WALTER GEORG KÜHNE (1911-1991) AND THE DISCOVERY OF THE FIRST SEMI-ARTICULATED TITANOSAURIAN SAUROPOD FROM EUROPE

Bernat Vila[1,2]

[1] Institut Català de Paleontologia Miquel Crusafont, Universitat Autònoma de Barcelona, Carrer Escola Industrial 23, 08201 Sabadell (Barcelona), Catalonia, Spain.

bernat.vila@icp.cat

[2] Museu de la Conca Dellà, Carrer del Museu, 4, Isona (Lleida), Catalonia, Spain.

ORCID ID: 0000-0002-5935-1732

[Word count: 9386 words]

Abstract

In 1954 Walter Georg Kühne (1911-1991), the renowned discoverer of Mesozoic mammals, explored the south-Pyrenean basins of Catalonia with the aim of finding Cretaceous mammal-bearing sites. As a result, the German paleontologist discovered one of the most important dinosaur fossils in the history of dinosaur research in Spain. In the Tremp Basin, near Orcau village, he found the remains of a large sauropod dinosaur, but a series of incomprehensible vicissitudes made the find forgotten and its extraction incomplete for over 60 years. Unprecedented research into the history of this discovery, including unpublished documents, images, and field notes, has revealed details on the costs of the campaigns, the daily logistics, the field techniques, and the fossils unearthed in the 1954 and 1955 excavations. More importantly, this new research ascertains that Kühne had already determined that the dinosaur skeleton was articulated from the pelvic

girdle onwards. Even without being published, that was a historically significant achievement as, back then, the new specimen became the first and semi-articulated titanosaurian sauropod found in Europe. Currently, the sauropod fossils found by Kühne in Orcau, together with additional appendicular and axial bones, are the holotype of *Abditosaurus kuehnei* (Vila et al., 2022).

Key words: Dinosaur, Walter Georg Kühne, discovery, titanosaurs, *Abditosaurus*

Introduction

Walter Georg Kühne (1911–1991), also known as the 'legendary explorer of Mesozoic mammals' (Kielan-Jaworowska et al., 2004), was one of the leading paleontologists in the study of fossil mammals during the 20th century (Figure 1). Kühne, Professor of Paleontology at Freie Universität Berlin since 1963, authored more than 70 publications (Schlüter, unpublished; Şengör, 2021) that became a cornerstone in the study of Mesozoic mammals (Kielan-Jaworowska et al., 2004; Kielan-Jaworowska, 2013). Notable examples of such papers include the establishment of the genus *Morganucodon* (Kühne, 1949) and the monograph on *Oligokyphus* (Kühne, 1956). Besides researching the evolution of early mammals, Kühne also devoted time to other taxonomic groups (the enigmatic lobopodian *Xenusion* or the Silurian graptolites; Kühne, 1936, 1953), and to illustrate and develop techniques and methods for discovering, collecting, and preparing microvertebrate fossils (Kühne, 1961, 1971).

<FIGURE 1 NEAR HERE>

Despite his prolific and extensive academic and fieldwork background, very few people have been aware that Kühne discovered, excavated, and collected the bones of a large dinosaur in Catalonia, representing a very significant discovery in the history of dinosaur research in southern Europe. Although acknowledged to have produced some of the first dinosaur finds in Spain, Kühne's surveys in the southern Pyrenees were reported only in abstracts or short articles in journals of this country (Talens, 1955a, b; Lapparent and Aguirre, 1956a, b; Lapparent, 1958; Bataller, 1958). Internationally, the scientific impact and the relevance of his discovery were non-existent (Weishampel et al., 2004) and, out of Spain, only two articles (Schlüter, 1981; Kohring and Schlüter, 1995) made a very short reference to the dinosaur discovered by Kühne in the Upper Cretaceous of Catalonia. Regarding the precise whereabouts of the fossils extracted by Kühne in the 1950s, they remained completely unknown and unstudied for nearly 60 years, and only in the last decade some authors reviewed some of the sites (Pereda-Suberbiola and Ruiz-Omeñaca, 2012) and identified a few of the extracted pieces (Martín et al., 2017; Vila et al., 2022). However, no detailed information was available on when and which dinosaur elements Kühne had discovered and extracted, or what interpretations he made during his fieldwork.

The aim of this paper is to comprehensively narrate the story of how Kühne discovered the first semi-articulated sauropod dinosaur in the Upper Cretaceous of Europe, as well as to underscore his meritorious paleontological work during his stay in Catalonia. The historical and documentary research carried out in the last decade allows us to expose for the first time the unpublished data of the finding, the excavation and extraction techniques used, and the conclusions reached by the German paleontologist on the basis of fossils that more than 60 years later gave rise to the new titanosaur species *Abditosaurus kuehnei* (Vila et al., 2022).

Materials and methods

The historical research here presented is largely based on unpublished field notes by Walter Georg Kühne (property of Urs and Anna Klebe), the regular mail correspondence (letters and reports, Appendix 1) of the Lucas Mallada collection housed in the Archivo MNCN-CSIC (Madrid, Spain), some personal letters housed at the Universitäts Bibliothek Freiburg, and the interviews with Eugeni Nadal (Josep Nadal's son, collaborator in 1954's Kühne field campaign), and Professor Emiliano Aguirre and Josep Montané (collaborators in 1955's Kühne field campaign).

Geological context

In Catalonia, Kühne searched for new vertebrate localities in the uppermost Cretaceous continental deposits of the Tremp basin (eastern Tremp syncline, Lleida province) and the region North of Berga (Vallcebre syncline and surrounding areas, Barcelona province) (Figure 2). The continental deposits in these areas correspond to the Tremp Group (Mey et al., 1968) or 'Garumnian' facies (see Rosell et al., 2001 for equivalences), a unit deposited atop the Campanian-Maastrichtian Arén Sandstone Fm in the Tremp basin and atop of the Les Serres Limestone Fm (Souquet, 1967) North of Berga. The Tremp group is divided into different formations that encompass the Cretaceous-Paleogene transition. These are the La Posa Fm (grey marls and sandstones, limestones, and coals with abundant invertebrate fauna), the Conques and Talarn formations (an alternation of brown, ochre, and reddish marls with sandstones), the Suterranya and Sant Salvador de Toló Fm (micritic limestones), and the Esplugafreda and Claret formations (red mudstones, sandstones, and conglomerates). Kühne preferently visited the Cretaceous units of the La Posa Fm, to a lesser degree the

Conques Fm, and exceptionally outcrops of the Talarn Fm, which all have a Maastrichtian age (Fondevilla et al., 2019) at the areas surveyed.

Results

First field survey in Catalonia and the Instituto Lucas Mallada

The story of the discovery of the "Kühne's dinosaur" began in 1953 when he first traveled to Catalonia. A year before, he had returned to Germany from the United Kingdom, where he had moved in 1938 in search of new opportunities, and where he had succeeded on his search for Mesozoic mammals (such as with the discovery of several individuals of the cynodont *Oligokyphus*; Kühne, 1956). In 1952 Kühne had become a lecturer of paleontology at the Freie Universität in West Berlin and, as narrated by Schlüter (1981), he had 'the intention of making an entirely new beginning'. Most likely, this new research approach included the search for fossil mammals in Portugal and Spain, after the option of doing fieldwork in southern China was rejected (Schlüter and Kohring, 1993). Therefore, in October 1953, Kühne moved to Catalonia on his own and started the field survey in the Montsec Range, in NE Spain. There, he visited the quarries of the Lower Cretaceous konservat-lagerstätte of La Pedrera de Rúbies and later moved northwards to the Tremp basin, where he prospected the Cretaceous outcrops around the Vilamitjana, Suterranya, and Llordà villages (Figure 2A). That was his first contact with the continental 'Garumnian' facies of the south-Pyrenean basins.

<FIGURE 2 NEAR HERE >

In January 1954, after that first field survey in Catalonia, Kühne wrote a letter to Bermudo Meléndez, paleontologist and secretary of the Instituto Lucas Mallada (now included in the Museo Nacional de Ciencias Naturales) in Madrid, expressing his interest in conducting research on coal mines in the southern Pyrenees. He also explained the finding of 'isolated bones of an amphibian in the 'Garumnian' coal mines in Suterranya' (letter 17/01/1954, can0773). Three months later, in a second letter, he formally presented a plan to the Instituto Lucas Mallada for systematic surveys and excavations in the summer of the same year (letter 20/04/1954, ACN0773). Kühne explained that assemblages of vertebrate fossils occur frequently in the Tertiary coals of Eastern Europe and insisted that the numerous Cretaceous coal deposits that had been discovered in Spain needed to be explored. Kühne justified this by the fact that after his explorations of the Cretaceous coals of Suterranya (Tremp Basin) in the previous year he had collected a jaw with teeth that he had attributed to a lacertid. Therefore, that finding was 'clear material evidence that, as in the Tertiary coals, vertebrates exist in Cretaceous coals' (letter 20/04/1954, ACN0773). Thus, according to the Berliner paleontologist, 'the only way to determine whether vertebrate fossils exist in the Spanish Cretaceous coals is through systematic study and exploration', and therefore he proposed to prospect in the coal mines of the Pyrenees from August to October of 1954. In the same letter, Kühne made it very clear that his goal was 'the discovery of Cretaceous mammals' and set out his working conditions, which included, among other things, the possible hiring of mine personnel during this work.

The Instituto Lucas Mallada evaluated the proposal and two months later, on the 28th of June of the same year, Professor Bermudo Meléndez informed Kühne that the Standing Committee of the Instituto Lucas Mallada had approved the plan and a budget of 12,000 pesetas (the equivalent of 2800€ in today's currency) to carry out the work (Figure 3)

<FIGURE 3 NEAR HERE >

Fieldwork in northern Berga and the Josep Nadal's find

With the approved budget, Kühne began prospecting on the 29th of August 1954, in the 'Garumnian' outcrops of northern Berga (north of Barcelona, Catalonia). He specifically visited the dumps and the surrounding outcrops of most of the active coal (lignite) mines in the vicinities of the Fígols, Vallcebre, Sant Salvador de la Vedella, Cercs, La Nou de Berguedà, Saldes, and La Pobla de Lillet villages (Figure 2B). Kühne mainly prospected the 'Grey garumnian' (including outcrops of the 'lower limestones with coals' and 'marls with coals' units; Aepler, 1967; Oms et al., 2007) and identified some beds with abundant ostracods, gastropods, and other mollusks (e.g., *Unio*), and plant remains (Talens, 1955a). Regarding dinosaurs and other vertebrates, he only mentioned on his field notes a small limb bone shaft (30cm in length; 4x7cm in cross section) collected in Mina Consolació (Fígols), a small piece of turtle shell from Mina Campos (Saldes) from a private collection, and ganoid fish scales from Mina Tumí (Vallcebre). Some years later, those early surveys became the basis for the Diploma-thesis (equivalent of Master) of Reinhardt Aepler from Freie Universität Berlin (Aepler, 1967).

