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Pliny’s Presses: the True Story of the First Century Wine Press

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Summary: In a much-quoted passage of the “Natural History”, Pliny describes several wine press mechanisms. This description is of great historical importance, since it is the only such textual description of a vitally important class of technologies used for the production throughout the Roman Empire of both wine and olive oil, dietary staples in the ancient Mediterranean. Pliny’s text has been quoted and used as the basis for discussions of Roman farming and technological history for many decades. Yet it has never been properly understood in the light of related and recently published archaeological evidence, and close attention has never been paid to developing a precise translation, or to Pliny’s painstaking grammatical construction and word choices. A thorough and critical re-examination of the text reveals that modern scholars have routinely misinterpreted Pliny’s account of ancient press technology. In this paper, a new translation is offered, which more accurately aligns with archaeological and ethnographic evidence and which attempts to strip away the layers of modern interpretation, to rediscover previously ignored or misunderstood elements, and to restore the original sense of Pliny’s passage.

Keywords: Pliny the Elder, Roman technology, Roman wine production

In a short passage of the “Natural History”, comprising no more than 52 words in total, Pliny describes several wine press mechanisms. Despite its brevity, this description is of great historical importance, since it is the only such textual description of a vitally important class of technologies used for the production throughout the Roman Empire of both wine and olive oil – two of the three dietary staples in the ‘Mediterranean triad’.1 Because of its inestimable value as a record

1 It is important to distinguish ‘pressing’ with these machines from other processes in wine and oil production which occurred before pressing: the ‘treading’ of wine (crushing of the grapes, usually with feet) and the ‘crushing’ of olives (in a mill, which should be clearly understood to be a quite different machine from the ‘press’). After treading or crushing, further liquid could be squeezed from the fruit through the use of a press.

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of patterns of innovation in the ancient world, Pliny’s text has been quoted and used as the basis for discussions of Roman farming machines and technological history for many decades.\(^2\)

The only other detailed description in a Latin source is that of Cato, which describes only one type, in use in Italy during the middle Republic.\(^3\) Some descriptions of presses by Hero of Alexandria, whose \textit{floruit} is unknown, survive in an Arabic translation from the original Greek, but these are of uncertain value since they may be creative inventions rather than representations of machines in actual use.\(^4\) Hero comments that he does not intend to record “many other types of press, which it is pointless to describe, because their use among the multitude has been widespread and long-standing”\(^5\). Only a brief passing mention of presses appears in Vitruvius, who explains that he is not concerned with the “innumerable sorts” of common machines such as those with “drums, levers and hand-spakes for pressing”, because these are “at hand every day”.\(^6\)

A thorough and critical re-examination of the passage, however, reveals that we should in fact revise our understanding of Pliny’s account of the evolution of Roman technology. Dubious inferences, coloured by post-industrial assumptions, have been made about its overall meaning, obscuring what the ancient author was actually trying to say. Close attention has never been paid to developing a precise translation, or to Pliny’s painstaking grammatical construction and word choices. Nor has the text ever been comprehensively re-interpreted in the light of the full range of currently available archaeological and comparative ethnographic evidence. Undertaking all these tasks reveals that Pliny’s concise description carries different meanings from those traditionally imposed on it, far more

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\(^2\) Drachmann 1932, 1963; Forbes 1955/1965; White 1975, 1984; Curtis 2001, 2008; Thurmond 2006, 2016; Schneider 2007.

\(^3\) Cato Agr. 18–19.

\(^4\) Hero \textit{Mechanica} 3.13–21; dating: Masià 2015. Fleury 1996 suggests Hero’s purpose was to give theoretical instruction in physics, and to amaze and amuse the reader with his clever inventions; Frankel 1999, 88 doubts whether his machines were actually used.

\(^5\) 3.20. Our grateful thanks to A. Treiger and R. Turnbull for their generous assistance with the translation of this line from the 9th century Arabic.

\(^6\) Vitr. De Arch. 10.1.5: [...] \textit{sucularumque et prelorum et uectium si non fuisset torculariis praeparatio, neque olei nitorem neque uitium fructum abeber potuisse ad iucunditatem [...]}; \textit{non minusque sunt innumerabili modo rationes machinationum, de quibus non necesse uidetur disputare, quoniam sunt ad manum cotidianae, [...] quae communes ad usum consuetudinibus habent opportunitates}. (“[...] had not there been provision of drums, levers and hand-spakes for pressing, we could not have had the shining olive oil nor the fruit of the vines for our pleasure. [...] No less innumerable are the types of machines, about which it is unnecessary to speak since they are at hand every day [...] and [...] have frequent opportunity to be used according to custom”). Vitruvius also briefly refers to presses at De Arch. 6.3 (see below).
closely aligned with archaeology than at first appears, and that he tells us much more than traditional interpretations of the text suggest. Indeed, his description provides the only surviving evidence for some aspects of ancient pressing and presses, which has routinely been obscured and overlooked through mistranslation and misunderstanding. Careful analysis reveals that Pliny has much to tell us about Roman technologies and patterns of innovation in these 50-odd words, if only we pay close attention to them.

The passage under consideration reads as follows:

Antiqui funibus uittisque loreis ea detrahebant et uectibus. intra C annos inuenta Graecanica, mali rugis per coeleas ambulantibus, ab aliis adfixa arboris stella, aliis arcas lapidum adtollente secum arbore, quod maxime probatur. intra XXII hos annos inuentum paruis prelis et minore torculario aedificio, breuiole malo in media derecto, tympana inposita uinaceis superne totu pondere urguere et super prela construere congeriem.

Previous translations are presented in the table (see Appendix). The authors offer the following new translation:

“Men of old would drag [the levers] down with ropes and leather straps and also with hand-spakes. Within the last 100 years ‘Greek-style’ [presses] have been devised, with the threads of the rod running throughout the length of the screws; with the star of the pole being fixed in position by some, in some with the pole raising with itself boxes of stones, which is especially favoured. Within the past 22 years there has been devised a way, with small presses and in a smaller press building, with a shorter rod directed toward the middle, to press plates placed on top of the marc from above with all its weight and to build a mass above the presses.”

Our translation is deliberately and inelegantly literal in order to represent in English exactly what Pliny says without introducing interpretative language or ideas, to the extent that this is possible. The technical vocabulary, which reflects ancient farming machines and techniques no longer in use, is not easily conveyed in modern English, and requires considerable exegesis, which will be attempted below.

The general outlines of the passage are clear and uncontroversial: Pliny describes three different categories of presses. The first type is described as having a lever lowered by means of ropes, leather straps, and hand-spakes. Pliny then describes two versions of a type of press in which a screw was used to lower and raise the lever (lever-and-screw presses). Thirdly, he describes a direct-screw press type, in which the screw operated directly on a plate laid over the fruit,

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7 Plin. Nat. 18.74.317.
without a lever. His descriptions seem sparse in comparison to Cato’s exhaustive catalogue of parts, materials and measurements, but Asper has observed that ancient descriptions of machines should be understood in terms of their specific aims. He does not deal with our short passage, which is perhaps why none of his categories of aims exactly fits what Pliny is trying to do here. Asper does, however, observe that Cato’s description of his press provides a recipe (complete with a list of ingredients) for its construction, but “he [does not] explain how it actually works”. Asper has thus inadvertently supplied the key to understanding Pliny’s text: as we shall see, his aim is not to give a recipe, but to explain how each category of press works. The problems in modern interpretations arise, precisely, from a fundamental misunderstanding of this purpose of Pliny’s in the passage.

