Sesselfelsgrotte VII

Naturwissenschaftliche Untersuchungen

Wirbeltierfauna 2 – Mollusken – Vegetation

FRANZ STEINER VERLAG STUTTGART
2017

Sesselfelsgrotte VII

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Herausgegeben von

Gisela Freund und Jürgen Richter

für das

Institut für Ur- und Frühgeschichte
der Friedrich-Alexander-Universität Erlangen-Nürnberg

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von Gisela Freund und Jürgen Richter (Hg.)

(Forschungsprojekt „Das Paläolithikum und Mesolithikum des Unteren Altmühltals II“ Teil VII)

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Vorworte

Seit Erscheinen von Band VI der Publikationsreihe „Sesselfelsgrotte“, dem ersten, der der Auswertung aus dem Bereich der Naturwissenschaftlichen Disziplinen gewidmet ist, sind abermals drei Jahre vergangen. Es seien an dieser Stelle keine der im ausführlichen Vorwort zu Band VI angeführten Begründungen für die zeitlichen Verzögerungen während der Auswertungs- und Publikationsphase wiederholt. Jedoch der Verlust von Mitarbeitern, der eine der bedauerlichen Begleiterscheinungen bei langandauernden Publikationsunternehmen ist, betrifft die Sesselfelsgrotte in besonderem Maß.

Im Frühjahr 2015 schied Herr Ludwig Reisch aus gesundheitlichen Gründen für immer von jeder Mitarbeit aus und damit jener Kollege, für den es seit vielen Jahren eine Selbstverständlichkeit war, dass er die Gestaltung der drei die Naturwissenschaften betreffenden Bände in Hauptverantwortung übernehmen würde. Der schmerzliche Verlust traf den in Vorbereitung befindlichen Band VII in drei Punkten: ein neuer, erfahrungs- und kenntnisreicher Mitherausgeber musste die Lücke rasch schließen. Dies geschah. Dem Autor von Band III, dem Bearbeiter der G-Schichten, des reichsten und problembeladensten paläolithischen Komplexes, der niemals sein Interesse an dem Grabungs- und Publikationsunternehmen und an dem Projekt „Das Paläolithikum und Mesolithikum des Unteren Altmühltals II“ verloren hatte, Herrn Jürgen Richter sei bereits an dieser Stelle für seine Bereitschaft und stete Hilfe gedankt. Für Band VII fiel zudem der Autor Ludwig Reisch für zwei Beiträge, denen er sich seit Jahren verbunden und verpflichtet fühlte, aus: für die Auswertung der Molluskenbestände und die der Sedimentanalysen, die er, zunächst als Assistent und später als Institutsvorstand, wesentlich selbst geleitet hatte. Rascher als gehofft, war Herr Wolfgang Rähle bereit, die Mollusken zu bearbeiten. Seine Einsatzfreude wurde durch die 1999/2000 in Folge einer Baumaßnahme am Fuß der Sesselfelsgrotte angefallene reiche Banatica-Fauna, die für die Auswertung der Bestände in der Sesselfelsgrotte und damit für die chronologische Ansprache der gesamten Schichtfolge so ausschlaggebend wichtig wurde, belohnt. – Für die Auswertung der jahrelang im Labor des Instituts durchgeführten Sedimentanalysen ergab sich jedoch keine schnelle Lösung. Mit Hilfe von Herrn Richter konnte Herr Martin Kehl gewonnen werden, mit dem Herr Richter gemeinsam eine Wertung der Analysen in Band VIII vorbereitet.

An Stelle dieses Beitrags ist in Band VII ein Teil der für Band VIII vorgesehenen umfangreichen der Großfauna gewidmeten Arbeiten von Herrn Thomas Rathgeber, der seit 1986 die gesamten Faunenbestände der Sesselfelsgrotte im Naturkundemuseum in Stuttgart betreut, getreten. Herrn Rathgeber sei gedankt, dass er der drängenden Bitte nachkam, die Vorlage der Großfauna in sinnvollen Teilen vorzunehmen. So enthält Band VII die Ergebnisse der Unteren Schichten, die für die Gliederung des Frühwürm im Bereich der Kulturentwicklung (s. Band II) und für alle einschlägigen naturwissenschaftlichen Disziplinen weit über Mitteleuropa hinaus so besonders wichtig wurden. – Dafür zeugt auch der in vorliegendem Band von Frau Maria Knipping behandelte paläobotanische Bereich. Auch Frau Knipping gebührt besonderer Dank, übernahm sie doch neben dem pollenanalytischen Teil auch jenen umfangreichen der Auswertung von über 3000 Holzkohlestücken, die seinerzeit von Josef Stieber-Budapest bestimmt wurden, von ihm aber nicht weiter bearbeitet werden konnten.

War das Ausscheiden von Herrn Stieber einer der frühen Verluste im Mitarbeiterkreis der Sesselfelsgrotte, so war es 1996 der Tod von Frau Elisabeth Schmid für die Sedimente und 2012 der von Frau Angela von den Driesch für die reiche Vogelfauna. Dieser Beitrag sollte sinnvollerweise in Band VI erscheinen. Jedoch fehlte die fachliche Auswertung der von Frau von den Driesch noch vollständig durchgeführten Bestimmungen. Herrn van Kolfschoten sei für seine aktive Hilfe und Mitarbeit gedankt. Er gewann Herrn Jørn Zeiler als

Ornithologen und als dritten Autor. Somit konnte der Beitrag als letzter über die kleinen Wirbeltiere in Band VII aufgenommen werden.

Seit Beginn der Grabungsarbeiten 1964 war es eine Selbstverständlichkeit, dass das Knochenmaterial ebenso sorgfältig zu bergen und zu dokumentieren sei wie das lithische. Daraus resultierte auch die Planung von drei die Naturwissenschaften betreffenden Bände. Der Beitrag von Herrn Rathgeber, der die gesamte untere Hälfte des Sedimentpaketes der Sesselfelsgrotte behandelt und in Band VIII eine Fortsetzung für die obere Hälfte erhalten soll, stellt samt Katalog (im Anhang) eine geraffte Wertung aller beteiligten Disziplinen, auch der archäologischen, die dazu die notwendigen Daten und Fakten lieferte, dar. Mit Hilfe der zahlreichen Pläne lässt sich zudem der Verlauf von fünfzehn Grabungskampagnen nachvollziehen, für das dem lithischen Fundstoff gleichwertige Knochenmaterial auf „Zentimeter und Gramm".

Stets gebührt der Dank der DFG und dies besonders für Band VII, förderte sie doch die Autoren bei den schon lange zurückliegenden und langwierigen Analysenarbeiten. Band VII trägt damit eine nun schon alte Schuld ab.

Ein letzter Dank gilt dem nun schon langjährigen Vorstand des Instituts für Ur- und Frühgeschichte, Herrn Thorsten Uthmeier, der nie seine Hilfe versagte und alle Möglichkeiten des Instituts zur Verfügung stellte. So übernahm Frau Nicole Bößl eine digitale Umsetzung längst veralteter Pläne im Beitrag Rathgeber und arbeitete sich mit Akribie und viel Geduld in diese ein. Frau Sabine Kadler, die Leiterin des Erlanger sedimentanalytischen Labors, blieb seit Fertigstellung von Band VI eine vielseitige und unentbehrliche Hilfe.

Herr Uthmeier sorgte im August 2016 mit Angehörigen und Studierenden des Instituts für die dringend anstehende Sanierung und Verschalung des seit Grabungsende 1981 freistehenden Zeugenblocks. Trotz dieser nun vollständigen Verschalung aller Profile kann die Schichtfolge im Zeugenblock dank eines Sichtfensters weiterhin eingesehen und studiert werden.

Erlangen, im November 2016 Gisela Freund

Der erste Spatenstich in der Sesselfelsgrotte datiert aus dem Jahr 1964. Rund 31 Jahre später, 1995, lag der Band von W. Weißmüller über die Unteren Schichten als erster Teil der Sesselfelsgrotten-Monographienreihe vor. Seitdem sind insgesamt sieben Bände mit fast 2500 Seiten erschienen, verteilt auf einen Zeitraum von nunmehr 22 Jahren.

Die Methoden der Quartärforschung haben rasante Fortschritte gemacht, aber in dem halben Jahrhundert der Sesselfelsgrotten-Forschungen ist im westlichen Mitteleuropa dennoch keine zweite Fundstelle ausgegraben worden, die in ähnlicher Weise über die Umwelt- und Kulturentwicklung der letzten 90–100 000 Jahre Auskunft geben könnte. Dies zeigen gerade auch die Bände, die den naturwissenschaftlichen Untersuchungen gewidmet sind. Nach den Kleinsäugern, den Hasenartigen, Fischen, Amphibien und Reptilien (Sesselfelsgrotte VI) folgen nun im vorliegenden Band die Vögel, der erste Teil der Großfauna, die Mollusken und die botanischen Reste.