In the 20th of September 1954, Kühne focused his efforts on the Tremp basin (Figure 2A), around Suterranya village and other outcrops near Vilamitjana, Gavet de la Conca, Basturs, Orcau, and Figuerola d'Orcau, where he collected some vertebrate bone fragments. During the weeks he surveyed the area, Kühne stayed in Suterranya and asked the people of the village about the presence of fossils collected or identified in the area. On the 23rd of September, he 'took a piece of bone and showed it to all the farmers

working in the field and asked them if anybody had seen anything like it before. The third person who was then approached answered my question affirmatively' (transcribed and translated from German; Kohring and Schlüter, 1995). That person, Josep Nadal Miró (1906-1992), explained that at some point between 1950 and 1952 he had collected a fossil bone while hunting 'in a ravine halfway between Suterranya and Orcau' (Kühne field notes). Nadal thought it was a mammoth bone (Eugeni Nadal, personal communication 2015), but the German paleontologist immediately identified it as a dinosaur bone, specifically as the distal end of a metapodial ['… the farmer showed me half a well-preserved metatarsal bone of a medium-sized dinosaur'] (translated from German; Kohring and Schlüter, 1995). Kühne underscored that 'It had a dark brown color, distinctly different from the gray-blue color of the bones identified in the eastern Suterranya' (Kühne field notes). It was the first clear indication of the presence of dinosaur bones in the area (Figure 4A and B).

At the end of the summer of 1954, Kühne visited the Instituto Lucas Mallada and handed the bone over to Bermudo Meléndez. On November, Meléndez wrote to Josep Nadal thanking the help given to Professor Kühne and stating that he would be paid 250 pesetas for the bone (Figure 4C). The specimen was deposited at the Museo Nacional de Ciencias Naturales de Madrid (specimen no. MNCN59304) but it was not studied by anyone, not even by Kühne, until about 60 years later when Escaso et al. (2010) and Martín et al. (2017) referred it to a humerus of Nodosauridae indeterminate.

Interestingly, the present search reveals for the first time that indeed the place where Nadal found the bone was somewhere in the ravine that runs from east of Suterranya to Orcau (Barranc dels Cantals), and therefore in Lower Maastrichtian outcrops of the La Posa or the Conques formations ('Grey Garumnian' or 'Lower Red Garumnian', respectively) (Fondevilla et al., 2019), but it does not correspond to the 'Locality 4' of

Lapparent and Aguirre (1956b) also named ‘Suterranya-Mina de lignit’ (contra Sellés and Vila, 2015 and Martín et al., 2017).

<FIGURE 4 NEAR HERE >

Discovery and first excavation (1954)

After Nadal’s finding, on the 25th of September they both visited the outcrops between Orcau and Suterranya. ‘The next morning the farmer took me to the place where he had collected the piece. It was a 500 m wide erosive ravine with more than 20 gullies. I started my search for the westernmost gully and I found the dinosaur skeleton at the easternmost’ (translated from German; Kohring and Schlüter, 1995). Kühne determined that the bone fragments, some of considerable size, belonged to dinosaurs and he was therefore convinced that it was a place worth excavating. Over the next two days he prepared the excavation and continued prospecting east of Orcau, and north of Basturs (points 19 and 20, Figure 2A).

On the 28th of September, the excavation started and nine days later he had already identified about ten bones. Some of them (two chevrons, a right tibia, and the distal half of a left femur) were collected (Table 1). Additional six complete or partial bones (a complete left humerus, the proximal half of a left femur, a ‘large and flat bone’, two articulated dorsal vertebrae, the distal half of a left fibula) were protected with jackets and left at the site. During the excavation days, Kühne wrote important notes on excavation and extraction techniques in his field notebook, as it was an unprecedented excavation with a large skeleton in a remote place. The excavation and extraction of the bones proved difficult for Kühne because the bones were embedded in a marl layer with a strong dip. Therefore, he accompanied the sketch in Figure 5 with a note in which he

stated that ‘Future excavation must take place in a cut whose excavation surface falls into the mountain. Only in this way it can be prevented that when a bone is exposed, another bone falls over it, so that in ‘normal excavation’ the excavation surface is covered with imbricating bone ends and no progress is possible.’ (transcribed and translated from Kühne field notes).

<TABLE 1 NEAR HERE >

<FIGURE 5 NEAR HERE >

The excavation ended on the 6th of October and, after a day of preparing the jackets to safely remove the bones, Kühne and Nadal spent another day transporting them to Nadal’s house in Suterranya. There, before returning to Germany, Kühne asked his colleague to send them to the Instituo Lucas Mallada in the next weeks. Nadal distributed the jackets into four wood boxes and on the 13th of December he registered them to Madrid from the Tremp railway station. By the beginning of January 1955 all the four boxes containing the dinosaur fossils arrived in Madrid in perfect condition. Almost at the same time, Kühne send a field report to Professor Maximino San Miguel de la Cámara, director of the Instituto Lucas Mallada, in which he detailed all the fieldwork activities and the main conclusions after prospecting for and the excavating of the fossil materials. Most significant was the fact that the fossil accumulation was more extensive, that a second excavation was needed to determine whether the skeleton was complete, and that the remains could be assigned to a large sauropod dinosaur of the family Titanosauridae (letter and report 10/01/1955, ACN0738). Based on his report, Jacinto Talens summarized the fieldwork and referred the material tentatively to the

genus *Titanosaurus* (Talens, 1955a), now considered as a *nomen dubium* (Wilson and Upchurch, 2003).

Once back in Germany and after the unexpected discovery of dinosaurs near Orcau, Kühne wrote to Professor Otto Heinrich Schindewolf (1896-1971): 'In Spain I "encountered" a titanosaurid from the Upper Cretaceous and brought some specimens to Madrid, the unearthed huge rest is waiting for me until the summer of 1955. Thus, you go out to find rat-sized Cretaceous mammals ('Ratten-große', sic) and bring home a 10-ton beast, and that's just the beginning' (translated from German, letter to Professor Schindewolf, December 1954).

Second excavation (1955)

With the final report on January 1955, Kühne also submitted a new proposal to the director of the Instituto Lucas Mallada (letter 10/01/1955, ACN0738). This included a new working plan for that year to carry on the excavation of the sauropod skeleton in Orcau and the prospects in the Tremp basin. The proposal included three months of fieldwork and asked for professional fees of 550 German marks, the travel expenses of the round trip from Berlin, the daily subsistence allowances, and an extra fund of 9,000 pesetas. Finally, he requested the material costs (plaster, boxes, packaging, and transport) and the hiring of two workers for a month who assisted in removing sediment from the site. Bermudo Meléndez replied that the Instituto Lucas Mallada accepted his plan for the excavation of the sauropod's skeleton, but informed Kühne that the institute would appoint a Spanish paleontologist to accompany him and take charge of the fossils (letters 9, 11/05/1955, ACN0738). The person assigned to accompany Kühne was

Emiliano Aguirre (1925-2021), at that time a 30-year-old fellow from the Instituto with a degree in Natural Sciences (letter 15/08/1955, ACN0738).

In early July, the Instituto Lucas Mallada officially notified Kühne that it would subsidize his proposal with 12,000 pesetas (the same amount as the previous year) and that they would take care of the remaining expenses, including the daily wage of the worker, the material, and the transportation of the fossils to Madrid (letter 07/07/1955, ACN0738).

With all the funding available and the permissions ready, Kühne started the second excavation in the Orcau site. Emiliano Aguirre arrived in Tremp on the 14th of August and joined the excavation from the beginning, on the 16th of August, being mainly responsible for documenting the progress of the work with photographs and notes.

On the afternoon of the 17th of August, Kühne and Aguirre headed for the pathway from Suterranya to the ravine where the fossils had appeared the previous year (a ravine now called 'Barranc dels Cantals', Figure 6A and B). The German and the Spanish paleontologists entered the ravine from its lowest and westernmost stretch (Figure 6C) and after walking along the riverbed about 500 meters to the east they arrived at the sauropod site (Figures 6D and E) and evaluated it after a year of inactivity. The excavation formally began six days later, on the afternoon of the 23rd of August, when the two paleontologists removed the surface debris to rediscover the six pieces that Kühne had left protected the previous summer.

<FIGURE 6 NEAR HERE >

As Kühne had pointed out the year before, the excavation could not be carried out without further digging into the excavation front as this would be covered with

sediment and the bones would not be identified. The aim was to remove vertically the southern edge of the gully in order to have more workspace available, and to crop out the layer with bones in the deepest point of the hollow, which plunged strongly to the south. At the same time, it was necessary to lower the northern edge of the gully along the entire width of the excavation front, about 4-5 meters in an east-west direction, in order to make the layer with bones visible on the surface.

To carry out this work, Josep Montané Morera, a 21-year-old miner from Suterranya and the person who was finally hired by the Instituto Lucas Mallada to work as a stonecutter, joined the team at the second day. The three expedition members lowered the gully's margins with picks, shovels, and pickaxes, but it soon became clear that more expeditious methods had to be used.

The next morning Aguirre went to Tremp to acquire explosives, while Kühne and Montané continued to manually lower the gully's head and its southern and northern margins. By the end of the day, the depth of the excavation front inside the gully had been reduced by 80 cm (Figure 7A).

On the morning of the 26th, two explosives' technicians from the Suterranya mine, Pere Fàbregas and Frederic Vergés, visited the site and exploded several shot holes with dynamite (Figure 7B and C).

<FIGURE 7 NEAR HERE >

Then they all began the work of cleaning the hollow and the surface of the excavation front, removing the excess debris (Figure 7D). This process was repeated for the next two working days until they had cut out a space 3 meters deep, 6 meters wide and 2.5 meters length (Figure 8A) with the bone-bearing layer located on the northern edge of the hollow and dipping south (Figure 8B). At the end of this work, on the 31st of

August, the first bone appeared (a femur of about 120-130 cm long; Figure 8C) and Kühne began to delimite it.

<FIGURE 8 NEAR HERE >

The very same day, Aguirre left the excavation, and from that moment on, Kühne and Montané were the only members of the expedition in charge of discovering and delimiting new bones and extracting and covering them with jackets. On the 1st of September, Kühne began a general mapping of the accumulation of bones (Figure 9A) with sketches of the relative position of the elements and numbered the bones indicating the year and a correlative numbering (e.g., 55/1, 55/2, 55/3, etc.). He also noted features on their preservation. For instance, he documented that 'except for the shafts of the appendicular bones, most of the bones are pierced by 'worm' traces in all directions (not observed in the 3 chevrons). The preservation - with the exception of the largest bones - is poor.' (transcribed and translated from German, Kühne field notes).