Modern historical interpretations of the text ultimately derive from the 1932 study of ancient press technology by Drachmann, whose interpretations (and errors) were adopted in the influential works of Forbes and White. Drachmann subjected Pliny’s passage to a strictly technical analysis, interpreting it in relation to Cato, Hero and ethnographic evidence for presses observed in the 18th to early 20th centuries. In this discussion, he described Pliny’s text as “a summary of the development of the press”; the second press type (lever-and-screw) as “invented in Greece”; and the third press type (direct-screw press) as “the next step forward”. Finally, he stated (entirely without evidence) that “it must often have happened in Italy that a man wanted to transform an already existing lever press into a direct screw press”. He also represented Pliny’s press types in a series of diagrams which have greatly influenced later writers (see figs. 1a and b).

Thus, Drachmann imported three interpretative concepts into the passage, which, as will be demonstrated here, are completely without foundation in Pliny’s text, but nevertheless have been highly influential on subsequent discussions. Firstly, Drachmann assumed that Pliny’s intention was to give a picture of an overall process of technological change in press mechanisms over time (the

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8 The long horizontal wooden element of these presses can be termed either a ‘lever’ or a ‘beam’, but in technological discussions it is usually referred to as the ‘lever’ since it fulfils this mechanical function. It was lowered so as to press on fruit in containers such as piled frails (flat woven baskets).
9 Asper 2017. His categories of aims are to provide a ‘recipe’ for practical construction; to provide comprehensive knowledge through classification; to guide decision-making; or to give a scientific explanation.
10 Asper 2017, 30.
11 Drachmann 1932; Forbes 1955/1965; White 1975, 1984.
12 Drachmann 1932, 50, 56.
13 Drachmann 1932, 58.
“development of the press”). Secondly, he took Pliny to mean that each of the three press types described represented a series of improvements upon earlier and inferior types in a “step forward”. Thirdly, he implied that successive types tended to supersede the earlier and “inferior” types, with a final and best form of press – the direct-screw presses – replacing the earlier types in an evolutionary process. A fourth (although less significant) misconception, that the screw press came from Greece, was also to be perpetuated in later works.

Forbes essentially reiterated these interpretations, citing Drachmann’s study and writing that “Pliny gives us a valuable summary of this evolution”. He described each of Pliny’s press types as an “improvement”, and hinted at an
inevitability in the process by which the screw was “to supersede” the lever-and-drum, and a lever press “had to be transformed” into a direct screw press. He also postulated both that the lever-and-screw had been “invented in Greece” and that the direct screw was “possibly a Greek invention”. 

Half a century after Drachmann, these concepts were embedded more deeply into historiography by White, in whose seminal work of 1975 on ancient Roman farming equipment, Pliny’s passage was described as “Our authority for the development of the lever press [...] where he summarizes [its] development”15. By 1984, Drachmann’s “development/step forward” had become a progressive linear evolution toward greater efficiency, beginning with a “simple Catonian press”, which was described as “not the most efficient way of doing the job”, followed by “The first definite advance [...] a Greek invention” (Pliny’s second press type) and finally, closely following Drachmann’s reference to a “step forward” and the claim that farmers would wish to “transform” lever presses into Pliny’s third type, the direct-screw presses: “The next advance was to do away with the lever altogether.”16 White amplified the notion of farmers renovating their presses in this way by adding that “the clumsy, space-wasting lever could be eliminated, and replaced by a direct-screw press”17.

Healy’s 1999 examination of Pliny’s writing on technology only mentioned wine-presses very briefly: “In the ‘Natural History’, levers are employed, among other uses, as part of the machinery of winepresses.” Citing White, Healy stated in a footnote: “the lever press was scrapped, according to Pliny, in the mid-1st cent. AD and replaced by a direct-screw press.”18 Here, Drachmann’s fictional Italian “man [who] wanted to transform an already existing lever press”, perpetuated in White’s description of a “lever [...] replaced by a direct screw press”, had cast a long shadow, resulting in the “scraping” of the lever press altogether.

By the early 21st century, this teleological vision of successive press types, each superseding earlier and ‘inferior’ types, had become even more entrenched in historiography, as was the location of the invention of the screw press in Greece. Thus, the Oxford “Engineering and Technology in the Classical World” declares “The first development [...] was the addition of a winch [...] wrapped around a drum [...] The second major innovation was the application of the screw [...]. It appeared in practical

14 Forbes 1955, 133–137 (=1965, 140–144) (emphasis added).
15 White 1975, 230.
16 White 1984, 68–70 (emphasis added).
17 White 1984, 185 (emphasis added).
18 Healy 1999, 164, n. 51 (emphasis added).
use in Greece by the first century B.C. [...]. By the mid-first century A.D., the beam was being discarded altogether in favour of the screw alone”.

In an earlier work by the same author, the first lever-and-drum press is described as “simple” and the direct-screw as “the final development”.\textsuperscript{19} The obsolescence of the oldest type (Pliny’s first press) when newer types were invented in the 1st century is implied by its description as “the most widespread type [...] at least through the first century B.C.”\textsuperscript{20} While regional variations in an evolutionary pattern are acknowledged, the teleological view of a linear development in which earlier types were displaced by subsequent inventions remains unquestioned: “So, for instance, not all areas have a linear development from, say, the lever-and-drum through the lever-and-screw press. Some areas show a shift from the lever-and-drum directly to the screw type.”\textsuperscript{21}

Most recently, the economic historian Peter Bang has called “the screw press” one of the “significant [...] technological improvements” which “bespeak gains in the technological capacity of ancient society”, simultaneously adopting the ideas of progressive improvement, increased “efficiency”, and widespread change.\textsuperscript{22} A more detailed version, presented by Schneider in the recent “Cambridge Economic History of the Greco-Roman World”, still echoes Drachmann’s and White’s vision, in essence repeating the tropes that “Wine- and oil-presses were significantly improved in Roman times”; that “improvements [...] were generally aimed at increasing the efficiency of the pressing process”; and in addition to this aimed “to limit the size of the press-rooms”. While noting that “innovations [...] were not established throughout the Empire, but only in individual regions”, this is attributed purely to the expense of replacing “older technology”.\textsuperscript{23}

These interpretations of Pliny’s passage are completely at odds with a large body of archaeological evidence, which has been closely investigated only within the last two decades. This evidence reveals that patterns of press technology in the Roman Empire were highly regional. Different forms of press – not explicitly mentioned by Pliny – existed outside Italy in important oil and wine producing regions, most notably the Levant, southern Gaul, Hispania, and Africa, where

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\textsuperscript{19} Curtis 2008, 382 f. (first quotation) and 2001, 391, 393.
\textsuperscript{20} Curtis 2001, 387 (emphasis added).
\textsuperscript{21} Curtis 2001, 386 (emphasis added).
\textsuperscript{22} Bang 2009, 200.
\textsuperscript{23} Schneider 2007, 149, 157 (emphasis added).
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Fig. 2: Reconstruction of the lever-and-weights press at Oilery FVIII, Chhîm, Lebanon, by Marek Puszkarski. Waliszewski 2014, fig. 43.