Viele der 16 Autoren, die bislang mitgewirkt haben, verbrachten Jahre mit der Auswertung des ergrabenen Quellenmaterials. Ihnen gilt mein großer Dank und Respekt als neuer Mitherausgeber ebenso wie der Herausgeberin Gisela Freund, die das Editionsprojekt mit Disziplin und Energie durch alle Höhen und Tiefen vorangetrieben hat und – buchstäblich in täglicher Arbeit im Sesselfelsgrotten-Raum des Erlanger Institutes – das Autorenteam motiviert und zusammengehalten hat: Danke!

Köln im Dezember 2016 Jürgen Richter

Die Herausgeber sind der Deutschen Forschungsgemeinschaft zu Dank verpflichtet - insbesondere danken wir Herrn Dr. Hans-Dieter Bienert für die viele Jahre währende Betreuung und Unterstützung des Publikationsprojektes Sesselfelsgrotte und seinem Nachfolger Herrn Dr. Christoph Kümmel für die wohlwollende Begleitung des Antrages, der den vorliegenden VII. Band nun möglich gemacht hat.

Birds in a rock shelter: the Palaeolithic avifauna from the Sesselfelsgrotte (Neuessing, Lower Bavaria)

Angela von den Driesch†, München, Jørn Zeiler, Haren**, Thijs van Kolfschoten, Leiden****

1. Introduction

The Sesselfelsgrotte (Neuessing, Lkr. Kelheim/Donau, Germany) is a site in Central Europe with a long Middle and Upper Palaeolithic sequence. The site is located in the lower valley of the river Altmühl, a tributary of the river Danube (Fig. 1). It is a southwest facing rock shelter or abri within the village Neuessing,

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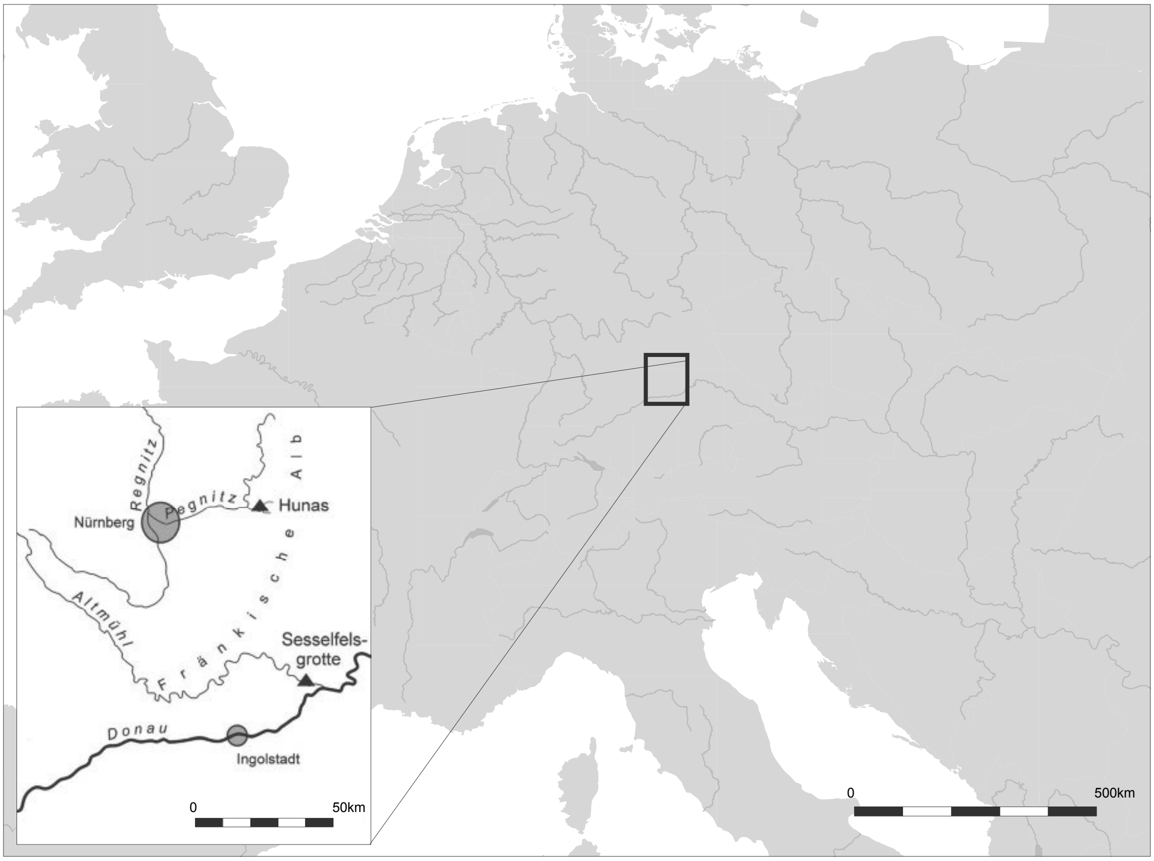

Fig. 1. Geographical location of the Sesselfelsgrotte (after van Kolfschoten 2014).

located 374 m above sea level and about 25 m above the present level of the river Altmühl. The site has been excavated in the frame of the research project "*Das Paläolithikum und Mesolithikum des Unteren Altmühltals II*" and the excavations have been executed under L. Zotz († 1967) and G. Freund in 1964–1977 and in 1981. A detailed description of the excavations and the exposed sedimentological sequence is presented by G. Freund (1998).

The Sesselfelsgrotte with up to nearly 7 m of deposits (mainly rock debris with a matrix of more fine-grained, clay deposits) mainly of Pleistocene age is divided into ca. 35 sedimentological and ca. 25 archaeological (Middle, Upper and Late Palaeolithic) (sub)units (Fig. 2). A layer of loess sediment (D) has been encountered between 1 and 1.50 m from the top of the sequence. The lower part of the sequence (the layers S and 3-West to M1) consists of Early Weichselian, Mousterian deposits (Weißmüller 1995). The unit is correlated with Marine Isotope Stages (MIS) 5d–5a and the beginning of MIS 4 (based on the occurrence of cold indicators in layer M3) (Richter et al. 2000). The overlying L, K and I are archaeologically almost sterile. The layer L and the base of layer K are correlated with the end of MIS 4. The top of layer K and the layer I reflect the transition between MIS 4 and MIS 3 (van Kolfschoten 2014). The layers H to E1–3 have also been referred to MIS 3 (Böhner 2008). Layer G yielded a large number of artefacts indicating several occupations of Mousterian and mostly Micoquian character (Richter 1997). The loess deposits of the archaeologically sterile layer D are correlated with MIS 2. The layers C1 and C2, with Upper and Late Palaeolithic artefacts (Dirian 2003) mark the transition of the Bölling-Allerød complex to the Younger Dryas. Layer A is artificially deposited and has a Holocene, late Medieval age (Freund 1998, 298).