Preparing the bones to be safely extracted was a complex task, especially the vertebrae. Kühne annotated in his field notebook that 'he had worked unsuccessfully on the vertebral mess ('Wirbelschweinerei')' or that 'at the end of the day I left this hideous preparation!' (transcribed and translated from German, Kühne field notes). In fact, he could not recover the three articulated dorsal vertebrae (55/6; Figure 9B) and left them on the site. Plate bones such as the scapula were also very difficult to consolidate and extract entirely. This was also the case for the probable ilium (55/10) and perhaps other bones of the pelvic girdle, which appeared fragmented in several parts and with other bones (e.g., ribs) attached on top (Figures 9C and D). Due to these circumstances, Kühne stated that 'several small parts of this object were extracted (55/10), but most of

them are still in the field' (report 23/02/195, ACN0739). When bones were attached one to each other or were closely articulated he also had problems to safely preserve them. Thus, he admitted that 'In the recovery of 55/5 [left humerus], the western corner of 55/7 [glenoid of left scapula or coracoid] was destroyed before its girdle nature was recognised', (transcribed and translated from German, Kühne field notes). When possible, Kühne glued bony fragments and consolidated parts of the bones with flour glue and prepared jackets with plaster, jute, and paper (usually newspaper sheets). Altogether, Kühne collected and/or mapped about ten sauropod bones (a complete right femur and humerus, the distal half of a left fibula, the anterior end of a left scapula, a chevron, an indeterminate 'short' bone, a few small fragments of an ilium, a complete dorsal vertebra, and fragments of at least three dorsal ribs) together with almost all the bones left in the previous campaign (except for the dorsal vertebrae and other indeterminate bones). In addition, Kühne reported 'an isolated crocodile tooth' (transcribed and translated from German, Kühne field notes). As in 1954, Kühne left small parts of mapped bones (most of the ilium fragments, 55/10; two dorsal ribs, 55/11 and 12; the posterior blade fragment of the left scapula, 55/9; and three articulated middle dorsal vertebrae; Figure 9B, C) at the site, protected under plaster. The maximum depth of the digged hole at the end of excavation was 3m, reached in the middle of the excavation at a length of 2m.

<FIGURE 9 NEAR HERE >

Another important difficulty of the excavation was the access to the site, and thus, the transportation of the bones to the nearest village, Suterranya, represented a real challenge to Kühne and his colleagues. In the first week of work at the site, Emiliano

Aguirre remarked that the long trail following the ravine 'is inaccessible by the mules. The pieces must be carried on the shoulder to the ravine entrance (Figure 6C). From there to the town, [there is] a bad pathway to go on foot and mule.'. So, in the last days of excavation, when Kühne and Montané had to extract and transport the bones out of the site, they ruled out to carry the bones along the riverbed. Therefore, they devised a particular system of transport more suitable to the particular terrain conditions. First, Kühne and Montané put the jacket (20-30kg) they had to carry into a sack full of straw; next, they tied the sack with a 10-meter rope that they dragged down the slope to the riverbed. Once there, the sack was tied to a pole and transported by the two men, who climbed as far as possible to the other side of the ravine. Then, the bag was put back on the rope and dragged up again to a flat area on top of the hill where it was tightly stuffed with more straw and transported by mule to Suterranya. The excavation ended with the last pieces being transported on the 22nd of September (report 23/02/1956, ACN0739). Similarly to what Nadal had made the previous year, Montané stored the jackets in his house, and four days later he distributed them onto nine boxes and registered them to Madrid from Tremp (letter 28/09/1955, ACN0738).

New attempts for more excavations

In February 1956, Kühne sent a report on the excavation conducted the previous summer and asked the Instituto Lucas Mallada to undertake an additional excavation (letter 22, 23/02/1956, ACN0739). In April, the director of Instituto and Bermudo Meléndez responded by expressing great satisfaction with the work done and, although Meléndez could not anticipate the conditions for the excavations and did not yet have a detailed work plan, they conveyed the confidence of continuing the excavations in the summer 1956 (letter 13/04/1956, ACN0739). Meléndez also informed Kühne of an

agreement that the Instituto Lucas Mallada had reached with Abbé Albert-Félix de Lapparent, 'one of the few dinosaur specialists in Europe'. The agreement was 'for him to be in charge, once the extraction of remains is finished, of his study and assembly in the Museo of Madrid with the collaboration of Emiliano Aguirre'. Thus, the provisional plan was that the 1956 excavation would be carried out by Kühne and Aguirre with some visits of Lapparent (letter 13/04/1956, ACN0739).

Indeed, two months later (on the 21st of June), the Instituto Lucas Mallada sent a letter to the president of its board to explain that

'Professor Lapparent will come to Spain next summer and will be in Madrid to visit the site and study the collected fossils. Apart from the round-trip travel expenses from Paris, the accommodation expenses of the said Professor in Spain can be calculated at about ten thousand pesetas' (the equivalent of 2,300€ in today's currency; translated from Spanish, letter 21/06/1956, ACN0739).

Four days later, however, Meléndez informed Kühne that they had to cancel the excavations in Tremp because the Consejo Superior de Investigaciones Científicas had denied 'the credit that in previous years has been granted to this institute [the Instituto Lucas Mallada] for research carried out by foreign professors' (letter 25/06/1956, ACN0739). Thus, it seems that the Instituto Lucas Mallada did not obtain the funds to subsidize Kühne's planned work on the Orcau excavation but maintained a commitment for inviting and funding Lapparent to study the material already deposited in Madrid and conduct a new exploration in the Tremp basin. In this context, in the summer of 1956, Albert-Félix de Lapparent and Emiliano Aguirre visited the Tremp basin and explored the main 'Garumnian' outcrops (Lapparent and Aguirre, 1956a, b). Kühne no longer excavated the Orcau locality and neither Lapparent nor Aguirre extracted more bones from there. Regarding the study of the remains of the sauropod deposited in the

Museo Nacional de Ciencias Naturales, it seems that Lapparent had never studied them in detail as they remained in jackets until the 80s and early 2000s. However, Lapparent and Aguirre (1956a) referred part of the collected material to a new species of *Hypselosaurus* that is currently considered a *nomen dubium* (Le Loeuff, 1993).

Other significant findings of Kühne

The first week of the 1955 survey, before starting the excavation in Orcau-1, Kühne and Aguirre prospected together the 'Garumnian' outcrops of the Tremp Basin, except for three days (19th to 22nd of August) in which Kühne prospected on his own. On the 19th and 20th of August the German paleontologist visited various outcrops from northeastern Basturs, the Barranc de la Costa Gran and later the western gullies of Barranc de Basturs (Fig. 10A). The descriptions made by Kühne in his field notes during those days refer to unusual fossils. Thus, in the western gullies of Barranc de Basturs he found no bones but 'flat hand-sized snail and 15-20cm diameter 'grey' calcite-covered sphaeres' (*flache handgroße Schnecke und 15-20 cm Durchnesser graue Calzit bedeckte Sphaeren*, transcribed and translated from Kühne field notes).

At present one knows that the 'flat hand-sized snail' most probably corresponds to the *Lychnus* gastropod, the only gastropod of this size reported in the egg-bearing levels of the Barranc de Basturs and Barranc de la Costa Gran outcrops (Lapparent, 1958; Sanz et al., 1995; Sander et al., 1998), atop of the Aren Sandstone Fm. Alongside the *Lychnus* gastropod, the "15-20cm diameter 'grey' calcite-covered sphaeres' reported in this stratigraphic level probably might be interpreted as dinosaur (megaloolithid) eggs (Fig. 10B). Due to its size and composition, they might be alternatively interpretated as oncolites; however, this interpretation can be ruled out as no oncolite-bearing levels have been reported in none of these two ravines prospected by Kühne.

Therefore, I interpret the descriptions of these unusual fossils reported by Kühne as those of likely dinosaur eggs. More specifically, they might correspond to the eggs described three years later, in September 1958, by Albert F. de Lapparent, C. Bézier, and N. Glachant in the Basturs eggsites (Lapparent, 1958). That both scientists referred to the same localities is proved by a citation of the French paleontologist about Kühne's visit at the locality three years before ('W. Kühne avait déjà reconnus à cette place en 1955'; Lapparent, 1958). Despite having misidentified the fossils (probably due to his lack of expertise or to the fact that they were extremely unknown and rare at that time), I argue that Kühne could have been the original discoverer of the dinosaur eggs in the Basturs site in August 1955. However, the formal interpretation of these remains corresponds to the publication of Albert-Félix de Lapparent in 1958.

<FIGURE 10 NEAR HERE >

Discussion

The most commendable milestone of Kühne's finding in the Orcau-1 locality is the fact that by the end of the 1955 season he gathered evidence that led him to conclude that the sauropod was articulated from the pelvic girdle onwards, with the body axis oriented north-south, and preserving the neck and the skull (Figure 11A). Therefore, on his field notes he argued:

'Signs that neck and head are south of the shoulder region:

1) One dorsal spine of the three associated vertebrae is northward directed

2) The northernmost element is a caudal chevron

3) No more than 6 limb bones have been found to date.'

and

'…many of these [vertebrae], however, [are] in the centre'.

In this passage, Kühne probably referred to that they were trunk or dorsal vertebrae, as an indication of their position along the sauropod body length.

'[there is a] …large cluster of bones in an area of unknown length and about 1.5m wide.' and 'West of excavation all outcrops thoroughly searched without success, only one loose limb fragment'

Here, he probably underscored the fact that most of bones accumulated in a small area and were in contact one to each other, not dispersed, as a clear signal of authoctony and low transportation.

Finally, Kühne concluded that 'The body axis most probably is in a north-south direction'.

A review of the bone distribution in the Orcau's quarry map resulted in additional evidence to support Kühne's interpretation. First, the main appendicular bones (femora and humeri) appeared symmetrically positioned on both sides (right and left) of the accumulation. Second, some of these bones, specifically the left elements, were found articulated with the corresponding girdles (i.e., the left femur was found articulated with the acetabulum of the left ilium and the left humeri appeared articulated with glenoid area of the left scapula; Fig. 11B). This distribution indicates an authoctonous accumulation of the elements affected by very low transportation and a rapid burial of the sauropod carcass that favored the semi-articulation of the skeletal elements.