Fig. 3: Reconstruction of a Roman period Hispanic lever press with single parallelepipedic counter-weight. Adapted from Peña Cervantes 2010, fig. 7.
large lever presses weighted by multiple or single weight-stones and varied rope and winch arrangements were widely used (see figs. 2 and 3).24

Secondly, all the evidence in the form of depictions and archaeological remains in Pliny’s own region of Campania indicates that prior to the eruption of Vesuvius in the 1st century Pliny’s first press type – the lever-and-drum press – was still used for all wine production. The lever-and-drum wine press is clearly attested in wall paintings at Pompeii and by archaeological remains in the region, throughout Italy and in nearby regions from the 1st century until late antiquity, in spite of the fact that light-weight direct-screw presses were used for pressing cloth in fullonicae, and possibly for small-scale oil production for perfume manufacturing.25 Thirdly, the direct-screw press did not replace lever presses in an evolutionary process in any region. There is no evidence whatsoever of lever presses being “discarded altogether” and replaced by direct-screw presses. The lever press, in various forms, continued to be the dominant form of press throughout the Empire.26 Indeed, the efficacy of such lever presses is attested by their continued use over two millennia, up to the 20th century.27

To this archaeological evidence we must add that ethnography and mechanical calculations clearly indicate that Pliny’s second and third types of presses, employing a screw, did not improve the “efficiency of the pressing process” by producing more wine or oil or doing so more quickly by virtue of using a screw.28

24 Key works are Callot 1984; Amouretti – Brun 1993; Mattingly 1996; Frankel 1999; Kingsley 2002; Brun 1986, 2003, 2004, 2005; Ayalon – Frankel – Klöner 2009; Peña Cervantes 2010, 2012, 2014; Waliszewski 2014; further discussion of regional types in Lewit 2007, 2012. Ground-breaking typologies were presented by Brun in 1986 and by Frankel 1999, 99–106.
25 Frankel 2001; Brun 2004, 14–27, 56 f.; Matijašić 1993. A painting at the House of the Vetii at Pompeii depicts the lever-and-drum press still in use for wine in the 1st century. The clothes press depicted at the Fullonica of Veranius Hypsaeus at Pompeii Reg. VI, Ins. VIII n. 20 (see image http://www.pompeiiinpictures.org/R6/6%2008%2020%20p2.htm) is a double direct-screw press. The carbonised wooden direct-screw press discovered at Herculaneum Ins. III, n. 10 (see image http://www.herculaneum.uk/Ins%203/Herculaneum%203%2010.htm) was initially interpreted as another clothes press, but has recently been reinterpreted as a press producing fine oil for perfume production, as was the case with the press base found in Pompeii Reg. VII, Ins. IV n. 25; views differ on whether the latter was a screw or a wedge press, but it was certainly not associated with wine production: Jacono 1941; Mattingly 1990; Brun – Monteix 2009.
26 Europe: Brun 1986, 2004, 2005; Peña Cervantes 2010; Africa: Mattingly – Bruce Hitchner 1993; Mattingly 1996; Levant: Frankel 1999; Waliszewski 2014, 419–442.
27 Rozier 1776; Bernard 1788; Paton – Myres 1898; Drachmann 1932, 53–56, 170 f.; Humbel 1976; Amouretti et al. 1984; Avitsur 1994; Frankel 1999, 110 f., 122 f.; Lauvergeon 2004.
28 Pressure per cm² is not determined by this element, but by multiple factors such as the height/length/weight of the lever, the size and number of weights used, height and surface area of the frail in which fruit is placed, heights and position of anchorage and pressing points in relation to other elements. See Waliszewski 2014, 252–258 and Lewit (forthcoming) Table 10.1.
This is most vividly demonstrated by the fact that in Roman Africa – a region of intensive surplus production of oil and wine attested by the multiplication of presses and vast size of pressing installations – a variety of technological innovations were introduced but these never included the screw. The screw rather reduced the effort required, breakage, and accidents, since the screw was less inclined to break than a rope; indeed, Hero calls the lever-and-screw press “easier and more secure”\textsuperscript{30}. A rope, however, was much simpler and cheaper to replace than a carved wooden screw, which could also break or wear out.\textsuperscript{31} Finally, there is no archaeological evidence whatsoever that either the lever-and-screw or direct-screw press was invented in Greece or even used there in Pliny’s time.\textsuperscript{32}

The simplest solution, in the light of this evidence, would be to discard the Pliny passage altogether, on the grounds either that he was simply ignorant of practices in the provinces and even within his own home district of the Bay of Naples, that the passage was unfinished, or that it became irrecoverably corrupted in transmission.\textsuperscript{33} Thanks to his nephew Pliny the Younger’s description of his work habits, the overwhelming impression we have of Pliny the writer (of 102 volumes!) is that of a diligent scrivener, who, when not engaged in official duties or in private night-time conversations with the emperor Vespasian, was constantly reading or being read to by his slave \textit{lector}, and furiously jotting down notes or creating extracts.\textsuperscript{34} This suggests a rather bookish, arm-chair writer, disinclined to get his hands dirty through autopsy and experiment; he was, after all, a wealthy aristocrat of equestrian rank. As for the text, Pliny’s rather abstract vocabulary (and circumlocutions used to compensate for the relative poverty of technical vocabulary in the Latin language) tested the literacy of even the most highly educated readers, to say nothing of later copyists.\textsuperscript{35} His Latinity is idio-
syncratic, to say the least: diffuse, unstable and indeterminate, according to one scholar, his text is riddled with

“sentences that seem to race headlong after a completeness always out of reach [and] often compressed to the point of unintelligibility […]. [T]hey meander, trail away, or, just on the point of ending, start to life abruptly with a fresh infusion of ablatives”. 36

White observes that

“[Pliny’s] style is extremely inconsistent: longer passages of ‘fine writing’ with rhetorical flourishes and intolerably pompous perorations are found alongside blunt, curt, but by no means lucid sentences, which are often badly constructed, as if the author was in too much of a hurry to attend his grammar!” 37

Here Pliny becomes a naughty modern schoolboy slacking off in Latin class. Forbes bemoans difficulties in translation presented by “the fact that Pliny was not a technician but an encyclopaedist” 38. Even Drachmann felt that our “passage has a very strong suggestion of Plinius jotting down notes while an old factor is explaining how to get the best out of the pressing” 39.

In stark contrast to these observations, however, in our passage Pliny expresses himself reasonably clearly, provided the Latin is allowed to speak for itself (without, upon translation, introducing interpretative concepts foreign to the text). And, as will be seen, the passage is in fact thoughtfully, even elegantly, constructed. As for the question of whether Pliny had first-hand experience of different press types, we know that he was well-travelled, seeing military service throughout Rome’s western provinces, serving as a junior officer in Germania Inferior and Superior, and later holding procuratorships in the very regions in which diverse wine and oil technologies were prominent: Hispania Tarraconensis and Africa. He ended his career as the prefect of the Roman fleet stationed at Misenum, a cosmopolitan port populated by officials from around the Empire. 40 If even a fraction of the villas and estates that Pliny’s nephew and sole heir, Pliny

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36 Murphy 2004, 34–36.
37 White 1984, 183 (perhaps overly harsh, as will be seen below).
38 Forbes 1955, 134 (=1965, 141).
39 Drachmann 1932, 60.
40 He may also have been procurator of Gallia Narbonensis and Gallia Belgica: Syme 1969, 211–214; Healy 1999, 18–22 is more cautious about the Gallic procuratorships.
the Younger, inherited once belonged to his uncle (two of them lovingly described at Plin. Epist. 2.17 and 5.6), Pliny the Elder was a substantial landowner. Although he never mentions direct observation of farming on his own estates in his “Natural History”, referring instead to works like Cato’s *De Agricultura*, it is unlikely that a man of his curiosity and thoroughness would have been ignorant of practices on his own estates or that his agricultural knowledge was solely theoretical. In addition, there may have been legal reasons for Pliny to be conversant with the presses on his estates. His nephew’s letters discuss the renting of land to tenants,41 and Roman law tells us that in tenancy arrangements a land-owner was responsible for providing the wine press and all its parts.42

What, then, should we make of his brief description of press technology, which in light of archaeological evidence seems inaccurate and inadequate? Rather than consigning to oblivion one of the few surviving Latin texts on the matter, we should try to strip back the layers of modern interpretation and look closely and systematically at each phrase of the passage itself, reassessing our understanding of each in the light of current knowledge of the remains of actual presses across the Roman Empire. In so doing, we find that Pliny does not in fact say what he is alleged to have said, but, indeed, tells us more than has usually been noticed.

**Antiqui funibus uittisque loreis ea detrahebant et uectibus**

The impression that Pliny is constructing a chronological sequence that begins with the description of an obsolete practice has its origin in this phrase. Different translations (see Appendix) place the practice in the far past. It has also been universally assumed that Pliny is here referring to the type of Italian lever-and-drum press that is described by Cato in his *De Agricultura* 18–19, which used a very large wooden drum, worked by long hand-spakes (see fig. 4).