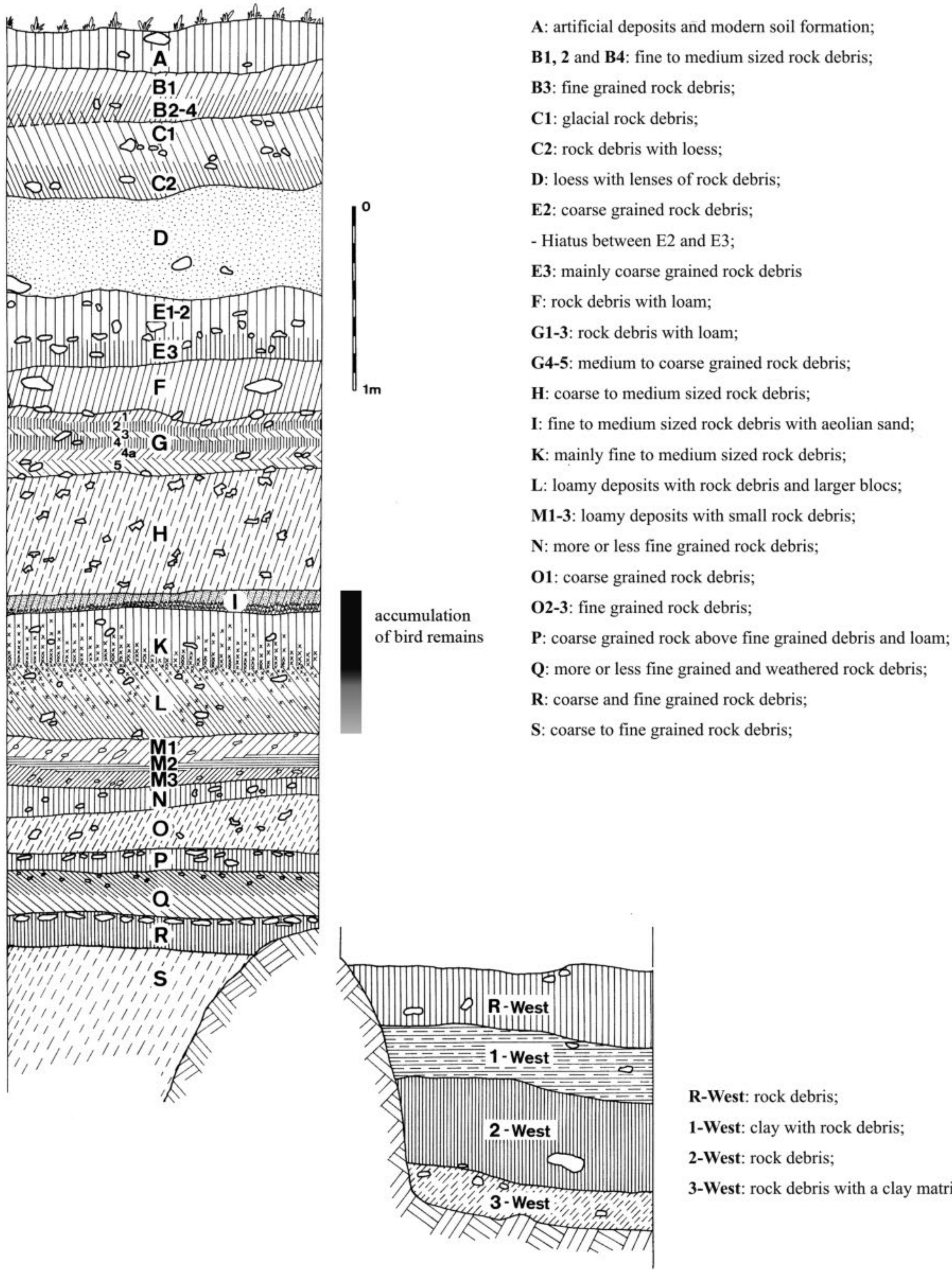

Fig. 2. Schematic profile showing the depositional sequence of the Sesselfelsgrotte infill (modified after Freund 1984, Fig. 34; description by L. Reisch).

Bird remains have been found in almost all strata, be it in (strongly) varying numbers. The layers I and K yielded the largest part: together they account for almost 90 % of the total number of bird bones. As for stratum K, more than half of the remains (56 %) comes from the substrata Kii–iii. These were deposited in cold conditions (though not quite as cold as in layer L), whereas the upper substratum Ki was formed in a period when the climate became warmer.

The analysis of the bird bones and bone fragments was carried out by the late A. von den Driesch, using the reference collection of the Staatssammlung für Anthropologie und Paläoanatomie in Munich (Germany). The preliminary results, based on about 900 "hand-picked" bones, were presented at the 5th Meeting of the ICAZ Bird Working Group in Munich (Germany) in 2004 and published in 2005 (von den Driesch 2005). Since the publication in 2005, more material (c. 3000 bones) mainly from sieving residues became available. This paper presents the results of the analyses of the combined first and second assemblages.

2. Species spectrum

The majority of the bird remains (69,2 %) could be identified to species or genus level. At least 72 species are represented, which is considerably more than in the study published by A. von den Driesch in 2005. This is due to the fact that part of the material analyzed after 2005, was collected by sieving, which produced a considerable number of small(er), mainly passerine species. The best represented groups are grouse, thrushes, buntings and finches, corvids, swallows and swifts, woodpeckers, owls, larks and tits. Figure 3 shows the frequencies of the larger species, while in Figure 4 those of the smaller songbirds are shown.

Tab. 1. Number of bird remains per species and layer.

	A–H	H	I	H–I–K	K	K/i	K/ii–iii	K/L	L	M–3–West	R–W	Σ
Whooper swan (*Cygnus cygnus*)	1	–	–	–	–	–	–	–	–	–	–	1
Bewick's swan (*Cygnus bewickii*)	1	–	–	–	–	–	–	–	–	–	–	1
Brent goose (*Branta bernicla*)	1	–	–	–	–	–	–	–	–	–	–	1
Goosander (*Mergus merganser*)	–	–	–	–	–	–	–	–	–	1	–	1
Goldeneye/Scaup (*Bucephula clangula/Aythya marila*)	1	–	1	–	–	–	–	–	–	–	–	2
Golden eagle (*Aquila chrysaetos*)	1	–	–	–	–	–	–	–	–	2	–	3
White-tailed eagle (*Haliaeetus albicilla*)	1	–	–	1	–	–	–	–	–	–	–	2
Sparrowhawk (*Accipiter nisus*)	–	–	2	–	–	–	–	–	–	–	–	2
Griffon vulture (*Gyps fulvus*)	1	–	–	–	–	–	–	–	–	–	–	1
Peregrine (*Falco peregrinus*)	–	–	–	–	2	–	–	–	–	–	–	2
Kestrel (*Falco tinnunculus*)	–	–	1	–	4	–	–	–	–	1	–	6
Medium-sized falcon (*Falco* sp.)	–	–	–	–	–	–	3	–	–	–	–	3
Merlin (*Falco columbarius*)	–	–	–	–	–	–	–	–	8	–	–	8
Capercaillie (*Tetrao urogallus*)	–	–	1	–	–	–	–	–	–	2	–	3
Black grouse (*Lyrurus tetrix*)	34	9	222	–	19	46	31	4	7	5	–	377
Willow grouse (*Lagopus lagopus*)	2	–	11	–	49	–	–	–	–	–	–	62
Ptarmigan (*Lagopus mutus*)	3	–	3	–	9	–	–	–	–	–	–	15
Lagopus sp.	6	28	372	3	14	107	174	–	14	1	–	719
Grouse (*Lyrurus tetrix/Lagopus* sp.)	–	–	206	–	–	36	52	–	–	–	–	294
Hazel hen (*Tetrastes bonasia*)	1	–	58	–	–	–	34	–	4	–	–	97
Grey partridge (*Perdix perdix*)	–	–	1	–	–	1	–	–	–	–	–	2
Spotted crake (*Porzana porzana*)	–	–	1	–	–	–	–	–	–	–	–	1
Redshank (*Tringa totanus*)	–	–	–	–	1	–	–	–	–	–	–	1