<FIGURE 11 NEAR HERE >

Unfortunately, the Instituto Lucas Mallada did not put faith in continuing the extraction of the dinosaur and therefore Kühne's assumptions could not be confirmed until 60

years later (Vila et al., 2022). However, the present literature review denotes how relevant was Kühne's prediction, as in 1955 there was only one sauropod species described in Europe on the basis of articulated or semi-articulated skeletons (the current nomen dubium '*Macrurosaurus semnus*' Seeley 1876). Thus, almost all species of sauropods from all ages (Middle Jurassic to the Upper Cretaceous) known in Europe before 1955 had been described from isolated, fragmentary, or disarticulated remains. Therefore, the Orcau sauropod became at that time the second semi-articulated sauropod found in Europe, despite having been only partially collected in 1955. Among titanosaurs, the first species had been described in Europe 23 years before (*Magyarosaurus dacus*, *M. hungaricus*, and *M. transylvanicus* from the Maastrichtian of Romania; Huene 1932) from isolated, fragmentary, and disarticulated material. It was not until the middle 2010s that *Lohuecotitan pandafilandi* (Díez Díaz et al., 2016) and some other unnamed remains (Ortega et al., 2015) from Lo Hueco site in Spain were described and/or reported as semi-articulated skeletons. Thus, the recently defined species from Orcau (*Abditosaurus kuehnei*, Vila et al., 2022) was described on the basis of the first semi-articulated titanosaurian skeleton found in the Late Cretaceous of Europe. This fact highlights the importance of Kühne's finding, reasserts the work conducted by him, and emphasizes his paleontological instinct.

Finally, the discovery of the Orcau sauropod gives evidence of 'Kühne's unusual talent for finding fossils', as Zofia Kielan-Jaworowska had already stated in 2013. Nevertheless, the finding was accidental as Kühne's original purpose was to find fossils of Cretaceous mammals specifically in the coal mines of the area. The finding, however, did not include mammals at all but a large dinosaur and occurred in non-carbonaceous sediments. This leads us to speculate on how the methodological

principles of Kühne (Schlüter, 1981; Şengör, 2021) changed or failed during the field survey in the Tremp basin. Originally, the discovery of vertebrate remains in the Suterranya coal mine in 1953 led him to follow the principle that Schlüter and Kohring (1993) named as the 'principle of series-formation', in which the Berliner paleontologist used to link geological phenomena isolated in time and space to determine the likely whereabouts of new fossil-bearing localities (Şengör, 2021). He had already applied this reasoning with the finding of early mammals in karst fissures in England (Kühne, 1947) and subsequently of amber in the Paris and Acquitanian basins (Kühne et al., 1973). That is to say, Kühne aimed to determine the likely occurrence of mammals (or other vertebrates) in the coal beds of the South-Pyrenean region based on the evidence from the fossil-bearing localities of the Tertiary coal mines of eastern Europe. Therefore, he followed a series of parameters indicative of facies where Tertiary vertebrates eventually occurred to search for fossils in stratigraphically older (Cretaceous) layers. Kühne initially prospected exclusively the coal mines of Suterranya and Llordà in 1953 and those from North Berga region in 1954, but with the finding of a dinosaur skeleton away from the carbonaceous facies he expanded the search to other sediments in the later 1954 and 1955 surveys (Figure 2). Thus, in Orcau he most probably did not follow his 'principle of series-formation' as he lacked any analogous example for dinosaur bone accumulations in continental deposits.

Conclusions

The Professor Walter Georg Kühne (1911-1991) was one of the most renowned paleontologists in the 20th century, especially for the discovery and description of Mesozoic mammals. In the middle 1950s, he visited the south-Pyrenean basins of Catalonia in the search of new mammal localities following his methodological

principles, but against all odds he discovered the remains of a large sauropod dinosaur in the Tremp Basin. Sixty years later, the finding of his field notes, alongside the analysis of unpublished documents and images, and interviews with people that collaborated with him in the field, allows to reconstruct the daily logistics of the campaigns, the field techniques used, and the fossils unearthed. This historical review ascertains that Kühne determined that the dinosaur skeleton was articulated from the pelvic girdle onwards, and thus the new specimen became the first and only semi-articulated titanosaurian sauropod found in Europe. Additionally, the present study concludes that he could have been the discoverer of the famous egg localities of Basturs, in the Tremp basin, three years before Albert Félix de Lapparent reported them.

Acknowlegments

I want to thank the help and collaboration of many people, with particular mention to Josep Montané and Professor Emiliano Aguirre (1925-2021) who excavated alongside Walter G. Kühne. Thomas Schlüter (University of Swaziland), Klaus-J. Reutter (Freie Universität Berlin) and Gerhard Hahn (Berlin and Marburg) provided key information for finding Kühne's field notes. The children of Kühne, Urs and Anna Klebe, assisted with the transcription and translation of the field notes and gave permission to reproduce images from them. Thomas Schlüter, Rolf Kohring, and Urs Klebe provided bibliographic references. Michael Schudack, Rolf Kohring, Jens Kosch (Freie Universität Berlin), Gabriele Kaiser (Staatsbibliothek zu Berlin), Doris Schweizer (Universitäts Bibliothek Freiburg), Nikolas Malchus, Laila Pilgren, (Institut Català de Paleontologia Miquel Crusafont), and Rodrigo Gaete (Museu de la Conca Dellà) assisted in the documents search. Eugeni Nadal provided information on his father's find. The Archivo Museo Nacional de Ciencias Naturales-CSIC provided permissions

to study and reproduce images and documents. I thank Adán Gregorio, Mònica Vergés, and María del Pilar Rodríguez Luque for let me access the documents. Adán Pérez (UNED) provided some images. Albert Prieto-Márquez reviewed the English. An early version of this manuscript was improved with the comments of Thomas Schlüter, A.M.C. Şengör, and an anonymous reviewer.

This research is part of the project VEBPI (reference I+D+i/PID2020-119811GB-I00) funded by MCIN/AEI/10.13039/501100011033/ and the project PLEC2021-007903 funded by MCIN/AEI/10.13039/501100011033 and 'NextGenerationEU'/PRTR. Additional funding was provided by the CERCA Programme and the project CLT009/18/00067 funded by the Departament de Cultura of the Generalitat de Catalunya.

Disclosure statement

The author declares no potential conflict of interest.

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Appendices

Appendix 1: Unpublished documents from the Archive MNCN-CSIC (Lucas Mallada collection)

Collection ACN0773

- letter from W.G. Kühne to Professor Meléndez (17/01/1954), 1p.
- letter from Professor Meléndez to W.G. Kühne (05/04/1954), 2p.
- letter from W.G. Kühne to Professor Meléndez (20/04/1954), 3p.
- letter from Professor Meléndez to W.G. Kühne (28/06/1954), 1p.
- document of payment approval (26/07/1954), 1p.
- letter from Professor Meléndez to Josep Nadal (24/1/1954), 1p.
- letter from Josep Nadal to Professor Meléndez (13/12/1954), 1p.

Collection ACN0738

- letter from W.G. Kühne to the Director of the Instituto Lucas Mallada (10/01/1955), 2pp.
- letter (1p) from W.G. Kühne to Prof. M. San Miguel de la Cámara + report (4pp) (10/01/1955).
- letter from Prof. Meléndez to W.G. Kühne (09/05/1955), 1p.
- letter from Prof. Meléndez to W.G. Kühne (11/05/1955), 1p.
- document of payment approval (13/06/1955), 2pp.
- letter from Prof. Meléndez to W.G. Kühne (7/07/1955), 1p.
- certificate by Bermudo Meléndez (15/08/1955), 1p.
- manuscript letter from Emiliano Aguirre to Bermudo Meléndez (16/08/1955), 2pp.
- field report by Emiliano Aguirre (July-August 1955), 7pp.

- manuscript letter from Josep Montané to the Director of the Instituto Lucas Mallada (28/09/1955), 1p.
- letter from Bermudo Meléndez to Josep Montané Morera (7/10/1955), 1p.

Collection ACN0739

- letter from W.G. Kühne to Bermudo Meléndez (22/02/1956), 2pp.
- letter from W.G. Kühne to Prof. M. San Miguel de la Cámara (22/02/1956), 1p.
- field report by W.G. Kühne (23/02/1955), 3pp.
- letter from Bermudo Meléndez to W.G. Kühne (13/04/1956), 2pp.
- letter from W.G. Kühne to Bermudo Meléndez (25/06/1956), 1p.
- letter to the President of ‘Patronato ‘Alonso de Herrera’’ (21/06/1956), 1p.

Figure Captions

Figure 1. Professor Walter Georg Kühne (1911–1991), during a lecture at the Palaeontological Society of Berlin in 1959 (courtesy of Urs and Anna Klebe).

Figure 2. Geographic map of Catalonia with indication of the main Upper Cretaceous localities and villages visited by Walter Georg Kühne from 1953 to 1955. A, Tremp basin; B, Northern Berga region. Prospecting areas/localities: 1, 'around Vilamitjana cemetery'; 2, Mina de Suterranya (i.e., 'Locality 4' of Lapparent and Aguirre, 1956b or 'Suterranya-Mina de lignit' of Sellés & Vila, 2015); 3, Mina de Llordà; 4, Mina de Sant Josep and Mina Consolació; 5, Mina El Collet; 6, 'mines around Pobla de Lillet'; 7, Mina de Sant Antoni; 8, mine around La Nou de Berguedà; 9, Mina Maria; 10, Mina Tumí; 11, Mina Campos; 12, 'mine around Cercs'; 13, Mina del Coll de Pradell; 14, 'between Suterranya and Vilamitjana' (including the 'Locality 3' of Lapparent and Aguirre, 1956b); 15, 'between Suterranya and Orcau'; 16, 'South of Vilamitjana'; 17, 'South of Fontsagrada'; 18, **Orcau-1** ('between Suterranya and Orcau', at Barranc dels Cantals; i.e., 'Locality 5' of Lapparent and Aguirre, 1956b); 19, 'between Orcau and Basturs' (including the 'Locality 7' of Lapparent and Aguirre, 1956b equivalent to the Orcau-2 locality of Ardèvol et al., 1995); 20, Barranc de la Costa Gran; 21, 'between Suterranya and Figuerola d'Orcau'; 22, 'around Orcau' (i.e. 'Locality 6' of Lapparent and Aguirre, 1956b); 23, Barranc de Basturs (or Barranc dels Corrals) and Barranc de la Costa Gran (including the 'Locality 8' of Lapparent and Aguirre, 1956,b and the egg locality reported by Lapparent, 1958); 24, 'between Basturs and Sant Romà d'Abella' (e.g. Barranc de les Collades); 25, 'Barranco de Enmedio' (Barranc de la Viella); 26, Barranc de la Fonguera; 27, 'from Orcau to Montesquiu'; 28, 'between Cellers and

Moror'; 29, 'between Moror, Sant Esteve de la Sarga, and Alsamora' and 'between Sant Esteve de la Sarga and Cellers' (including the locality 'Moror'of Brinkmann (1984). Localities/prospecting areas 2, 18, 22, 25, and 26 were prospected together with Emiliano Aguirre in the 1955 survey. Maps from GoogleMaps (https://www.google.es/maps/@42.1177987,0.9928178,12z/data=!5m1!1e4; https://www.google.es/maps/@42.1860123,1.8782472,12z/data=!5m1!1e4) accessed the 8 March 2022.