This interpretation has its origin in Drachmann’s statement “The press thus described is the Catonian press, known to us through Cato’s book”43. This has in consequence made it canonical in modern accounts of presses that lever-and-drum presses were a primitive type, predominant in the western Mediterranean

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41 Wim de Neeve 1990.
42 Dig. 19.2.19, citing the early 3rd century Ulpian, in turn derived from the 2nd century Neratius; see also Foxhall 1990, 108.
43 1932, 50. Note also White 1975, 230: “This is the type of press for which Cato (18) gives full specifications.”
up to the first century BC, but obsolete in Pliny’s time.\textsuperscript{44} Such an interpretation presents a significant problem in light of the fact that the Catonian press was evidently still the main type used for wine production in Italy, including in Pliny’s own Campanian region, during his own time.

Pliny uses the imperfect tense \textit{detrahebant}, expressing continuous action in the past. Even though this has been most often translated in English as “used to”, the past habitual aspect which clearly implies that the action is no longer carried out, the French translation “abaissaient” perhaps more exactly reproduces the Latin meaning of an incomplete action over a long period of time in the past, which can be translated as the English “they would [...]” rather than “they used to [...]”. Such a translation softens the chronological contrast between the press described as known to the \textit{antiqui} and those which are more recent, a contrast which is very much exaggerated by the unwarranted insertion (first in Rackham’s

\textsuperscript{44} E.g. Curtis 2001, 386 f.: “in the West [...] the \textbf{simple} lever and drum press [...] became the most widespread type of olive and grape press [...] \textbf{at least through} the first century B.C.”; Thurmond 2016, 160: “a \textbf{refinement} was introduced to the \textbf{conventional} beam-and-winch press” (emphases added).
1938 translation, and again in more recent translations) of the adversative “but” before “within the last hundred years” – a word which has no equivalent (e.g., *sed*, vel sim.) in the Latin text. In fact, Pliny is not contrasting what “men in the old days” did with current practice; had he meant to do this, he would have introduced the next type of press by writing “today” (*iam*, vel sim.) as he does elsewhere in book 18 of the “Natural History” when he talks about outmoded practices.  

Viewing Pliny’s passage in light of what we now know from archaeology, it also seems odd that he would take Cato’s lever-and-drum press as the archetype of ancient presses. In fact, Cato’s type was unusual and not widely used in Mediterranean areas outside Italy and Istria. These large machines were a regional variation used in commercial wine-production in those areas, and not the most ancient or ‘original’ form of press. For centuries, ‘ancient’ presses around both the western and the eastern Mediterranean had used single or multiple weight-stones of various kinds hung off the beam with ropes or straps (figs. 2 and 3), rather than the large wooden drum fixed to the ground in Cato’s press (figs. 1a and 4). These were the types most widely used outside Italy during Pliny’s time, and it seems highly unlikely that he would not have been familiar with at least some of them. It seems especially odd that Pliny would ignore the press types commonly used in Gaul and Hispania Tarraconensis, the latter being the one securely attested province where Pliny served as procurator, and where he could have seen them in operation. Elsewhere in this same book he describes Gallic ploughs (18.48.171–173), which he may well have personally witnessed in action during his likely procuratorships in Gallia Narbonensis and Gallia Belgica, and perhaps even earlier, as a junior officer in the German provinces around the Rhine. Finally, Pliny never mentions the distinctive large wooden drum of Cato’s press, which Cato calls a *sucula.*

For all these reasons, we must call into question the assumption that this part of the passage refers exclusively to Catonian presses. Pliny certainly used Cato’s treatise on Italian farming as one of his chief sources. Cato is listed in Pliny’s table of contents (Book 1) among the Roman authorities he consulted for Book 18, and

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45 Only a few lines before our passage, Pliny writes (18.74.315), *Vindemiam antiqui numquam existimauere maturam ante aequinoctium, iam passim rapi cerno* (“Men of old never thought the grape harvest was ready before the equinox; now I notice it is gathered in at any time”). The perfect tense of *existimauere* also presents a clear contrast with the imperfect tense of *detrahebant.*

46 Plin. Epist. 3.5.17, with Syme 1969, 211–218.

47 Pliny says the plough is used in Raetia Galliae (18.48.172), which is next-door to the province of Germania Superior, where he most likely served in AD 58: Syme 1969, 206 f. This important parallel passage is quoted and discussed further below, n. 135.
indeed he is quoted and cited by name elsewhere in the book 20 times. In another passage, Pliny cites Cato on olive processing (*nunc dicentur Catonis placita de oliuis*)\(^{48}\). Given that Cato’s treatise was by Pliny’s time 250 years old, Pliny’s use of *antiqui* in the passage is not inappropriate, but in all other instances in Book 18 he refers to Cato by name, starting with *iam M. Cato praecepta condidisset*\(^{49}\). In one instance, he cites Cato in relation to *antiqui*, with regard to animal fodder: *apud antiquos erat pabuli genus quod Cato ocinum uocat, quo sistebant aluom bubus*,\(^{50}\) but he still refers to him by name. Thus *antiqui* probably does not refer exclusively to Cato.

Close attention to Pliny’s construction of the phrase reveals an important choice of connectives: Pliny writes *funibus uittisque loreis [...] et uectibus*. The -*que* connecting *funibus* and *uittis loreis* (ropes and leather straps) links these two sets of objects closely together. The use of *et* rather than -*que* before *uectibus*, on the other hand, and the careful placement of that term separately at the end of the sentence, *after* the direct object and verb, suggest a looser connection. Pliny could have written, for example, *funibus et/ac uittiis loreis et/ac uectibus ea detrahebant*. That he chose not to indicates that *et* here must mean “and what is more” or “and [...] too” – its primary meaning.\(^{51}\) Hence our translation: “with ropes and leather straps and also with hand-spakes.”

This opens up the possibility that Pliny is grouping together various different older types of press: the most ancient which used ropes and straps with weights; the characteristic lever and counter-weight presses used in Gaul and Hispania in his own time (fig. 3); and Cato’s Italian lever-and-drum type which employed much longer hand-spakes termed *uectes*.\(^{52}\) These especially long hand-spakes (fig. 4), which Cato describes as being 4.4–5.3 m in length,\(^{53}\) contributed an

\(^{48}\) Plin. Nat. 15.6.23.

\(^{49}\) Plin. Nat. 18.5.22. Note also, e.g., *Reliqua praecepta reddentur suis locis, quae propria generum singulorum erunt. Interim communia quae succurrant non omittemus, et in primis Catonis humanissimum utilissimumque, id agendum ut diligant te uicini* (18.7.44); *In arando magnopere seruandum est Catonis oraculum* (18.10.49).

\(^{50}\) Plin. Nat. 18.42.143.

\(^{51}\) Oxford Latin Dictionary, s.u. 1. The Rackham translation also captures this nuance.

\(^{52}\) The term *uectes* was incorrectly translated by Rackham as “levers”, an error which has persisted in various translations, although recently corrected by Brun. It is clear from Cato that *uectes* refers not to the levers (termed *prela*) but to the long hand-spakes which were used in their operation: Cato Agr. 19.2; Amouretti – Brun 1993, 591.

\(^{53}\) *Vectes longissimos P. XIX, secundos P. XVI, tertios P. XV*: Cato Agr. 19.2. Rare evidence for the length of hand-spakes used for weights presses is provided by the mosaic of oil pressing at the Gallic villa of St Romain-en-Gal, from which it appears that they are about as long as a man is tall, so much shorter than the 4.4–5.3 m for Cato’s press with drum instead of weights (image: http://jfbradu.free.fr/mosaiques/gallo-romaines/st-rom-gal/pressage-olives.htm).
important mechanical advantage and thus perhaps appeared more distinctive to Pliny than the drum which they turned. This fits with his focus throughout the passage on the action of the presses, that is, “how it works”.