	A–H	H	I	H–I–K	K	K/i	K/ii–iii	K/L	L	M–3–West	R–W	Σ
Ruff (*Philomachus pugnax*)	1	–	–	–	–	–	–	–	1	–	–	2
Whimbrel (*Numenius phaeopus*)	–	–	1	–	–	–	–	–	–	–	–	1
Cuckoo (*Cuculus canorus*)	–	–	6	–	–	–	–	–	–	–	–	6
Eagle owl (*Bubo bubo*)	1	–	–	–	–	–	–	–	1	1	–	2
Tengmalm's owl (*Aegolius funereus*)	2	–	9	–	2	2	11	–	2	–	–	28
Tawny owl (*Strix aluco*)	–	–	2	–	–	–	–	–	–	2	–	4
Short-eared owl (*Asio flammeus*)	–	–	–	–	4	–	–	–	–	–	–	4
Long-eared/Short-eared owl (*Asio otus/A. flammeus*)	–	–	51	–	–	–	–	–	–	–	–	51
Pygmy owl (*Glaucidium passerinum*)	–	–	8	–	–	–	–	–	–	–	–	8
Owl, species unknown	1	–	–	–	–	–	–	–	–	–	–	1
Alpine swift (*Apus melba*)	4	–	11	–	1	–	2	–	–	–	–	18
Swift (*Apus apus*)	–	–	5	–	–	–	–	–	–	–	–	5
Black woodpecker (*Dryocopus martius*)	–	–	1	–	–	–	–	–	–	–	–	1
White-backed woodpecker (*Dendrocopus leucotos*)	–	–	4	–	–	1	4	–	–	–	–	6
White-backed/Great spotted woodpecker (*Dendrocopus leucotos/D. major*)	–	–	3	–	–	–	–	–	–	–	–	3
Great spotted woodpecker (*Dendrocopus major*)	–	–	8	–	–	–	–	–	–	1	–	9
Three-toed woodpecker (*Picoides tridactylus*)	–	–	–	–	–	–	–	–	–	2	–	2
Shore lark (*Eremophila alpestris*)	–	1	17	–	–	11	17	–	–	–	–	46
Sky lark (*Alauda arvensis*)	–	–	4	–	1	–	8	–	–	–	–	13
Wood lark (*Lulula arborea*)	–	–	–	–	–	–	2	–	–	–	–	2
Crag martin (*Ptyonoprogne rupestris*)	–	–	1	–	–	–	–	–	–	–	–	1
Barn swallow (*Hirundo rustica*)	3	–	8	3	1	–	–	–	2	1	–	18
Sand/House martin (*Riparia riparia/Delichon urbica*)	–	–	2	–	–	1	–	–	–	–	–	3
Pipit (*Anthus* sp.)	–	–	–	–	–	–	9	–	–	–	–	9
Waxwing (*Bombycilla garrulus*)	1	–	19	–	4	5	41	–	2	–	–	72
Dipper (*Cinclus cinclus*)	–	–	19	–	–	3	10	–	1	3	–	36
Red-backed shrike (*Lanius collurio*)	–	1	2	–	–	–	–	–	–	–	–	3
Great grey shrike (*Lanius excubitor*)	–	–	3	–	–	–	1	–	–	–	–	4
Dunnock (*Prunella modularis*)	–	–	–	–	–	–	3	–	–	–	–	3
Goldcrest (*Regulus regulus*)	–	–	–	–	–	–	1	–	1	–	–	2
Wheatear (*Oenanthe oenanthe*)	–	–	–	–	–	–	11	–	–	–	–	11
Robin (*Erithacus rubecula*)	–	–	1	–	–	–	–	–	–	–	–	1
Robin/Bluethroat (*Erithacus rubecula/Cyanosylvia svecica*)	–	–	19	–	–	7	30	–	–	–	–	56
Mistle trush (*Turdus viscivorus*)	1	1	60	–	4	16	4	–	–	2	–	88
Ring ouzel (*Turdus torquatus*)	1	–	1	–	3	–	–	–	–	–	–	5
Redwing (*Turdus iliacus*)	1	–	10	–	1	–	–	–	–	–	–	12
Ring ouzel/Fieldfare (*Turdus torquatus/T. pilaris*)	8	–	11	6	3	–	–	2	7	1	–	38
Blackbird/Ring ouzel/Fieldfare (*Turdus merula/T. torquatus/T. pilaris*	–	2	101	–	–	44	64	–	–	–	–	211

	A–H	H	I	H–I–K	K	K/i	K/ii–iii	K/L	L	M–3–West	R–W	Σ
Redwing/Song thrush (*Turdus iliacus*/ *T. philomelos*)	–	–	18	–	4	5	8	–	–	–	–	35
Long-tailed tit (*Aegithalos caudatus*)	–	–	6	–	–	–	3	–	–	–	–	9
Great tit (*Parus major*)	–	–	9	–	–	1	–	–	–	–	–	10
Coal/Blue/Crested tit (*Parus ater*/ *P. caeruleus*/ *P. cristatus*)	–	–	6	–	–	–	1	–	–	–	–	7
Nuthatch (*Sitta europaea*)	–	–	2	–	–	–	3	–	–	–	1	6
Wren (*Troglodytes troglodytes*)	–	–	–	–	1	–	–	–	–	1	–	2
Yellowhammer/Snow bunting (*Emberiza citrinella*/ *Plectrophenax nivalis*)	1	–	17	8	17	–	3	4	2	–	–	52
Bunting, unknown species (Emberizidae)	–	–	2	–	10	–	–	3	–	–	–	15
Chaffich/Brambling (*Fringilla coelebs*/ *F. montifringilla*)	–	3	44	–	–	24	20	–	2	–	2	95
Goldfinch (*Carduelis carduelis*)	–	–	–	–	–	2	–	–	–	–	–	2
Siskin (*Carduelis spinus*)	–	–	4	–	–	5	3	–	1	–	–	13
Redpoll (*Carduelis flammea*)	1	–	6	–	–	1	–	–	–	–	–	8
Linnet/Twite (*Carduelis cannabina*/ *C. flavirostris*)	–	–	1	–	–	–	–	–	–	–	–	1
Bullfinch (*Pyrrhula pyrrhula*)	–	–	20	–	–	7	7	–	–	–	–	34
Hawfinch (*Coccothraustes coccothraustes*)	–	–	–	–	–	–	–	–	2	–	–	2
Crossbill (*Loxia curvirostra*)	–	–	–	–	3	–	–	3	2	–	–	8
Nutcracker (*Nucifraga caryocatactes*)	–	–	–	–	–	–	–	–	–	1	–	1
Jay (*Garrulus glandarius*)	–	–	–	–	–	–	–	–	1	–	–	1
Siberian jay (*Perisoreus infaustus*)	–	–	–	–	1	–	–	–	–	–	–	1
Jay/Siberian jay (*Garrulus glandarius*/ *Perisoreus infaustus*)	–	–	–	–	–	–	–	–	–	1	–	1
Jay/Nutcracker (*Garrulus glandarius*/*Nucifraga caryocatactes*)	–	12	7	–	–	2	7	–	–	–	–	28
Jackdaw (*Corvus monedula*)	1	2	–	–	3	2	4	–	3	–	–	15
Chough (*Pyrrhocorax pyrrhocorax*)	3	–	–	–	1	–	4	–	2	–	–	10
Alpine chough (*Pyrrhocorax graculus*)	9	–	1	1	4	4	5	–	1	1	–	26
Σ remains, identified	92	59	1409	22	166	333	580	16	66	29	3	2775
Σ remains, not identified	29	38	589	7	45	153	307	2	37	22	1	1230
Σ remains, total	121	97	1998	29	211	486	887	18	103	51	4	4005

As can be seen in Table 1 and Figs. 3 and 4, grouse – mostly black grouse (*Lyrurus tetrix*), willow grouse (*Lagopus lagopus*) and ptarmigan (*Lagopus mutus*) – is the best represented group, followed by thrushes. Of these, at least three species could be identified: mistle thrush (*Turdus viscivorus*), ring ouzel (*Turdus torquatus*) and redwing (*Turdus iliacus*). Buntings and finches come third, with at least nine different species: yellowhammer or snow bunting (*Emberiza citrinella* / *Plectrophenax nivalis*), chaffinch or brambling (*Fringilla coelebs* / *F. montifringilla*), goldfinch (*Carduelis carduelis*), siskin (*Carduelis spinus*), redpoll (*Carduelis flammea*), linnet or twite (*Carduelis cannabina* / *C. flavirostris*), bullfinch (*Pyrrhula pyrrhula*), hawfinch (*Coccothraustes coccothraustes*) and crossbill (*Loxia curvirostra*). The other small passerine birds, like swallows, larks and tits are represented in lower numbers. These include, among others, crag martin (*Ptyonoprogne rupestris*), barn swallow (*Hirundo rustica*), sand or house martin (*Riparia riparia* / *Delichon urbicum*), shore lark (*Eremophila*

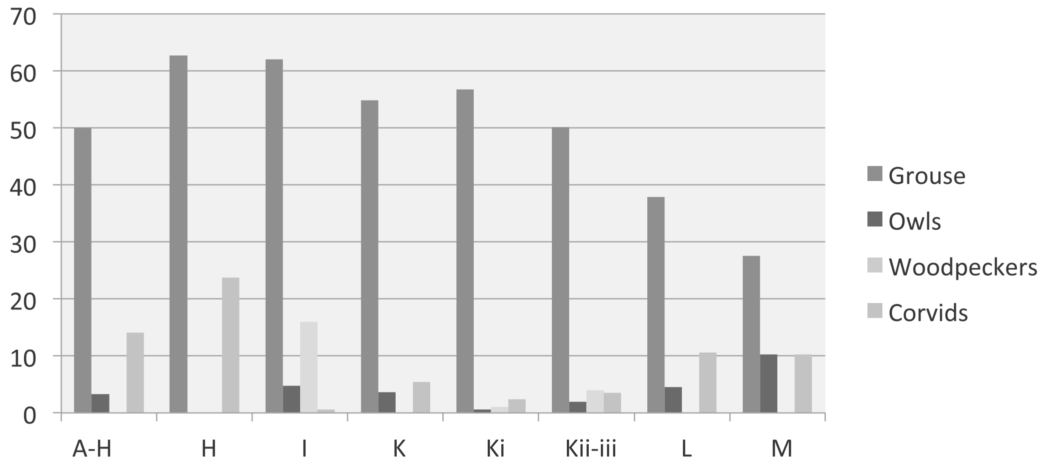

Fig. 3. Proportion of grouse, owls, woodpeckers and corvids (% of identified remains) per stratum (only strata with > 25 identified remains).

