovi n. sp. is characteristic of interstadials and the transitions to interglacials. It is accompanied by taxa such as *Pupilla* sp., *Pseudonapaeus otostomus* (Westerlund, 1898), *Pseudonapaeus* sp., Vitrinidae, *Parmacella* sp. and *Leucozonella* cf. *rubens* (E. von Martens, 1874). During the more arid, glacial phases *V. ranovi* is replaced by *Vallonia asiatica* (Nevill, 1878), currently a typical species of high mountains in Central Asia (Gerber, 1996).

As mentioned above, the gastropod faunas of the interglacial horizons of Khonako III are not preserved in the soils but *V. ranovi* is recorded at the transitions to the interglacials indicating a probable interglacial preference. The only modern specimen of *V. ranovi* known is an empty shell found on a slope with springs, dense vegetation of herbs and grasses, and willows providing shade. This indicates that the species prefers relatively moist, at least mesic habitats.

Stratigraphical distribution *Vallonia ranovi* n. sp. is known as a fossil at the type locality from the following strata: PC2 (interglacial of MIS 7), transition from PC2 to L2, LI2b (interstadial between PC2 and PC1), and at the base of PC1 (transition to MIS 5e). This corresponds to a range from the upper Middle Pleistocene to the lower boundary of the Upper Pleistocene (ca. 250 – 126 ka BP).

In addition, two presumably Holocene and a single modern specimen from Dusti, ca. 20 km north of Khonako, are assigned to the new species.

Geographical range See under type locality and material examined. *V. ranovi* is likely to be endemic to the northeastern edge of the Afghan-Tajik Depression.

Discussion

The interpretation of the new form from Khonako and Dusti as a species distinct from its Central Asian congeners is corroborated by a series of morphological character states that remained constant over at least 250 ka, as well as constant differences in habitat preference.

Vallonia asiatica (Nevill, 1878), which occurs syntopically and, in small numbers, contemporaneously with the new species at the type locality is readily separable by the presence of a thickened lip within the peristome. Furthermore, *V. asiatica* differs in the way that the last whorl distinctively ascends before descending towards the aperture, often giving the shell a somewhat distorted appearance; by the umbilicus being elliptical and eccentric due to its faster expansion in the last one-third whorl; and by less densely set ribs (on the average).

V. ranovi n. sp. most closely resembles the North and Central Asian *Vallonia tenuilabris* (A. Braun, 1843). The latter, however, is less depressed (especially the body whorl), and is sometimes almost subglobular. The whorls of *V. tenuilabris* are strongly rounded above and below and more broadly arched at the periphery. In *V. tenuilabris* the umbilicus diameter usually increases distinctly faster at the end and the umbilicus is thus elliptical and eccentric. In *V. tenuilabris* the last whorl, when seen from the side, often ascends gradually before descending rather abruptly.

Vallonia ladacensis (Nevill, 1878), a Central Asian species of high mountain ranges, resembles *V. tenuilabris* in whorl shape; its whorls increase more slowly than in *V. ranovi* n. sp., its last whorl as well commonly ascends before descending towards the aperture. The umbilicus