The neat 8-word phrase, when more literally translated, can thus be seen as a succinct and accurate generic description of the various kinds of presses used in the Mediterranean for centuries prior to the application of the screw, which Pliny goes on to describe next. Pliny highlights the essential mechanical feature of these older types of presses: the lowering of the lever is effected with ropes and straps, whether by hanging multiple weights (as in the Levant), or a single parallelepipedic weight (as in Gaul, Hispania, and Africa), or wound around a drum worked by long hand-spakes (as in Italy and Istria). This would explain why Pliny does not add specific geographic information or name Cato. Since these press types would be very familiar to his readers, as the main forms still in use, he skips quickly to the more notable types, employing a screw, which he describes in more detail. The implication is not that the old ones are no longer used, but that the new ones are less well-known and therefore require description. It is not a statement that the Catonian press was the archetypical but obsolete “old press”.

_intra C annos inuenta Graecanica_

With this phrase, Pliny clearly turns his attention to a newer class of presses, unambiguously dated to the late 1st century BC. The fact that these presses employed a screw is universally agreed, but beyond that all is confusion. It has been widely stated on the basis of Pliny’s description that these presses were “Greek” or “invented in Greece”. This is clearly impossible, since there is no archaeological evidence whatsoever for these kinds of presses in Greece dating to the 1st century BC. Indeed, dated examples from Greece do not appear until late antiquity (5th–7th century); presses previously used in Greece employed not screws but stone weights, either a single parallelepipedic weight, or mul-

54 By not going into great detail about old types that are familiar, Pliny follows precisely the same approach as Hero and Vitruvius: above, nn. 5–6.
55 Drachmann (see Appendix): “presses invented in Greece”; White 1984, 68: “embodied in a Greek invention”; Brun 1986, 112: “pressoirs grecs”, modified in 2003, 59 to the more accurate “les ‘pressoirs grecs’ ont été inventés”; Asper 2017, 31, quoting Curtis: “Greek […] presses”; Curtis 2008, 383: “It appeared in practical use in Greece by the first century B.C.” Thurmond confuses this generic description at the start of our passage with the more specific description of the direct-screw press which follows later, and attributes the fictional term _torcula graecanica_ to Pliny: Thurmond 2016, 160.
56 Summarised in Peña Cervantes 2012, 45.
multiple smaller weights. There is also textual evidence for the continued use of ropes and weights in Greece from the 2nd century writer Longus, who describes a farmer who “needed a rope, his own having broken, for hoisting a stone being used to crush the grapes after treading”.

Returning to our text, Pliny does not say that the devices are Graeca (“Greek”) but rather that they are Graecanica. Elsewhere in Book 18 he clearly prefers the term Graecus when discussing methods of agriculture used by Greeks/in Greece. We must therefore reject the idea that he is describing a method of pressing currently practiced in Greece and look for a specific reason Pliny had for using the word Graecanica, and the difference in meaning from Graecus that this might carry. Varro in “The Latin Language” describes Greek words that have been modified for Latin usage as Graecanica – “Greek in origin”. Thus Pliny is referring to something of Greek origin which has been adapted to Roman use. Peña Cervantes, arguing that screw-operated presses were a Baetican invention, suggests that the “Greek origin” refers to the Greek invention of the continuous screw, rather than its specific application to a press. This is an invaluable insight. The invention of the continuous screw was attributed by the Romans to the Greek engineer of Sicily, in Magna Graecia, Archimedes of Syracuse, who famously employed it in mechanical devices such as water-raising machines. The words following these in the passage (discussed in detail below) evoke the principle of the Archimedean machines, describing a screw grooved with threads for its whole length – in other words, a continuous screw, which has no end point. Thus Pliny is using the term accurately to describe something of Greek cultural (Syracusan) origin, which has been modified by Roman use in this next group of presses. Pliny is certainly

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57 Frantz – Thompson – Travlos 1988, 121 f.; Brun 2004, 79–82; Foxhall 2007, 188–192; Waliszewski 2014, 177.
58 Daphnis and Chloe 2.13. The full passage reads: Τῶν δή τις ἀγροίκων ἐς ἀνολκὴν λίθου θλίβοντος τὰ πατηθέντα βοτρύδια χρῄζων σχοίνου, τῆς πρότερον ραγείσης, κρύφα ἐπὶ τὴν θάλασσαν ἐλθών, ἀφρουρήτῳ τῇ νηῒ προσελθών, τὸ πεῖσμα ἐκλύσας, οἴκαδε κομίσας, ἐς ὅ τι ἔχρῃζεν ἐχρήσατο.
59 E.g. of cultivating turnips: genera eorum Graeci duo prima fecere [...] et ea serendi modum ex eodem semine docuere (18.34.129, emphasis added).
60 Varro Ling. 10.70. Cato Agr. 3.5 mentions in passing trochileae Graecanicae as part of a block and tackle arrangement to work an olive crushing device, like Pliny’s screw assembly, a mechanical element of a larger device. It appears from Vitr. De Arch. 10.2 that these types of blocks were often adapted from Greek inventions. The blocks have Greek names, as betrayed by the use of “ch” (chi), as in rechamus and trochilea, and all the architects and buildings he mentions in the chapter are Greek.
61 “Apuntamos que, tal vez el ‘origen griego’ [...] se refiera al propio sistema de tornillo sin fin y no a su aplicacion especifica en las prensas de viga”: Peña Cervantes 2010, 46 f.
62 Discussed in detail a century before Pliny by Vitruvius (De Arch. 10.6).
not claiming that the screw wine press was either “invented in Greece” or had “appeared in practical use in Greece” in the past century.

This brings us to the subject of this clause – and of the main sentence. Graecanica can mean “Greek-style things” as the subject of the verb, but as some authors have recognized, the subject is most likely prela, “presses” (neut. pl.), with Graecanica, its modifier, meaning “Greek-style” (i.e. Archimedean). White and Brun are probably correct to surround the adjective with quotation marks (see Appendix, p. 596): it may have been a nickname reflecting their most distinctive feature, the Archimedean screw, since there is nothing particularly Greek in style about any of the other elements of these presses. The main verb of the clause (and of the entire sentence), inuenta, lacks its auxiliary, erunt – a common elision. We therefore translate “‘Greek-style’ [presses] have been invented”.

Thus, in this section Pliny is explaining that while the old way was to use various methods of lowering a lever with ropes and straps, which could be combined with hand-spakes (working a drum), in the last 100 years different types have been devised that make use of a Syracusan-style continuous screw. He then goes on to explain the nature of these inventions – and they are plural – in the ablative. This is a clear and very accurate description of the actual route of technological transfer of the 3rd century BC screw from Sicily (in Magna Graecia) to Italy, where it was well known to Vitruvius by the 1st century BC, and was then employed within a different type of machine, the wine press.

*mali rugis per cocleas ambulantibus*

While here we obviously have a reference to some kind of screw (regularly referred to by its loanword from Greek, coclea or cochlea, e.g., Vitr. De Arch. 6.6.3), this is a very difficult phrase, translated in widely differing ways and often without regard to its grammar, and brings us for the first time to problems with the Plinian manuscript tradition, which will be discussed in more detail below.63

We must first emphasize that mali is a singular genitive of malus, not a plural. Thus, it cannot be translated as “spars” or “beams”. The translation of malus as “upright beams” is needlessly confusing, since the term “beam” is usually used in press contexts to mean the horizontal lever (invariably called a prelum), whereas the threads are a feature of the vertical rod which raises and lowers this beam/lever. The identification of the malus with this rod is confirmed later in

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63 The MSS variants on ambulantibus (bulantibus, bullantibus, buba[ntibus]) will not be discussed because they are all nonsensical.
Fig. 5: Traditional direct-screw press, probably from Western Galilee; reconstructed stone piers (a Near Eastern type of construction not attested for Roman Europe). Photo courtesy of Eretz Israel Museum, Tel Aviv, Israel.