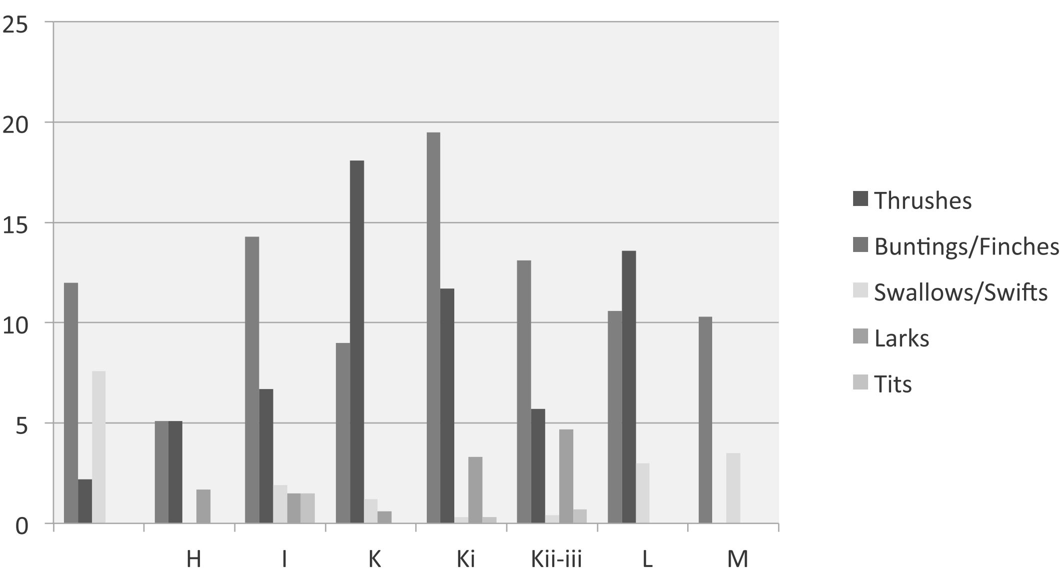

Fig. 4. Proportion of thrushes, buntings/finches, swallows/swifts, larks and tits (% of identified remains) per stratum (only strata with > 25 identified remains).

alpestris), sky lark (*Alauda arvensis*), wood lark (*Lulula arborea*) and long-tailed tit (*Aegithalos caudatus*). The smallest bird species represented are wren (*Troglodytes troglodytes*) and goldcrest (*Regulus regulus*).

Corvids are best represented in strata A–H, H, L and M. The Siberian jay (*Perisoreus infaustus*), jay (*Garrulus glandarius*) and nutcracker (*Nucifraga caryocatactes*) are poorly represented; only a single bone of every species could be identified with certainty. However, jay and nutcracker have been more common, as appears from 28 remains that belong to either one of the species. Of the other two corvids, Alpine chough (*Pyrrhocorax graculus*) is present in more strata and in higher numbers than the red-billed chough (*Pyrrhocorax pyrrhocorax*).

Remains of woodpeckers and owls are most numerous in layer I. Of the first, four species were identified: black, white-backed, great spotted and three-toed woodpecker (*Dryocopus martius*/*Dendrocopus leucotos*/*D.*

major / *Picoides tridactylus*). As for the owls, the remains represent at least five species: eagle owl (*Bubo bubo*), Tengmalm's owl (*Aegolius funereus*), tawny owl (*Strix aluco*), short-eared owl (*Asio flammeus*) and pygmy owl (*Glaucidium passerinum*).

Diurnal birds of prey are relatively rare and appear in low numbers, although seven different species have been identified: golden eagle (*Aquila chrysaetos*), white-tailed eagle (*Haliaeetus albicilla*), sparrowhawk (*Accipiter nisus*), griffon vulture (*Gyps fulvus*), peregrine (*Falco peregrinus*), kestrel (*Falco tinnunculus*) and merlin (*Falco columbarius*).

In terms of biotope, the bird species represent both open and more wooded areas. For instance, willow grouse breed in birch and other forests as well as in moorlands and the tundra of Scandinavia, while the hazel hen is a bird of mixed woodland. Other typical forest species are woodpeckers and owls (except for the short-eared owl which is a bird of open areas). Part of the small songbirds, such as thrushes, finches and tits, as well as corvids (especially jay, Siberian jay and nutcracker) depend on the presence of trees and/or shrubs. Sky lark, shore lark, pipit, wheatear, swallows, martins and swifts are typical birds of open landscapes.

It is striking that remains of waterfowl (swans, geese and ducks) and waders are very rare, and found almost exclusively in strata A–H. They include whooper swan (*Cygnus cygnus*), Bewick's swan (*Cygnus bewickii*), brent goose (*Branta bernicla*), goosander (*Mergus merganser*), redshank (*Tringa totanus*), ruff (*Philomachus pugnax*) and whimbrel (*Numenius phaeopus*). Except for the merganser, all waterfowl species nowadays are migratory. Goldeneyes breed in the boreal forests of northern and eastern Europe. Bewick's swan and brent goose are arctic species; the breeding grounds of the whooper swan lie in subarctic Eurasia, further south than those of Bewick's in the taiga zone. Scaups breed in the northernmost reaches of Europe.

3. Taphonomical analyses

Detailed conclusions about the palaeoenvironmental conditions during the deposition of the different levels and the conditions during human occupation can only be drawn if one knows the taphonomical history of the fossil remains. It is important to know if there is a taphonomical bias in the accumulated assemblage. The main question to be answered first of all, is: who is responsible for the accumulation? Birds of prey are the most obvious candidates, but carnivores and, of the larger animals, hominins should not be excluded. It is important to stress that the majority of the bird remains has been collected from the archaeologically (almost) sterile layers L–H, whereas the archaeologically rich layers P–M1 and G yielded only a small amount of bird remains. Layer G for example, is very rich in archaeological finds; it also yielded the majority of the larger mammal fossils (Rathgeber 2014) as well as the majority of the Leporid remains (referred to *Lepus timidus*) that show cut marks (Maul 2014). Remarkable are the hominin remains from Layer G which include one worn milk molar and 12 bones of a foetal skeleton (Rathgeber 2006). The presence of cut marks as well as the spatial distribution indicate hominin interference in the accumulation of the larger mammal and Leporid remains.

The Sesselfelsgrotte bird remains do not show any sign of hominin interaction: no cut marks, or hominin/human tooth marks. Although these signs of human activities are relatively seldom found on bird bones, their complete absence among the large amount of bird bones from the Sesselfelsgrotte is indeed striking. On the other hand, as is noted by Bochenski (2005), signs of activities by birds of prey (such as beak impacts) are equally rare. This suggests that the Sesselfelsgrotte bird remains including those from the archaeologically rich layers G and M must have been the result of natural accumulations, most certainly deposited through pellets of owls and birds of prey, species that are also represented in the fossil record of the Sesselfelsgrotte.