Figure 3. Document with the budget approval for the grant awarded by the Instituto Lucas Mallada-CSIC to Walter Georg Kühne for the study of Cretaceous deposits in the Pyrenees. July 26, 1954. ACN0773, courtesy of the archive of the Museo Nacional de Ciencias Naturales.

Figure 4. Josep Nadal's finding. A, Original handwritting notes of Walter G. Kühne on his field notebook, on the 23rd of September 1954, the day he knew about Josep Nadal's fossil bone (courtesy of Urs and Anna Klebe, yellow shading text translated from German: ' Indication Dino. Well preserved distal end of a metapodial. José Nadal from Suterranea (sic) found the piece while hunting; in a barranca between Suterranea and Orcau between 1950-52. The piece is dark brown, not light grey-blue of the adjacent bones close east of Suterranea'); B, The specimen MNCN59304 found by Josep Nadal (scale bar in cm) and currently housed at the Museo Nacional de Ciencias Naturales, in Madrid; C, Letter by Bermudo Meléndez (Instituto Lucas Mallada) to Josep Nadal (courtesy of Eugeni Nadal; yellow shading text translated from Spanish: 'Mr. Kühne gave us a fossil bone, collected by you, which corresponds to a phalanx of the metapod (sic) of a dinosaur. Although the specimen itself has no commercial value, the Director

of this Instituto has decided to pay you the amount of 250 pesetas for the transfer of said fossil to the Museo Nacional de Ciencias Naturales, as an expression of our gratitude for the help provided to Mr. Kühne.').

Figure 5. Sketches of the 1954 excavation made by Kühne on his field notes. The gully with excavated bones in the Orcau site (above) and cross-section (North-South) view of the excavation front with indication of some exposed bones (below). Text transcribed and translated from German.

Figure 6. Excavation evaluation on the afternoon of August 17, 1955. A, Orthographic view of the Barranc dels Cantals ravine with indication of the Orcau-1 locality (dashed line indicates the itinerary to the site); B, Kühne and Aguirre walked from east Suterranya to the ravine with the dinosaur fossils; C, Kühne (behind the black umbrella) entering the ravine excavated in the Tremp Formation outcrops; D, the fossiliferous gully 'as it was before starting the works' (rectangle marks the site, arrow indicates the dip of the layers, North on the right; photography, indications and notes by Emiliano Aguirre); E, Field sketch of the fossiliferous gully by Emiliano Aguirre (ACN0738). Photos (Archivo MNCN-CSIC, ACN0738/003/003, ACN0738/003/003.22, ACN0738/003/003.21) were taken by Emiliano Aguirre, courtesy of the archive of the Museo Nacional de Ciencias Naturales. Orthographic photo by http://www.icc.cat/vissir3/ (accessed the May 15, 2022).

Figure 7. Excavation works on early days. A, Walter Kühne (right) and Josep Montané (left) on the afternoon of August 25, 1955, after removing manually part of the northern and southern margins of the gully (on the right side is E. Aguirre's beret, who took the

photo); B, The explosive technician Frederic Vergés (on the left) and Walter Kühne preparing one of the five shot holes placed inside the gully on the morning of August, 26, 1955; C, Explosion of the dynamite shot holes in the fossiliferous locality (bottom right corner); D, The explosive technicians Pere Fàbregas and Frederic Vergés, the miner Josep Montané (standing from left to right), and Walter Kühne (from behind) after the explosion and before the removal of the excess debris. Images (Archivo MNCN-CSIC, ACN0738/003/003.1_a, ACN0738_003_003.15_a, ACN0738_003_003.9_a, ACN0738_003_003.12_a) taken by E. Aguirre and courtesy of the archive of the Museo Nacional de Ciencias Naturales.

Figure 8. Excavation and findings on the Orcau-1 locality. A, field scheme by Emiliano Aguirre depicting the progress of the work space available on the site from the 24th to 30th, August 1955 (the scheme represents a North-South cross section of the excavation, North on the right side); B, Josep Montané digging the excavation front on the northern margin of the gully with the excavated 3-m deep hollow on behind him, after the use of explosives (the jacketed bone to his lower right corresponds to 55/1; August 31, 1955); C, Right femur (55/3) with an estimated proximodistal length of 130 cm (August 31, 1955; the pick handle equals 90 cm). Images (Archivo MNCN-CSIC, ACN0738_003_003.6_a, ACN0738_003_003.4_a) taken by E. Aguirre and courtesy of the archive of the Museo Nacional de Ciencias Naturales.

Figure 9. Mapping of bone accumulation in the Orcau-1 locality. A, General mapping of the accumulation of bones, initiated by Kühne on September 1st, 1955; B, Detailed sketch of the three articulated dorsal centra (55/6) (September 8, 1955); C, Detailed sketch of the relative position of the left ilium (55/10), femur (‘femur 54’), and scapula

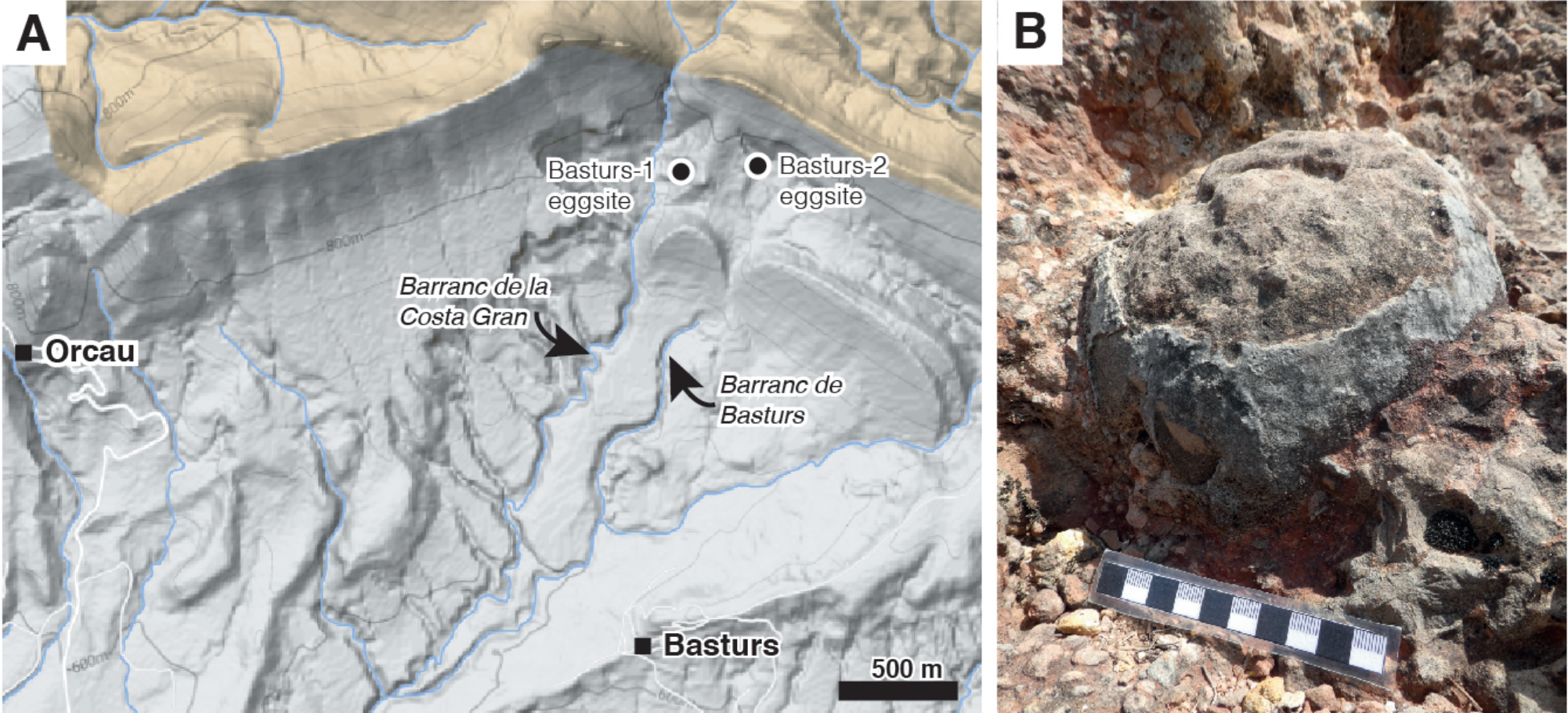
(55/9) (September 15, 1955); D, Detailed skecth of the relative position of the distal ends of the left humerus (55/5) and left fibula (55/2). Transcribed and translated text from German: (a) 'turns out to be a small indefinable remain. Removed'; (b) 'top view of bone layer 45° falling to S'; (c) '1954 vertebrae not found'; (d) ' "Humerus" extracted 1954'; (e) 'end cutted by erosion'; (f), 'basis of 'Barranco'; (g) 'top view of the horizontally placed layer. Surface'; (h) 'nothing here'; (i) 'vertebrae not recovered. 10/09'; (j) '55/7; over 55/7, below 55/9'; (k) '55/6 cast of the impression of 3 vertebrae of the lying surface (hanging wall surface was removed during preparation)'; (l) 'cut bone'; (m) 'opisthocoelous'; (n) 'concave to the front'; (o) 'damage by excavation workers (or other people digging there)'; (p) 'still stuck in the mountain'; (q) 'In both parts of 55/2 there are parts of the end of 55/5 above at the →(arrow)'; (r) 'limb bones in approximation'; (s) '55/2 in the footwall of 55/5'; (t) 'damage due to faulting'; (u) 'end (is) cuttable'.