Fig. 6: 16th century lever-and-screw press with screw fixed by taissons, Clos de Vougeot: Lauvergeon 2004, fig. 4. Photo Inv. M. Thierry Inventaire général ADAGP, 2003.
the passage, where Pliny describes a direct-screw press *breuiore malo in media
directo*: here the *breuiore malo* must be the shorter screw rod which bears down
toward the middle of the smaller press, and not a lever, which these presses do
not have (see fig. 5 and below).

All the manuscripts read *colecias*, but Mayhoff, without any MS authority (*ego*
appears in the *apparatus criticus* on this passage), emended this to *coeleam* in
his later edition of the Teubner text. His correction at first seems reasonable,
if we take Pliny to be describing one screw of a particular press. However, if we
take this to be a more generic description of the nature of the screw element
used in a variety of different presses, not one particular screw, the plural makes
sense; he then goes on to describe several designs of rods, within all of which
the threads run up to the top of the screw section. Throughout the passage, *prela*
are referred to in the plural (see further discussion below), and this seems to be
matched by *colecias*. It is thus unnecessary to intervene in the manuscript tradi-
tion here.

The ablative absolute *rugis ambulantibus*, which evidently confused some
manuscript copyists, perfectly describes the visual impression when one observes
a continuous screw, which, as it turns, looks as if the threads are coiling upward
in an endless circular motion. They are the ridges or threads “of” a screw rod,
therefore the genitive *mali*. The emphatic preposition *per*, which is simply ignored
in most translations, or weakly expressed as “round/autour”, is in fact a crucial
word, packing a powerful punch for its size: it explains that the thread runs the
length of the rod and creates a continuous, or unending screw, rather than the
rod being grooved with a thread for only a short length. Figure 6 shows how this
principle is characteristic of lever-and-screw presses, the thread reaching right to
the top of the rod well above the lever (see fig. 6).

It seems odd that in this single phrase Pliny appears to use two terms to mean
the same thing – a *malus* with *rugis ambulantibus* and a *cocelea*. As will be seen,
Pliny has chosen his words and structured our passage very carefully to give a
very precise and detailed yet succinct description of press technology, and this
section is no exception. Close examination of extant examples of these presses
shows that the rod section which incorporates the screw can be divided into two
parts: a lower part, which has no thread, onto which the hand-spakes attach,
and which also continues below the hand-spakes; and an upper part, which is
carved with a thread, and thus forms a screw, which continues upward through
and beyond the lever, the thread continuing right to the top as discussed above
(fig. 6). This can also be clearly seen in the 3rd century sarcophagus relief in the
Museo Archeologia of Aquileia (see fig. 7).

We suggest Pliny uses *malus* here because that was what the entire rod assem-
bly, with all its parts, was called, and that only the upper, threaded part of the
rod would have been called the *coclea*. Were this not so, Pliny could simply have written *cocleae* instead of *mali* here.

Some support for these suggestions can be found by looking ahead to later in the passage. When discussing the design of direct-screw presses, Pliny again calls the screw-rod by the term *malus* in the phrase *breuiore malo [...] uinaceis superne [...] urguere*. As can be seen in figure 5, in these types of presses, the threaded screw section does not itself press on the fruit. It is the lower, non-threaded part of the rod which does this, which is why Pliny uses *malus* rather than *coclea* in this later section. If this is so, then Pliny’s use of *malus* earlier in the passage is deliberate, and refers to the entire screw-rod assembly rather than the *coclea* alone.

Based on this suggestion, and reading his phrase with close attention to its grammar and context, we conclude that Pliny is explaining the design of the Archimedean screws used in the types of press which he goes on to describe, and in which the carved threads of the rod (termed the *malus*) run all the way up to the top of its upper part, which – since it forms a screw – is termed the *coclea*. This type of rod is later contrasted with the much shorter rod in the next group to be described, discussed below.
ab aliis adfixa arboris stella, aliis arcas lapidum adtollente
secum arbore

This section of Pliny’s text is the most problematic in terms of the transmission and restoration of the text. Most printed editions of Pliny’s “Natural History” before the 1890s privileged MSS d (Paris lat. 6797, third quarter of 12th century, Northern France, probably St. Amand) and E (Paris lat. 6795, 9th–10th century, France). E dominated the subsequent MS tradition, which is why the Teubner editor Karl Mayhoff called it the “vulgate” tradition. Mayhoff had already begun revising Ludwig von Jan’s Teubner text before the latter died in 1870, after having completed his edition of the “Natural History”. The reason for this, one supposes, is that Mayhoff had become dissatisfied with the “vulgate” tradition. In many sections of the text, including our passage, he corrected many of Jan’s readings derived from the vulgate.

The second aliis in this phrase, unfortunately, has no MS authority: it is an editorial intervention by Mayhoff. Some MSS (D, F) read ab alis, “by means of wings”; others, including the “vulgate” d and E and their descendants, a palis, “by means of stakes”;64 and a later scribal annotator (F2) has replaced alis with ab aliis in F. As we have argued elsewhere, F2 is probably incorrect to insert ab in the text, that is, to make the construction an ablative of agent, since the participle, adtollente, is active rather than passive.65 Despite the absence of any MS authority, therefore, Mayhoff is probably right to print aliis, a locative ablative.66 Once we accept this emendation, it emerges that the passage describes two versions of this press type, worked by different mechanisms.67 One type is built by some (ab aliis); in some types (aliis) a different mechanism is used. The almost universal translation as “some/les uns” and “others/les autres” is also problematic in that it sets up a false parallelism: the two uses of aliis in the two parts of the sentence

64 These same MSS read palis in place of ab aliis earlier in the sentence (palis adfixa arbori stella, “with the star fixed to the pole by means of stakes”) which makes no sense, since the star would not be fixed to the pole in this way, nor is Pliny concerned with how the two elements are joined.
65 In the Budé edition, Le Bonniec – Le Boeuffelle 1972, 162 print ab aliis. On the pitfalls and problems of the Budé edition, see Reeve 2007, 115 f.; Lewit – Burton 2019, n. 10.
66 See Lewit – Burton 2019. Rackham got this (almost) right. His translation has the ablative of agent followed by an ablative of accompaniment (see Appendix, p. 597).
67 Jüngst – Thielscher 1954 and 1957, 53–126 emend Mayhoff’s ab aliis […] aliis to malis […] a malis, so that Pliny describes only one form of this press, not two. Since Pliny’s description can be matched with types of lever-and-screw press which are known from historical and ethnographic studies (see below), and there is no manuscript authority for their emendations, this has been rightly ignored by all subsequent translators and editors.
in fact refer to two different things – press builders, in the first instance, and the presses themselves, in the second. That is, the second *alii* does not refer back to the first *alii*; the referent of the second is not the same as the first.

One final problem is the emendation of *stella* to *stela*, suggested by Hörle in 1937 and printed by Le Bonniec and Le Boeuffe in the current Budé edition.68 On this reading, the two types of press Pliny describes are distinguished by use of a large stone block in one and of a box of stones in the other. In the first type, then, “some attach a block of stone” to the rod. This interpretation of the term *stela* cannot be sustained, however. *Stela* means a stone on which something is written, and this is how it is used by Pliny in the two secure instances of the word in the “Natural History”.69 Hörle’s suggested emendation is, moreover, an entirely unnecessary intervention in the text. As earlier authors had shown, the *stella* is an apt description of the four radiating hand-spakes used to turn the screw.70 The 3rd century Aquileia relief mentioned earlier (fig. 7) shows clearly this arrangement, and the star-like effect. These multiple hand-spakes were much shorter than those used to work a drum-press, which is why they are described by a different term, *stella*, instead of *uectes*, which was used to describe the long hand-spakes of the lever-and-drum presses, discussed earlier.