3.1 Spatial distribution of the bird remains

The fossil bird remains show no random spatial distribution; most of them are concentrated in a limited number of squares (Fig. 5). A. von den Driesch demonstrated, based on the remains she analysed up to that

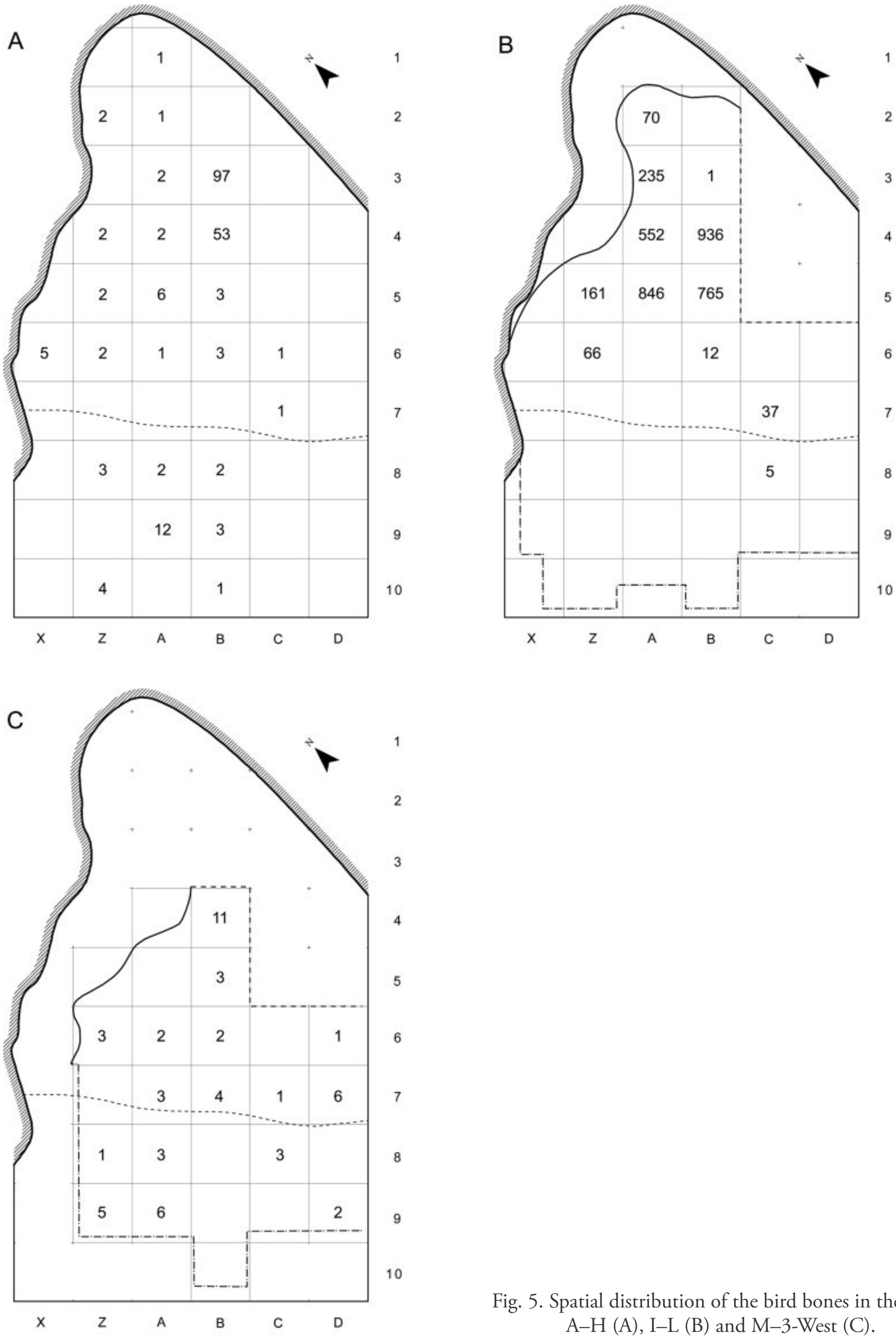

Fig. 5. Spatial distribution of the bird bones in the levels A–H (A), I–L (B) and M–3-West (C).

Tab. 2. Distribution of bones of grouse (Tetraonidae), diurnal and nocturnal raptors (Accipitridae/Strigidae) and crows (Corvidae) per square (after Von den Driesch 2005).

Taxa	Square	X	Z	A	B	C	D
Tetraonidae	2	–	–	3	–	–	–
Accipitridae/Strigidae	2	–	–	1	–	–	–
Corvidae	2	–	–	1	–	–	–
Tetraonidae	3	–	–	23	–	–	–
Accipitridae/Strigidae	3	–	–	1	–	–	–
Corvidae	3	–	–	–	–	–	–
Tetraonidae	4	–	–	57	58	–	–
Accipitridae/Strigidae	4	–	1	–	12	–	–
Corvidae	4	–	–	3	2	–	–
Tetraonidae	5	–	4	148	31	–	–
Accipitridae/Strigidae	5	–	7	7	1	–	–
Corvidae	5	–	1	–	1	–	–
Tetraonidae	6	1	2	1	1	1	–
Accipitridae/Strigidae	6	1	–	1	–	–	1
Corvidae	6	3	1	3	1	–	–
Tetraonidae	7	–	–	–	–	6	1
Accipitridae/Strigidae	7	–	–	–	1	2	2
Corvidae	7	–	–	–	–	8	–
Tetraonidae	8	–	–	1	2	–	–
Accipitridae/Strigidae	8	–	–	–	–	–	–
Corvidae	8	–	–	–	–	1	–
Tetraonidae	9	–	–	5	–	–	3
Accipitridae/Strigidae	9	–	–	1	–	–	–
Corvidae	9	–	1	7	–	–	–
Tetraonidae	10	–	3	–	–	–	–
Accipitridae/Strigidae	10	–	–	–	–	–	–
Corvidae	10	–	–	–	–	–	–

point, that the bones of three of the best represented groups (grouse, diurnal and nocturnal raptors and corvids) were mainly found in squares A4, A5, B4 and B5 (Table 2) and she concluded that we are dealing with remnants of pellets dropped at a covered place in the cave; a location preferred by most birds of prey (von den Driesch 2005). The distribution of the "new" material that has been analysed more recently shows the same pattern (Table 3).

The spatial concentration of birds remains overlaps significantly with the distribution area of the small mammal remains. The spatial distribution of the small mammal remains in the layers L, K and I is also mainly restricted to the squares A4, A5, B4 and B5 (Van Kolfschoten 2014). The distribution of other small vertebrate remains (fish, reptiles and amphibians) (Böttcher 2014) is also strikingly similar. This indicates that their accumulation is probably caused by the same actors, birds of prey.

Tab. 3. Distribution of the bird bones (incl. not identified remains) per square and stratum (excl. H–I–K and K/L).

	A–H	H	I	K	L	M–3-West	R–W	Σ
A1	1							1
A2	1		70					71
A3	2		235					237
A4	2		168	365	19			554
A5	6		576	270				852
A6	1					2		3
A7						3		3
A8	2					1	2	5
A9	12					4	2	18
B3		97	1					98
B4	53		337	529	70	11		1000
B5	3		393	362	10	3		771
B6	3		4	8		2		17
B7						4		4
B8	2							2
B10	1							1
C6	1							1
C7	1		2	35		1		39
C8			5			3		8
D6						1		1
D7						6		6
D9						2		2
H9	3							3
X6	5							5
Z2	2							2
Z4	2							2
Z5	2		142	19				163
Z6	2		60	2	4	3		71
Z8	3					1		4
Z9						5		5
Z10	4							4
Σ	114	97	1993	1590	103	52	4	3953

3.2 Accumulation by raptors

The variation in the representation of specific skeletal elements (Table 4) points to accumulation by raptors. Parts of the head and the pectoral girdle (furcula, scapula and coracoid) are well represented, as are the vertebra. The long bones of the wings and the legs are about equally represented, but the femora are relatively scarce. Also sternum and pelvosacrum are represented in low numbers. As stated by von den Driesch (2005), sternum, pelvosacrum and femur (as well as the proximal part of the tibiotarsus) are from that part of the bird that is rich in meat. This makes these bones far more subject to damage than the pectoral girdle and the wings that often are not digested but dropped just as the vertebra and the lower leg bones (distal part of the tibiotarsus, tarsometatarsus, tarsalia and phalanges).

According to Bochenski (2005) the ratio of wing to leg elements in pellets and uneaten food remains of owls and gyrfalcons is either 1:1 (as it is in the Sesselfelsgrotte) or the wing elements predominate, be it with a predominance that is not high in terms of percentages. Furthermore, in pellets of owls and diurnal preda-

Tab. 4. Spatial distribution of bird remains: skeletal elements of body parts (numbers) per layers and square meters.

	head	sternum	pectoral girdle*	vertebra	wings			legs			phalanges div.	totals
					long bones	pha-langes	pelvo-sacrum	long bones (-fe-mur)	femur	pha-langes		
I - A2	4	0	4	18	13	0	1	5	0	7	40	92
I - A4	6	0	7	11	7	5	0	5	2	0	19	62
K - A4	18	3	28	56	43	3	1	43	8	14	116	333
I - A5	18	1	15	48	36	9	1	30	3	9	125	295
K - A5	13	2	15	12	25	7	1	20	4	12	89	200
I - B4	17	2	16	59	40	6	0	27	14	12	116	309
K - B4	32	5	37	33	55	4	2	52	5	13	138	376
I - B5	20	1	13	63	17	6	1	23	5	7	91	247
K - B5	16	1	39	14	42	23	2	32	5	7	96	277
I - Z5	5	0	3	33	15	3	1	9	1	10	61	141
	149	15	177	347	293	66	10	246	47	91	891	