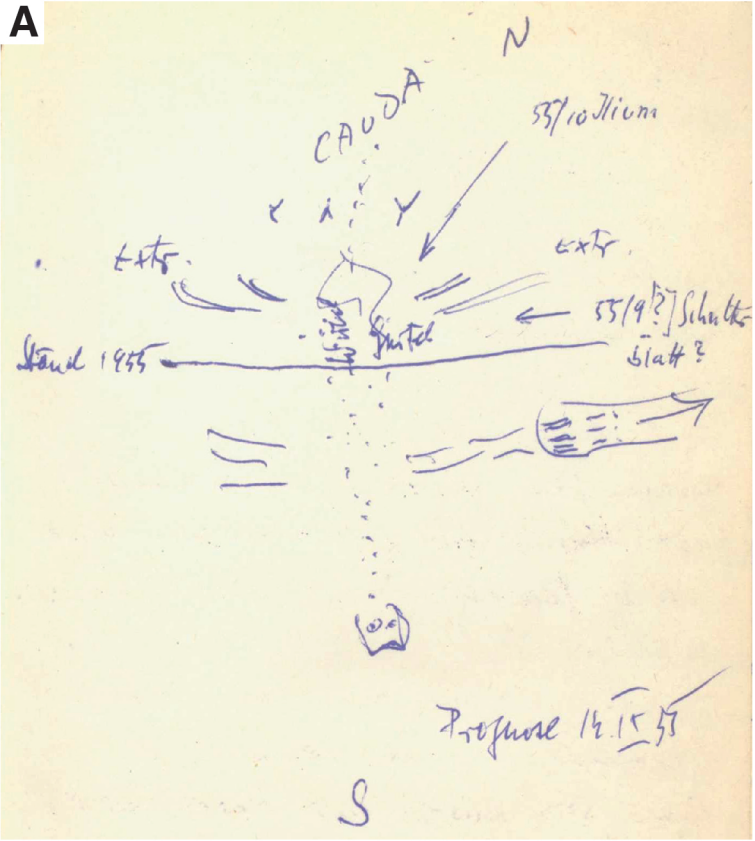
Figure 10. Prospected areas and examples of unusual fossils identified by Kühne near Basturs (Tremp basin). A, the Barranc de la Costa Gran and Barranc de Basturs outcrops, prospected by Kühne during the 19th and 20th of August, 1955; B, a dinosaur (megaloolithid) egg from Basturs-2 eggsite, north of Barranc de Basturs. Kühne could have described eggs like this as '15-20cm diameter 'grey' calcite-covered sphaeres'. Scale bar equals 10 cm. Map from GoogleMaps (https://www.google.es/maps/@42.1177987,0.9928178,12z/data=!5m1!1e4; accessed the 8 March 2022).

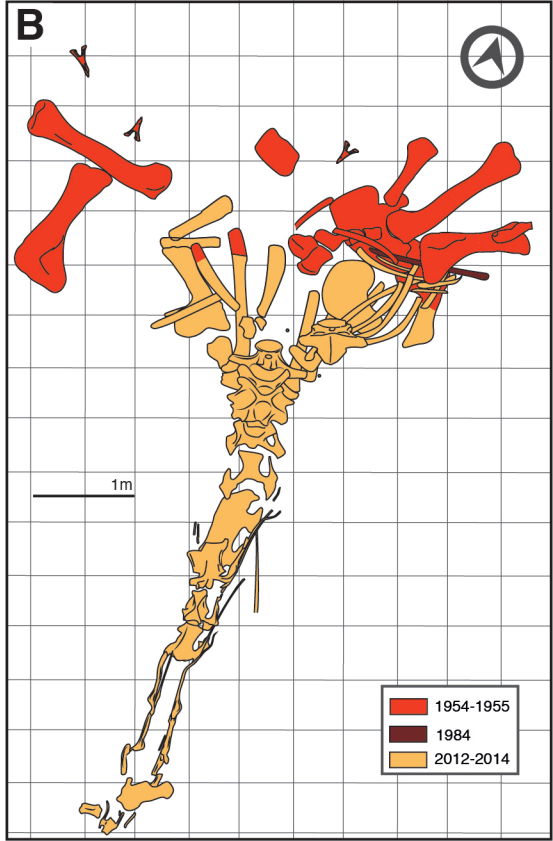
Figure 11. The titanosaurian skeleton from Orcau-1. A, scheme depicting the interpretation on how the sauropod skeleton was preserved at the site, drafted by Kühne

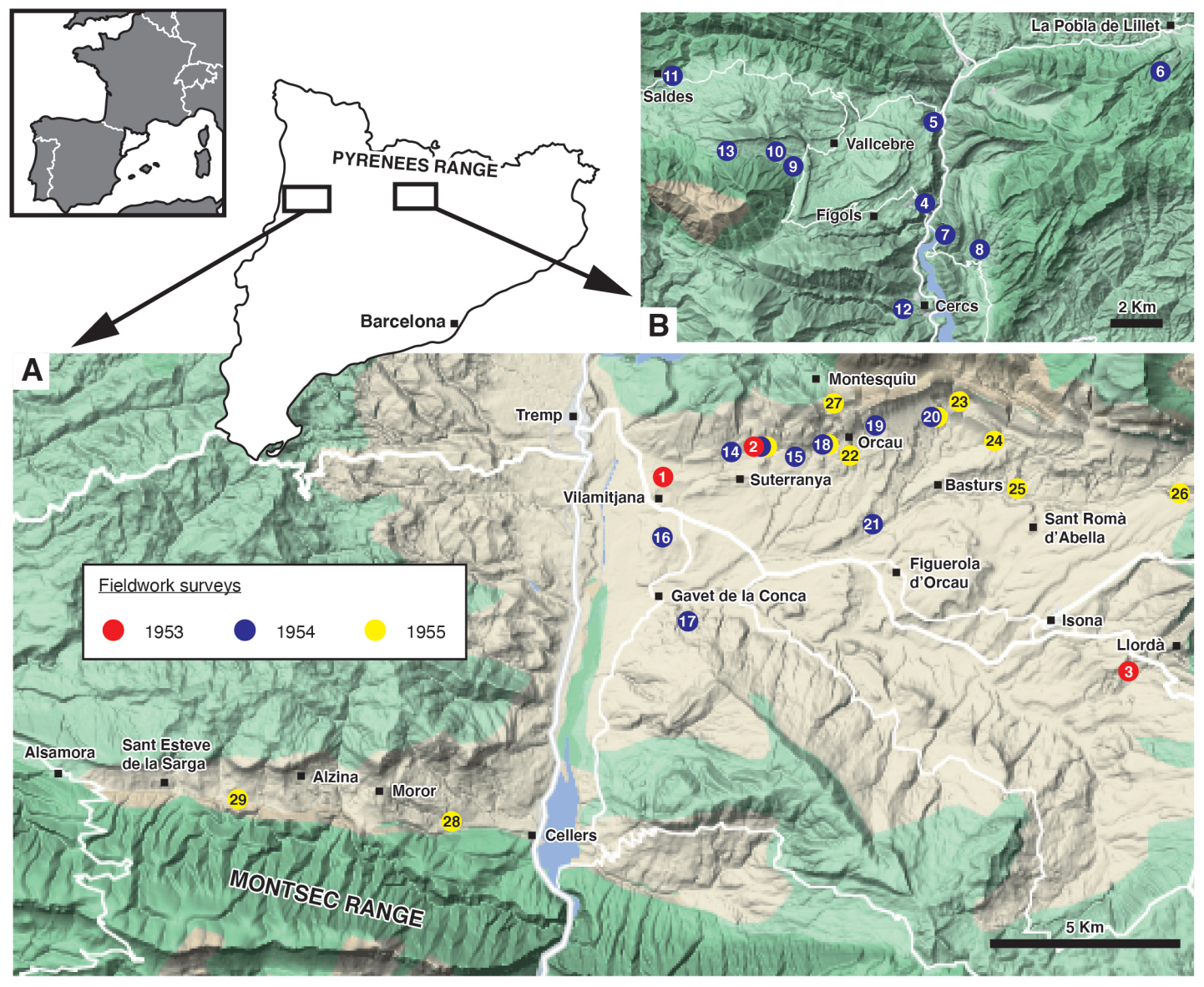
on his field notebook (September 14, 1955); B, Site map showing the skeletal elements mapped during excavations since 1954. The position of the remains discovered in the early excavations is based on sketches from Kühne's field notes (Figure 9A).


Morganucodon 1949 =
(Eozostrodon 1942
Späte Therapsiden
Microlestes
Diarthrognathus
TRITYLODON


A
Basturs-1
eggsite
Basturs-2
eggsite
Barranc de la
Costa Gran
Barranc de
Basturs
Orcau
Basturs
500 m
B


A
N
CAUDA
55/10 Illium
extr.
extr.
55/9 [?] Schulter-
blatt ?
Stand 1955
Protokoll 14.15 57
S


B
1m
1954-1955
1984
2012-2014


PYRENEES RANGE
Barcelona
A
B
Fieldwork surveys
1953
1954
1955
Tremp
Montesquiu
Orcau
Suterranya
Vilamitjana
Basturs
Sant Romà d'Abella
Figuerola d'Orcau
Gavet de la Conca
Isona
Llordà
Alsamora
Sant Esteve de la Sarga
Alzina
Moror
Cellers
MONTSEC RANGE
5 Km
La Pobla de Lillet
Saldes
Vallcebre
Figols
Cercs
2 Km

CONSEJO SUPERIOR DE INVESTIGACIONES CIENTIFICAS

INSTITUTO "LUCAS MALLADA"

(Sección)

D. Walter G. Kühne
(Nombre y apellidos, cargo o profesión)

de este Centro, declara haber recibido del Sr. Habilitado del Consejo, la cantidad de DOCE MIL - - -

- - - - - - - - - - - - *pesetas, importe total íntegro devengado por los conceptos y detalles que siguen:*

CONCEPTOS Y DETALLES NUMERICOS		IMPORTES INTEGROS
Importe de la beca concedida pra estudiar el Cretácico del Pirineo, con cargo al crédito especial de 50.000,-- Pts. concedido a este Instituto en la sesión de la Comisión Permanente del día 4 de mayo.		12.000,--
TOTAL INTEGRO...		12.000,--
A DEDUCIR POR IMPUESTOS:		
1,30 % de Utilidades	156,--	
		156,--
LIQUIDO A PERCIBIR.....		11.844,--

Madrid, 26 de Julio de 195 4

V.º B.º:
El Director,

M. Sandiquel

Conforme.
El Secretario,

B. Meléndez

Recibí,

Walter G. Kühne

A

23. IX 54

von Suterranea nach S.W. Plattige Schf.
auf Kl. Höhe am N. Hang 800 m. S. von
Villamitjana Flora 3 Blätter

Indication Dino. Wohler-
halten Metapod. distal Ende
José Nadal aus Suterranea let
das Stück bei der Jagd gefunden in
einem Barranca bei Suterranea in
Kreide bis 1950-52.
Das Stück ist dunkelgrau, nicht hell-
grau-blau der anstehenden Knochen
dicht östl. Suterranea.

B

C

CONSEJO SUPERIOR DE INVESTIGACIONES CIENTIFICAS
INSTITUTO "LUCAS MALLADA"
DE INVESTIGACIONES GEOLÓGICAS

P.º DE LA CASTELLANA
TELÉFONO 26 09 00
MADRID

Madrid, 24 de Noviembre de 1954.