There are thus no problems with the text as it stands if we accept Mayhoff’s minor emendation of F”s second *ab aliis* to *aliis*. It seems clear that Pliny is describing two sorts of lever-and-screw presses which used not different types of weights, but quite different mechanisms. This was already understood by Drachmann, who compared Pliny’s description with lever-and-screw presses known from ethnography, some of which could still be observed in action during his own time or a short time previously.71 In one form of lever-and-screw press, the base of the screw rod was fixed. Drachmann observed the example of a very unusual press at Fenis (Italy), in which the screw rod was anchored in a wooden press base, and in which the nut, rather than the screw, was turned. While he rightly

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68 Le Bonniec – Le Boeuffe 1972, 308, following Hörle 1937 (RE7 12 col. 1740). This emendation is used by White in 1984 and by Brun in 2003, 59, although elsewhere in his translation of the Pliny text he makes a number of significant improvements to their translation.

69 Plin. Nat. 6.32.150 and 34.53.174.

70 Drachmann 1932, 53, citing Meister 1763, followed by White 1975, 230. Hörle (above, n. 68) had rejected *stella* on the grounds that the hand-spakes do not sufficiently contrast with the *arca lapidum*. While this is true, the contrast Pliny emphasizes here, as will be seen shortly, is not between the *stella* and the *arca lapidum*, but between *adfixa* and *adpollente*.

71 Some important studies are provided in Drachmann’s appendix 1932, 122–124; Humbel 1976; Amouretti et al. 1984; Avitsur 1994; Lauvergeon 2004. Valuable records are also found in Rozier 1776 and Bernard 1788.
rejected this as an exact parallel to Pliny’s press, and formulated his own reconstruction, in fact a more fruitful comparison can be made with a type of lever-and-screw wine-press used in medieval to 20th century Burgundy. In these presses, the screw rod was fixed into the ground, wedged in place by an arrangement of wooden posts known in French as ‘taissons’ (fig. 6). A four-sided box or mortise, known as the ‘lanterne’, sat around this screw rod. Hand-spakes, known in French as ‘étiquets’, were passed through slots in this box, so that they radiated out and could be grasped by multiple workers. By use of these hand-spakes, the screw rod was turned, and with the turning of the screw, the heavy horizontal lever was pulled downwards, thus applying the pressure of its weight to the fruit. We suggest that Pliny’s second press was similar to these lever-and-screw

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72 It is clear from Pliny’s description of the *stella* or hand-spakes that these were connected to the screw rod, not the nut. See further discussion below. Forbes 1955, 135f. (=1965, 142) repeats Drachmann’s analogy with the Fenis press. One other ethnographic example (in Hungary) of a press similar to that at Fenis is listed by Frankel 1999, 111.

73 Lauvergeon 2004, 3–10; Humbel 1976, 90–92.

74 Such an arrangement would leave little archaeological trace. Some very large square pits filled with river stones, metal parts, and other debris associated with lever-and-drum presses at sites in north-eastern Hispania have been interpreted as the remains of anchorage systems analogous to French *taissons*: Martín i Oliveras – Bayés 2009. It should be noted, however, that the French *taissons* system was used to fix a screw rod in place, not a drum.
presses with a screw rod fixed in the ground by ‘taissons’, used in medieval to 20th century Burgundy (see fig. 10a).

The second form of lever-and-screw press, which was widely used in the Mediterranean from the middle ages to modern times, employed a mobile counter-weight. Instead of the base of the screw rod being fixed into the ground, a weight was joined to its end. For ease of use, this weight was usually on a lower floor level or sunk into a pit (see fig. 8).75

A box provided lodging for the hand-spakes by which the screw rod was turned, in an identical arrangement to the fixed types. In this form, however, as the screw turned, instead of forcing the horizontal beam downwards, it raised the counter-weight from the ground. The weight of the counter-weight – which was predictable and regulated by the size of the weight – would exert pressure on the fruit. The pressure would remain constant as the fruit was crushed, until the

75 In Campania, the 1st century press room on two levels at the villa of P. Fannius Synistor at Boscoreale, and the undated (post 1st century) oval pit at San Goiavanni del Paco have been interpreted as belonging to such arrangements: Brun 2004, 21–24.
Weight was lowered again to the floor by a reversed action of the screw.\footnote{Lauvergeon 2004, 46.} Weights could be constructed of whole stones (which could be up to 1 m in height and weigh around 1.000 kg or more), known from archaeological and ethnographic examples, and represented in the 3rd century Aquileia relief (fig. 7).\footnote{Lauvergeon 2004 provides a description and images of medieval examples, and a 19th century Greek example was described by Paton – Myres 1898, 211; Amouretti et al. 1984 document two 20th century Portuguese examples and Drachmann 1932, 122–124 and fig. 41 replicates an early 20th century description of such a press in use in Naples. Many archaeological examples are known, and the typology of such weight-stones was established by Brun 1986 and Frankel 1999. See also Callot 1984; Brun – Gilles 2001; Brun 2004, 2005; Peña Cervantes 2012; Waliszewski 2014; discussion of geographic spread and dating: Lewit 2012.} An alternative to constructing such huge stone objects was to join together smaller slabs of stone within a wooden frame (figs. 8 and 9).\footnote{Discussed by Lauvergeon 2004, 45–47 and figs. 15–17; Frankel 2001 suggests that circular base presses in Northern Italy with no evidence of drums or weight-stones may have used such boxes of stones. Note that \textit{lapides} here would mean shaped masonry slabs, not many small stones (Oxford Latin Dictionary, s.u. 4), as implied by White’s and Le Bonniec and Le Boeuffe’s translations.}

Once this evidence is taken into consideration, the correct reading of this section becomes clearer. Pliny is describing this sort of press with a mobile counter-weight lifted by a screw rod. The \textit{arcae lapidum} are arrangements of stone slabs in a box-like frame, to form the counter-weight. Pliny’s use of the plural \textit{arcae} suggests that in his time more than one box may have been attached to the rod, presumably one on each side, as in the 18th century example illustrated (see figs. 9 and 10b).\footnote{We are grateful to curator A. Münch and keeper A. Müssig of the Kloster Sankt Georgen Museum, Stein am Rhein (Switzerland), for their helpful advice on the working and history of this press.} The phrase \textit{adtollente secum} refers to the raising of this counter-weight as the screw turns, and presents no problems.

But all is not yet quite clear. Translations which make \textit{stella} a direct object of a fixing action – thus, “some people putting handles” or “les uns fixent un bloc” – cannot be correct, since \textit{stella} is in the ablative case. Nor can Pliny mean it is “fixed to” the \textit{arbor}, since \textit{arboris} is genitive, not dative.\footnote{The “vulgate” MSS of Pliny read \textit{arbori}, but Mayhoff was correct in rejecting this on the principle of \textit{lectio difficilior potior}.} Moreover, the point of the phrase is not that a star is being used “by some”, as the star is exactly the same in the two sorts of lever-and-screw presses which Pliny describes here (see figs. 6 and 8). The point is to contrast one lever-and-screw press mechanism with a different one in which there is a mobile weight. The solution lies in the verb: \textit{adfixa} is not the participle of the transitive verb \textit{affingo} but of \textit{affigo}, used intran-
Fig. 10a: Authors’ reconstruction of Pliny’s lever-and-screw press with fixed screw rod. Drawing by G. Ciddor.

Fig. 10b: Authors’ reconstruction of Pliny’s lever-and-screw press with *arcae lapidum*. Drawing by G. Ciddor.
sively to mean “fixed in position”. Thus, the meaning of the phrase is not that there is a star fixed to the pole but that the star (at the base of the pole) is fixed to the ground (see figs. 6 and 10a).