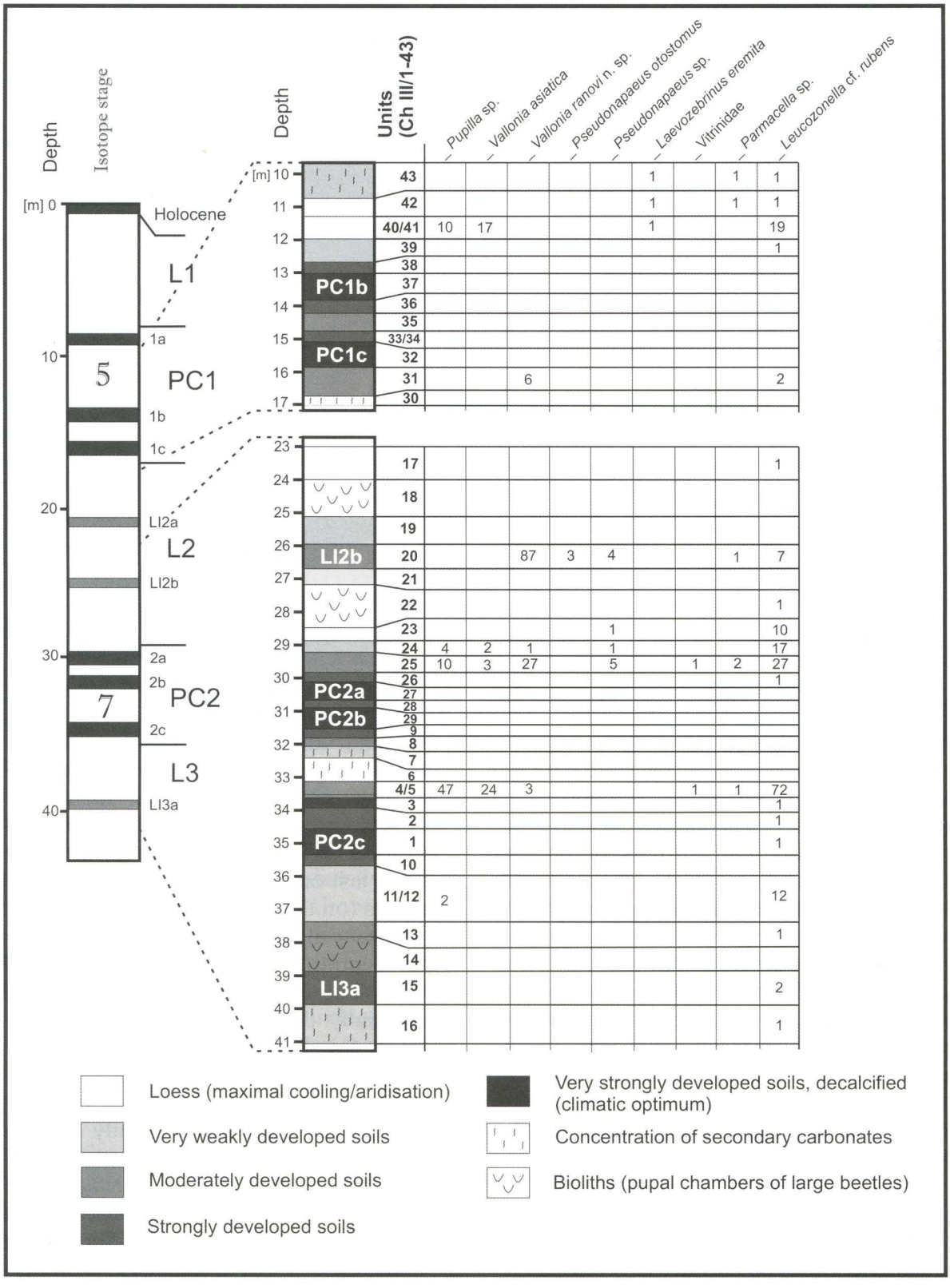


Figure 6 Left: Simplified schematic profile of the loess sequence in Southern Tajikistan. Right: Sections of the Khonako III profile investigated in 2002, and table showing the gastropod shell content (number of specimens) of the units. Profiles modified from Schäfer *et al.*, 1998 and 2003.

of *V. ladacensis* is wider than that of either *V. tenuilabris* or *V. ranovi* n. sp.

Vallonia mionecton (O. Boettger, 1889) is smaller than *V. ranovi* n.sp., its shell is even more depressed, its whorls are smaller and almost perfectly circular in cross-section, they increase more slowly; its umbilicus is significantly wider and shallower, its ribs finer, thread-like and more regular. In *V. mionecton*, too, the last whorl commonly ascends before descending towards the aperture.

The differences in the shape of the whorls can best be seen in juvenile specimens (fig. 5).

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