Sr.D. José Nadal
SUTERRAÑA

Muy Sr. mio:

Hace poco más de un mes, pasó por Madrid el Geólogo de nacionalidad alemana, Dr. Walter Kühne, que por encargo de este Instituto había estado realizando durante el verano investigaciones en las minas de lignito en el Cretácico de la vertiente meridional del Pirineo catalán, dicho Sr. nos indicaba que había dejado en poder de Vd. 4 cajones con fósiles recogidos por él.

Mucho estimaríamos de su amabilidad, diese los pasos necesarios para que dichos cajones fuesen enviados a este Instituto, a la dirección que encabeza esta carta, utilizando para ello las etiquetas que le remito.

Claro está que todos los gastos que éste envío ocasionen serán por cuenta del Instituto, el envío podrá Vd. realizarlo a portes debidos, o bien indicarnos la suma total que le adeudemos por gastos ocasionados.

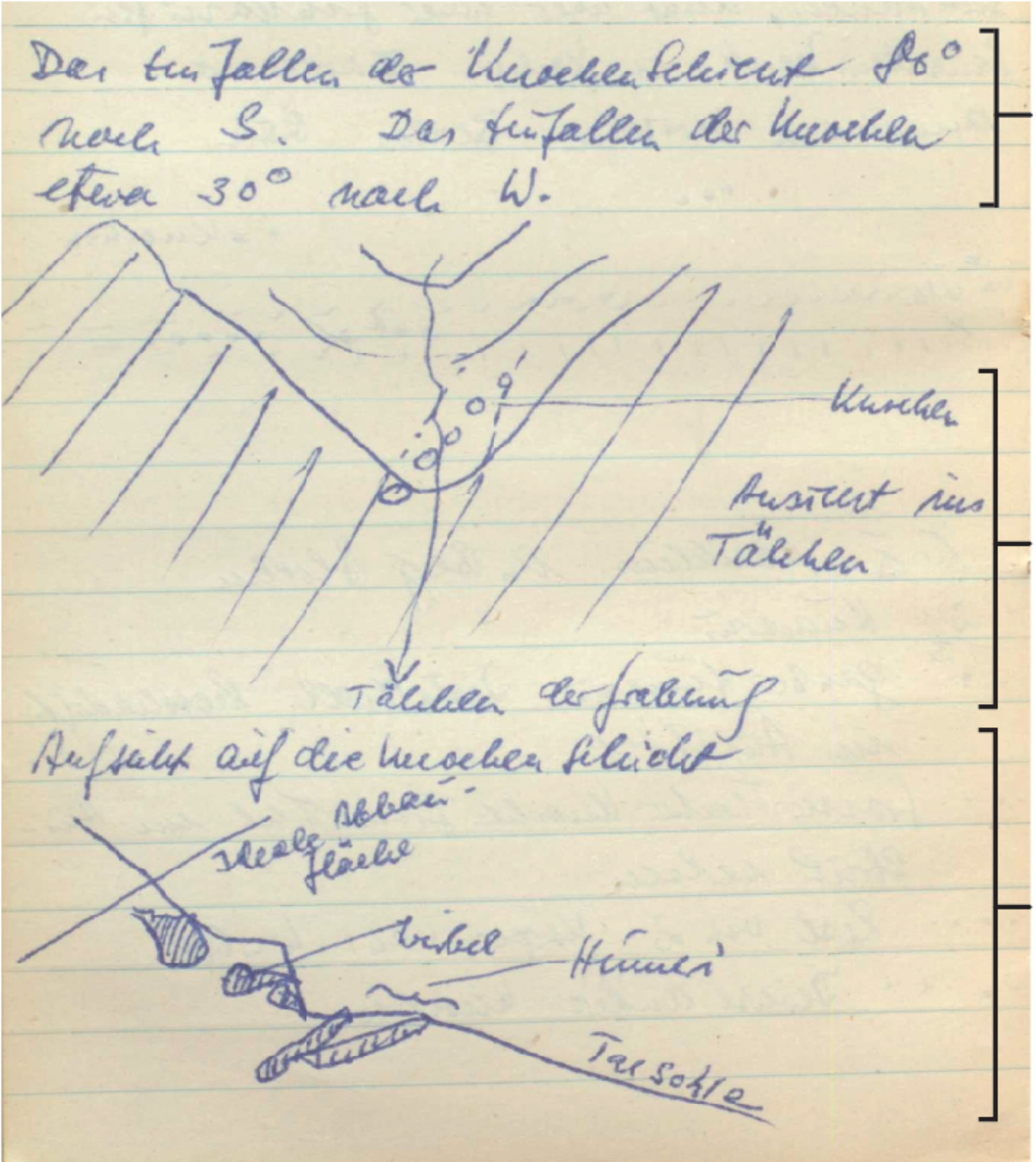
El mismo Sr. Kühne nos entregó un hueso fosil, recogido por Vd. que corresponde a una falange del metápodo de un Dinosaurio.

Aunque el ejemplar en si mismo, no tiene valor comercial ninguno, la dirección de este Instituto ha decidido abonar a Vd. la cantidad de 250,--Pts. por la cesión de dicho fósil con destino al Museo de Ciencias Naturales, y como expresión de nuestro agradecimiento por la ayuda prestada al Sr. Kühne. Tal cantidad le será remitida por giro postal o en la forma que Vd. nos indique en cuanto nos devuelva firmados los recibos que le acompañamos.

En espera de sus gratas noticias, le saluda atto.

B. Meléndez

Firmado: B. Meléndez
SECRETARIO DEL INSTITUTO



The dip of the bone layer 80° to S. The dip of the bones about 30° to W.