* pectoral girdle = furcula, coracoid, scapula

tors limb elements (wing and leg bones) greatly predominate over core elements (sternum, coracoid, scapula and pelvis). In uneaten food remains, they predominate to a lesser degree and even are in the minority. In the material from the Sesselfels cave, there is a general predominance of limb elements, which could mean that at least a considerable part of the remains come from pellets. A third criterion mentioned by Bochenski (2005) is the ratio of proximal (upper) elements (scapula, coracoid, humerus, femur and tibiotarsus) to distal (lower) elements (ulna, radius, carpometacarpus and tarsometatarsus). Using this ratio, three groups of avian predators can be distinguished:

Tab. 5. Spatial distribution of bird remains: numbers of proximal elements (scapula, coracoid, humerus, femur, tibiotarsus) vs. distal elements (ulna, radius, carpometacarpus, tarsometatarsus) per layers and square meters.

	total number of remains	proximal elements	distal elements	ratio prox:dist
I – A2	92	10	11	1:1,1
I – A4	62	11	9	1:0,8
K – A4	333	53	60	1:1,1
I – A5	295	33	48	1:1,5
K – A5	200	25	37	1:1,5
I – B4	309	44	50	1:1,1
K – B4	376	62	78	1:1,3
I – B5	247	31	22	1:0,7
K – B5	277	55	56	1:1,0
I – Z5	141	10	18	1:1,8

– diurnal birds of prey (only pellets), with a ratio of 1:1
– owls (pellets) and uneaten food remains of some diurnal birds of prey (gyrfalcon, peregrine falcon, imperial eagle and white-tailed eagle), with a clear but not very great predominance of proximal elements
– golden eagles (uneaten food remains), with a great predominance of proximal elements

Following Bochenski's criteria, we can see that in the Sesselfelsgrotte limb elements greatly predominate over core elements, and in most cases there is only a slight predominance of proximal elements over distal elements (Table 5). These are strong indications that most of the material comes from pellets. Also the fact that remains of both birds and fish, reptiles, amphibians and small mammals (e. g. rodents) are concentrated in the same squares of layers L, K and I, is a strong indication that at least a considerable part of the remains come from pellets, most probably of owls as the digestion of bones by diurnal raptors is stronger (see e. g. Andrews 1990).

The species spectrum of the Sesselfelsgrotte bird assemblages shows some striking similarities with that of the prey spectrum of present-day eagle owls (Table 6). Although the data come from different European countries (Netherlands, Germany, Austria, Denmark and Romania), the overall prey spectrum is very broad, including small mammals like voles and larger mammals up to the size of roe deer as well as all kinds of birds: both small songbirds and larger birds like ducks, pigeons, woodpeckers, corvids – and smaller owls and raptors (Bezzel *et al.* 1976; Frey 1976; Sandor & Ionescu 2009; Terp Laursen 1999; Wassink & Bijlsma 2006).

Tab. 6. Prey species of modern eagle owls (*Bubo bubo*) form Netherlands/Germany (Wassink & Bijlsma 2006), Austria (Frey 1976), Romania (Sandor & Ionescu 2009) and Denmark (Terp Laursen 1999) compared to the species spectrum of the Sesselfelsgrotte.

	Netherlands/ Germany	Austria	Romania	Denmark	Sesselfels-grotte
Little grebe (*Tachybaptus ruficollis*)	x	–	–	–	–
Great crested grebe (*Podiceps cristatus*)	–	–	x	–	–
Cormorant (*Phalacrocorax carbo*)	–	–	–	x	–
Blue heron (*Ardea cinerea*)	x	–	–	x	–
Domestic goose (*Anser anser* f. *domestica*)	–	–	–	x	–
Mallard (*Anas platyrhynchos*)	x	x	x	x	–
Teal/Garganey (*Anas crecca*/*A. querquedula*)	–	x	x		–
Tufted duck (*Aythya fuligula*)	–	–	–	x	–
Pochard (*Aythya ferina*)	–	–	–	x	–
Honey-buzzard (*Pernis apivorus*)	x	–	–	–	–
Goshawk (*Accipiter gentilis*)	x	–	–	x	–
Sparrowhawk (*Accipiter nisus*)	x	–	–	x	x
Common buzzard (*Buteo buteo*)	x	x	x	x	–
Kestrel (*Falco tinnunculus*)	x	x	x		x
Pheasant (*Phasianus colchicus*)	x	x	x	x	–
Grey partridge (*Perdix perdix*)	x	x	–	x	x
Domestic chicken (*Gallus domesticus*)	x	–	–	x	–
Quail (*Coturnix coturnix*)	–	–	x	–	–
Water rail (*Rallus aquaticus*)	x	x	–	–	–
Spotted crake (*Porzana porzana*)	–	–	x	–	x
Common moorhen (*Gallinula chloropus*)	x	x	x	x	–
Coot (*Fulica atra*)	x	x	–	x	–
Corncrake (*Crex crex*)	–	–	x	–	–
Lapwing (*Vanellus vanellus*)	x	–	–	x	–
Woodcock (*Scolopax rusticola*)	x	x	–	x	–
Curlew (*Numenius arquata*)	–	–	–	x	–
Black-headed gull (*Larus ridibundus*)	x	x	–	x	–
Herring gull (*Larus argentatus*)	–	–	–	x	–
Common gull (*Larus canus*)	–	–	–	x	–
Domestic pigeon (*Columba livia* f. *domestica*)	x	x	x	x	–
Stock dove (*Columba oenas*)	x		–	x	–
Wood pigeon (*Columba palumbus*)	x	x	x	x	–
Collared turtle dove (*Streptopelia decaocto*)	x	x	x	–	–
Turtle dove (*Streptopelia turtur*)	x		x	–	–
Cuckoo (*Cuculus canorus*)	–	–	–	x	x
Barn owl (*Tyto alba*)	x		–	x	–
Little owl (*Athene noctua*)	x		x	x	–
Tawny owl (*Strix aluco*)	x	x	x	x	x
Long-eared owl (*Asio otus*)	x	x	–	x	(x)

	Netherlands/ Germany	Austria	Romania	Denmark	Sesselfels-grotte
Ural owl (*Strix uralensis*)	–		x	–	–
Green woodpecker (*Picus viridis*)	x		x		–
Black woodpecker (*Dryocopus martius*)	x		–		x
Great spotted woodpecker (*Dendrocopus major*)	–		x		x
Sand martin (*Riparia riparia*)	–	–	–	x	(x)
Crested lark (*Galerida cristata*)	–		x		–
Dunnock (*Prunella modularis*)	–		x		x
Blackbird (*Turdus merula*)	–		x	x	(x)
Song thrush (*Turdus philomelos*)	–		x	x	(x)
Mistle thrush (*Turdus viscivorus*)	–	–	–	x	x
Thrush (*Turdus* sp.)	x		–	x	x
Blue tit (*Parus caeruleus*)	–	–	x	–	(x)
Tit (*Parus* sp.)	–	–	–	x	x
Warbler (*Sylvia* sp.)	–	–	x		–
Jay (*Garrulus glandarius*)	x	x	x	x	x
Magpie (*Pica pica*)	x	x	x	x	–
Jackdaw (*Corvus monedula*)	x	–	–	x	x
Carrion crow (*Corvus corone*)	x	x	–	x	–
Rook (*Corvus frugilegus*)	–	–	–	x	–
Raven (*Corvus corax*)	–	–	–	x	–
Rook/Carrion crow (*Corvus frugilegus/C. corone*)	–	–	x	–	–
Starling (*Sturnus vulgaris*)	x	–	x	–	–
House sparrow (*Passer domesticus*)	–	–	x	x	–
Tree sparrow (*Passer montanus*)	–	–	x	x	–
Bullfinch (*Pyrrhula pyrrhula*)	–	–	x	–	x
Hawfinch (*Coccothraustes coccothraustes*)	–	–	x	–	x
Sparrow/Finch (*Passer* sp./*Fringilla* sp.)	x	–	(x)	–	(x)

It is especially the combination of rodents and birds of all sizes that draws the attention, because it strongly resembles the zoological material from the Sesselfelsgrotte. So probably the accumulation of bird and small mammals remains is mainly caused by eagle owls that have been roosting and nesting in the cave for many generations.

The distribution of bird bones in the Sesselfels cave clearly reflects a natural accumulation, and is completely different from the patterns found in archaeological assemblages where we are dealing with human consumption waste, as for instance the Dutch Neolithic site of Schipluiden. There, wing bones outnumber leg bones by far. Parts of the head and vertebra are found in low numbers, and also elements of the pectoral girdle are relatively scarce (Zeiler 2006).