Bones

View into the small valley

Valley of the excavation

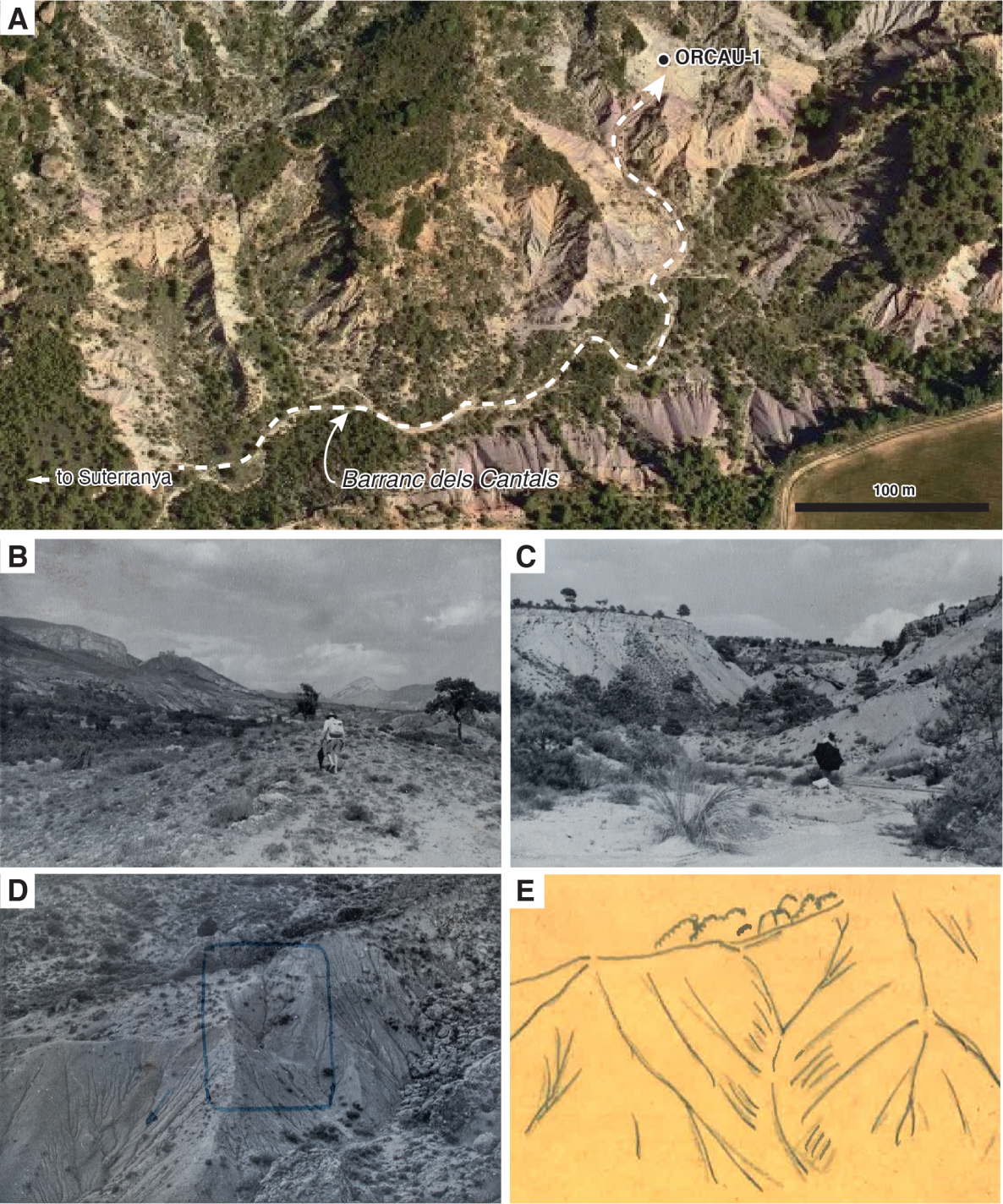
View of the bone layer

Ideal excavation surface

Vertebra

Humerus

Valley

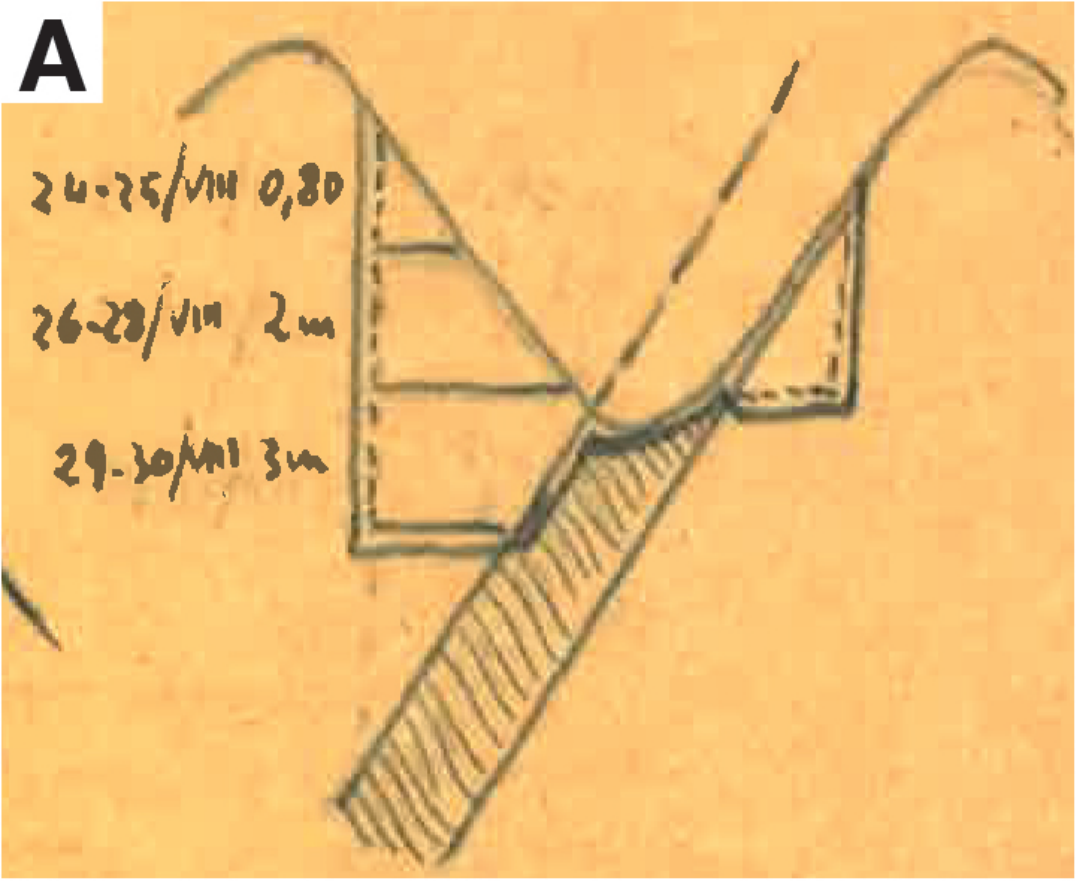

A
ORCAU-1
to Suterranya
Barranc dels Cantals
100 m
B
C
D
E


A


B


C


D


A
24-25/VIII 0,80
26-28/VIII 2m
29-30/VIII 3m


B


C

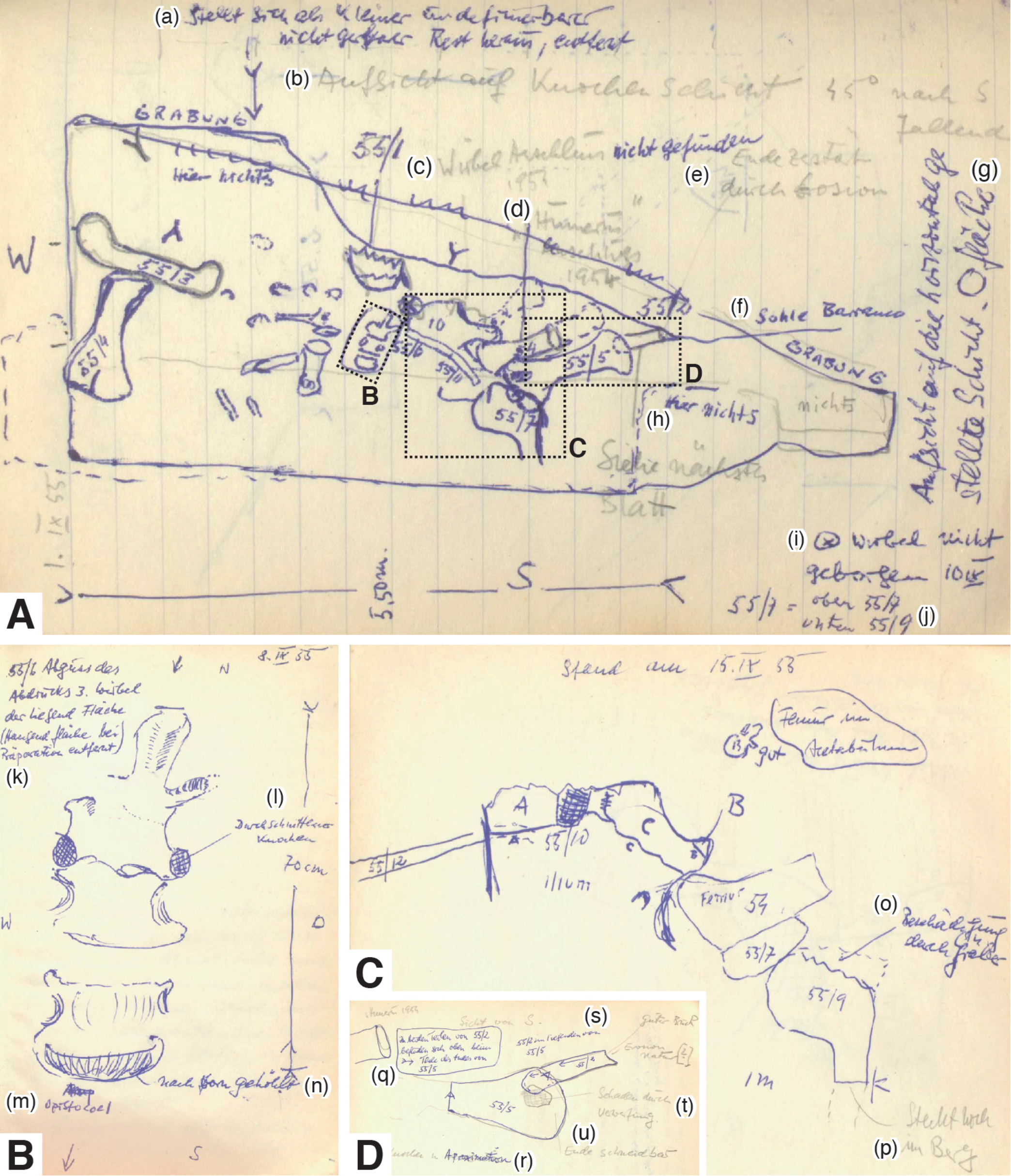

A
(a) Stellt sich als kleiner undefinierbarer nicht gefaßter Rest heraus, entfernt
(b) Aufsicht auf Knochen Schicht 45° nach S fallend
GRABUNG
55/1
hier nichts
(c) Wirbel Anschluss nicht gefunden
(d) Humerus
(e) Ende zerstört durch Erosion
55/3
55/4
55/6
55/5
55/7
55/2
(f) Sohle Barranco
GRABUNG
(g) Aufsicht auf die horizontal gestellte Schicht Oberfläche
hier nichts
(h)
nichts
Siehe nächstes Blatt
W
S
5,50 m
(i) ⊗ Wirbel nicht geborgen 10.IV
55/7 = oben 55/7 unten 55/9
(j)
B
C
D
B
(k) 55/6 Abguss des Abdrucks 3. Wirbel der liegend Fläche (Hangend fläche bei Präparation entfernt)
8.IV 55
N
(l)
Durchschnittener Knochen
70 cm
W
O
(m) Opisthocoel
nach Bonn geholt
(n)
S
C
Stand am 15.IV 55
Femur im Anstehenden
B gut
A
B
C
55/10
55/12
1/10 m
Femur
55/7
55/9
(o) Beschädigung durch Erosion
1 m
(p) Steckt noch im Berg
D
Sicht von S.
(q)
(s)
Guter Bruch
55/5
55/2
Schaden durch Verwitterung
(t)
(u)
Ende schneidbar
Knochen in Approximation
(r)

Table 1. Specimen list of the elements identified and collected by Walter Georg Kühne during the 1954 and 1955 excavations at the Orcau-1 locality. Observations transcripted and translated from German and based on the WGK field notes and reports.

Element	**Field number**	**Recovery year**	**Kühne's field observations**	**Current repository number**
Three caudal chevrons	unknown	1954 (two chevrons) 1955 (one chevron)	"Chevron in 2 pieces", "chevron. Very good [preservation]" (1954's field notes). "One chevron degraded and packed (above 55/3)" (1955's field notes)	MNCN 59539, MNCN 62760, MNCN 59295
Right tibia	N/A	1954 (3 parts)	"A-C femur in 2 pieces+loose middle" (1954's fieldnotes; Note: WGK misidentified the tibia as a femur)	MNCN79837-79838-79848
Left femur	"54A" and "54B" "Femur 54"	1954 (54A) 1955 (54B)	"Half limb bone detached from fault" (1954's field notes) "Half of a limb bone whose other more accessible half was excavated in 1954" (1955's report).	Unknown
Undetermined	55/1	Unknown	"Girdle bone, flat, in two pieces" (1955's report).	Unknown
Left fibula	55/2	1955	"Half limb bone" (1954's field notes), "55/2 was the eastermost piece when discovered in 1954" (1955's field notes). "Limb bone. Part. The rest was destroyed by erosion on the outcrop of the fossil bed" (1955's report).	MNCN-79847 (distal half)
Right femur	55/3	1955 (3 parts)	"Complete limb bone" (1955's report)	MCD-6987 (proximal third)
Right humerus	55/4	1955 (2 parts)	"Complete limb bone" (1955's report)	MCD-6988 (distal half)
Left humerus	55/5	1955 (2 parts)	"The humerus is about 160cm long, it is exposed along its entire length" (1954) "Complete limb bone" (1955's report)	MNCN-79834 (proximal half)
3 dorsal vertebrae	55/6	No	"Non-extracted vertebra" (1955's report)	Probably MCD-6729 and MCD-6730
Left scapula	55/7 and 55/9	No	"In the recovery of 55/5, the western corner of 55/7 [anterior end] was destroyed before its girdle nature was recognized", "55/7 might be part of 55/9", "55/7 and 55/9 lifted off" (1955's field notes). "Distal end [of 55/9] still on the field" (1955's report).	MCD-6715 (posterior end)
Undetermined	55/8	Unknown	"short bone" (1955's report)	Unknown
Ilium	55/10		"Pelvis. Several parts of this object were extracted, most of them are still on the field" (1955's report).	Probably MCD-6731 (anterior margin)

Dorsal ribs	55/11 and 55/12	No	“Ribs. Their proximal ends are still on the field” (1955’s report); “Remains of 10 under plaster” (1955’s field notes)	MCD-6721 (probably corresponds to 55/11)
Vertebra	55/13	Unknown	“Of the vertebra of 55/13, which was favourably exposed with a clearly intact corpus, a complete preparation in two parts has been made, on which the preparator can prove whether the recovery of vertebrae is worthwhile.” (1955’s field notes). “Complete vertebra, in two parts” (1955’s report).	Unknown