Remarkable is the occurrence of a humerus of a young owl (that unfortunately could not be identified to species level) in square C7 of layer B. This find shows that owls might have been nesting inside the cave (von den Driesch 2005), most probably the eagle owl. Also other species might have nested in the cave and died a natural death there: falcons (especially peregrine and kestrel), swifts, martins, choughs and jackdaws (see also Serjeantson 2009, 104). However, the young owl could also have come from outside the cave – as prey. It is not uncommon for larger owls and raptors, like eagle owls and peregrines, to prey upon their relative species. This phenomenon is known as *intraguild predation*: the killing of species that use similar resources. Among the prey of eagle owls, for instance, species like common buzzard, kestrel, tawny owl and long-eared owl are found. Peregrines occasionally kill smaller falcons like hobbies and kestrels, and even larger species like common buzzards (Wassink & Bijlsma 2006; Sandor & Ionescu 2009; Keijl 2013).

4. The stratigraphical distribution of the bird species in the context of past changes in climate and vegetation

The composition of the bird assemblages in the different strata varies almost certainly due to the changes in climate and vegetation. The composition from bottom to top is as follows (Table 1):

- Layer R–W: of the mere four remains, three could be identified. They belong to nuthatch and chaffinch or brambling.
- Layer M to 3-West: at least 15 species could be identified, be it all in low numbers. Among them are two species of woodpeckers, indicating the presence of some woodland. Von den Driesch (2005) mentions a deterioration of the climate in sub phase M1, and an increase in *Larix* and *Picea* in M3.
- Layer L: although quite low in number of bird remains, at least 21 species could be identified. It is one of the few layers in which eagle owl was found, a species still present in Bavaria (see e.g. Bezzel *et al*. 1976). Apart from grouse, corvids and songbirds (buntings/finches and thrushes) are most numerous. Woodpeckers are absent, which is in accordance with the cold climate and the tundra-like landscape. However, the find of a bone of jay indicates that not all trees had disappeared by then.
- Layer K/L: very low in number of bird remains, with only four species identified.
- Layer Kii–iii: second in number of bird remains, representing at least 31 species. Half of the identified bones come from grouse; thrushes are second best represented with 13,1 %. These layers were deposited under cold conditions, though not quite as cold as during the formation of layer L. The presence of birds like white-backed woodpecker and jay or nutcracker points to a certain recovery of the woodland.
- Layer Ki: this stratum provided at least 17 species, with grouse, thrushes and buntings/finches as the best represented groups (resp. 56,8 %, 19,5 % and 11,7 %). The warmer conditions in which this stratum was formed are not (clearly) reflected in the composition of the bird assemblage: the number of typical woodland birds (woodpeckers, jay/nutcracker) is almost the same as in layers Kii–iii.
- Layer K: at least 22 species, of which Siberian jay is the most remarkable. This is the only find of this species in the Sesselfelsgrotte. Siberian jays nowadays are resident birds of the taiga of northern Eurasia. Again, grouse dominate (54,8 %), followed by buntings and finches (18,1 %).
- Layers H–I–K: the mere 22 identified remains represent six species, most of which are small songbirds.
- Layer I: this layer provided the largest number of bird bones. At least 45 species could be identified, among which many small songbirds. Grouse and thrushes dominate with resp. 62 % and 14,3 % of the identified remains. Woodpeckers, absent or found in very small numbers in other layers, are relatively well represented by three different species and 16 % of the identified remains. Among them is the black woodpecker, absent in all other layers, a species that depends of old(er) forests. The warmer climate is also reflected in the presence of species like cuckoo and swift, typical summer residents. Layer I is one of the two in which capercaillie (*Tetrao urogallus*) was found. Nowadays this species is on the German "Red list" since threatened by extinction, and is no longer found in the lower mountainous areas of Bavaria. In the Bavarian Forest, the Black Forest and the Harz mountains numbers of surviving capercaillie decline despite massive efforts to breed them in captivity and release them into the wild.
- Layer H: at least seven species: grouse are by far the most numerous (62,7 % of the identified remains) and corvids come second with 23,7 %.
- Layers A–H: at least 25 species, with grouse dominating with 50 % of the identified remains, followed by corvids and thrushes with resp. 14,1 % and 12 %. Among the other species the presence of griffon vulture draws the attention, as nowadays it only occurs in southern and south-eastern Europe. In Germany, the species became locally extinct during the mid 18th century.

Summarizing, and focusing on the data from (sub)layers L, Kii–iii, Ki and I (Table 7), where a transition can be seen from a cold and dry climate to warmer and more humid conditions, the following conclusions can be drawn.

Tab. 7. Number of identified bird remains per species,(sub)strata I, K, Ki, Kii/iii and L.

	I	K	K/i	K/ii-iii	L
Goldeneye/Scaup (*Bucephula clangula*/*Aythya marila*)	1	-	-	-	-
Sparrowhawk (*Accipiter nisus*)	2	-	-	-	-
Peregrine (*Falco peregrinus*)	-	2	-	-	-
Kestrel (*Falco tinnunculus*)	1	4	-	-	-
Merlin (*Falco columbarius*)	-	-	-	-	8
Capercaillie (*Tetrao urogallus*)	1	-	-	-	-
Black grouse (*Lyrurus tetrix*)	222	19	46	31	7
Willow grouse (*Lagopus lagopus*)	11	49	-	-	-
Ptarmigan (*Lagopus mutus*)	3	9	-	-	-
Lagopus sp.	372	14	107	174	14
Grouse (*Lyrurus tetrix*/*Lagopus* sp.)	206	-	36	52	-
Hazel hen (*Tetrastes bonasia*)	58	-	-	34	4
Grey partridge (*Perdix perdix*)	1	-	1	-	-
Spotted crake (*Porzana porzana*)	1	-	-	-	-
Redshank (*Tringa totanus*)	-	1	-	-	-
Ruff (*Philomachus pugnax*)	-	-	-	-	1
Whimbrel (*Numenius phaeopus*)	1	-	-	-	-
Cuckoo (*Cuculus canorus*)	6	-	-	-	-
Eagle owl (*Bubo bubo*)	-	-	-	-	1
Tengmalm's owl (*Aegolius funereus*)	9	2	2	11	2
Tawny owl (*Strix aluco*)	2	-	-	-	-
Short-eared owl (*Asio flammeus*)	-	4	-	-	-
Long-eared/Short-eared owl *(Asio otus*/*A. flammeus*)	51	-	-	-	-
Pygmy owl (*Glaucidium passerinum*)	8	-	-	-	-
Alpine swift (*Apus melba*)	11	1	-	2	-
Swift (*Apus apus*)	5	-	-	-	-
Black woodpecker (*Dryocopus martius*)	1	-	-	-	-
White-backed woodpecker (*Dendrocopus leucotos*)	4	-	1	4	-
Great spotted woodpecker (*Dendrocopus major*)	8	-	-	-	-
White-backed/Great spotted woodpecker (*Dendrocopus leucotos*/*D. major*)	3	-	-	-	-
Shore lark (*Eremophila alpestris*)	17	-	11	17	-
Sky lark (*Alauda arvensis*)	4	1	-	8	-
Wood lark (*Lulula arborea*)	-	-	-	2	-
Crag martin (*Ptyonoprogne rupestris*)	1	-	-	-	-
Barn swallow (*Hirundo rustica*)	8	1	-	-	2
Sand/House martin (*Riparia riparia*/*Delichon urbica*)	2	-	1	-	-
Pipit (*Anthus* sp.)	-	-	-	9	-
Waxwing (*Bombycilla garrulus*)	19	4	5	41	2
Dipper (*Cinclus cinclus*)	19	-	3	10	1
Red-backed shrike (*Lanius collurio*)	2	-	-	-	-
Great grey shrike (*Lanius excubitor*)	3	-	-	1	-
Dunnock (*Prunella modularis*)	-	-	-	3	-
Goldcrest (*Regulus regulus*)	-	-	-	1	1
Wheatear (*Oenanthe oenanthe*)	-	-	-	11	-
Robin (*Erithacus rubecula*)	1	-	-	-	-
Robin/Bluethroat (*Erithacus rubecula*/*Cyanosylvia svecica*)	19	-	7	30	-
Mistle trush (*Turdus viscivorus*)	60	4	16	4	-
Ring ouzel (*Turdus torquatus*)	1	3	-	-	-