The distinction is therefore not between the stella and the weight, but between two arrangements of the rod (arbor), one of which is fixed to the ground and one of which lifts up a mobile weight. This makes perfect sense as a description of two types of lever-and-screw press known in the ethnographic record. This is emphasized by the positioning of adfixa as the first word. There is also a clear balance between the two descriptions of motion: adfixa in the first, and adtollente in the second. These participles support the idea, mentioned at the outset of this paper, that Pliny’s account of presses is concerned with the matter of “how it works”.

At this point, Pliny switches from malus to arbor to refer to the vertical rod. What appears at first to be a straightforward example of literary variatio – Pliny had just used malus, and so wanted to use a synonym (arbor) for the same object a mere eight words later – is in fact dictated by the two distinct comparisons which he is making in the passage. The first comparison is between lever-and-screw presses and direct-screw presses, which is emphasized by the repetition of the word malus. Within this comparison is nested a second comparison, between two different types of lever-and-screw presses. The two sets of comparisons can be represented schematically as follows:

\[
\begin{align*}
\text{mali} & \text{ rugis per cocleas ambulantibus} \\
ab & \text{ alis adfixa arboris stella,} \\
alis & \text{ arcas lapidum adtollente secum arbole} \\
breuiore & \text{ malo in media derecto}
\end{align*}
\]

Thus, the two different lever-and-screw press types he describes – those in which the screw rod is fixed on the ground, and those in which it raises a mobile counter-weight – are linked by his repetition of the term arbor, because they are two variations within a single genus. There is no need for the adversative “but” or “while” that is inserted by some authors into the text between them: they are two variants of one mode of functioning (the lever-and-screw mechanism).

Pliny’s use of the word arbor in place of malus to create this separation of the two sets of comparisons had, however, the potential to confuse a Roman reader. Arbor was the long-established term for a vertical post at the opposite, supporting end of a lever press, as we know from Cato (fig. 1a), either in the form of a pair

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81 The words arbor and malus are interchangeable, for example both can mean “tree” and “mast of a ship” (Oxford Latin Dictionary, s.v. arbor 1, 4b, malus¹, malus²).
82 Cato Agr. 18.1.
of *arbores* or of a single *arbor* (as more widely attested in Pliny’s region).\textsuperscript{83} To a Roman reader, *arbore adfixa* would immediately evoke such a fixed supporting post. In order to make clear to which end of the press he is referring – not the supporting end of the lever, which must always be fixed, but the opposite screw end – Pliny refers not simply to *arbor*, but to the *stella arboris*. The *stella* is thus introduced not as the point of comparison, but for clarity.

**quod maxime probatur**

This is the only explicit qualitative judgement in the passage. It therefore deserves close attention, since it is important in evaluating whether or not Pliny is giving a picture of successive and ever-improving presses, but has been often ignored.

*Maxime* is stronger than “greatly”, so the phrase means not merely “very much” but “most” or “especially” favoured or approved of. The *quod* clearly applies specifically to the second of the two lever-and-screw types, the one in which the screw “raises” a mobile weight. This is strongly supported by the evidence of ethnography. All presses were subject to the breaking of parts and to difficulties in withstanding the huge pressures generated by the pressing process. This was particularly the case with a screw press in which the lever was lowered by the action of a screw fixed in the ground. In such a press, the horizontal lever was in fact bent or curved by the screw, creating great pressures, so that the end of the screw had to be fixed with maximum firmness in the ground while still allowing the screw to be turned. The press was then liable to jamming and breakages, since the vertical screw tended to be forced sideways, and the fixed end was also subject to rotting. Not only were those with a mobile counter-weight not subject to these problems, but additionally the use of a mobile weight enabled a more regulated and even pressure to be applied to the fruit.\textsuperscript{84} Drachmann rightly concludes “there is no friction or chance of jamming [...]. No wonder Plinius writes: *quod maxime probatur*”.\textsuperscript{85}

While Drachmann accurately identified this press type (with mobile counter-weight) and the reasons it was praised by Pliny, what has been ignored is the present tense. It is clear from the verb *probatur* that Pliny is describing two current

\textsuperscript{83} E.g. at the villa of the Mysteries or the villa of Pisanella: Brun 2004, 16–21.

\textsuperscript{84} Lauvergeon 2004, 46 f. On the problems of operating a fixed screw press, Bernard commented: “Les frottements énormes qu’on a à vaincre rendent bientôt impuissants les efforts des ouvriers. Le pressurage se termine [...] parce qu’on ne peut continuer de tourner la vis sans la briser”: 1788, 425.

\textsuperscript{85} Drachmann 1932, 56, echoed by White 1975, 230 f.
systems used in presses, rather than two systems, one of which has replaced the former, or two old ones which have since been superseded. While one is preferred over the other, without explicitly telling us why, he talks about them as two parallel systems which are used contemporaneously (ab aliis [...] aliis) and in his own time. This is fatal to the prevailing notion that successive press improvements automatically rendered earlier press mechanisms obsolete.

\textit{intra XXII hos annos inuentum}

Pliny’s use of the very exact number “22 years” is puzzling. Some writers side-step this problem by translating the text simply as “20 years” (see Appendix, p. 598). Textual corruption, though quite common where numerals are concerned, is unlikely in this case since the extant manuscripts unanimously read “XXII”, and such low numbers are seldom corrupted.\textsuperscript{86} It is difficult to use archaeology to date precisely the introduction of direct-screw presses, the invention introduced by this phrase, especially since they have very poor archaeological visibility, being almost entirely constructed of wood. The oldest archaeological evidence for such a press in Italy, at San Pietro in Casale, has been dated to the 1st century AD, and was identified from a base of stones and tiles, with traces of wood, next to a sunken \textit{dolium}, preserved because the area was flooded.\textsuperscript{87} If this interpretation of the remains is correct, it fits the general chronology given by Pliny, but still does not explain his dating to an exact year.\textsuperscript{88}

Drachmann explores the question at some length.\textsuperscript{89} He comments on the contrast between the two dates given – a quite general “100 years” since the invention

\textsuperscript{86} See Shipley 1902, 46: “numeral signs [...] are productive of a larger proportion of serious corruptions than any other cause”, citing Bede Opp. 1.149 (\textit{numeri negligenter describuntur et neglegentius emendantur}, “numerals are carelessly copied and more carelessly emended”), and p. 52: “the great majority of the numeral corruptions involve the larger numerals.”

\textsuperscript{87} Ortali 1991; Brun 2004, 49.

\textsuperscript{88} Hero’s description of direct-screw presses has been taken (e.g. by Thurmond 2006, 97; Brun – Monteix 2009, 130) as verification of Pliny’s date for the introduction of the direct-screw press in the mid-1st century AD. However, Hero’s writings are of uncertain date. They have been dated to the mid-1st century AD on the basis that he mentions an eclipse (\textit{Dioptra} 35) which has been equated with a lunar eclipse which occurred in AD 62. However, it has been argued by Masià 2015 that Hero’s discussion does not necessarily imply that he himself had witnessed one, but is rather a hypothetical example. The only other indications of Hero’s \textit{floruit} are his mention of Archimedes, which gives a \textit{terminus post quem} of the 3rd century BC, and the fact that he is quoted by Pappus, giving a \textit{terminus ante quem} of the mid-4th century AD: Acerbi 2008. Thus it is difficult to rely on a 1st century dating of Hero for confirming Pliny’s chronology.

\textsuperscript{89} Drachmann 1932, 125–128.
tion of the lever-and-screw press and the precise “22 years” since the invention of the direct-screw press—and suggests that Pliny must be speaking from personal experience as a land-owner facing the “question of repairing or renewing presses [...] year after year [...].” This is plausible, but still does not explain the precision of XXII annos. There is another possible explanation: that the year that fell 22 years prior to that in which he wrote was somehow a memorable one in Pliny’s life. We do not know when exactly Pliny wrote this number—was this the figure he drafted in the first edition of the “Natural History” in AD 77 or 78, or did he change it in 79 when he was working on a revised version? His nephew says that he died in his 56th year, but it is uncertain whether he was counting exclusively or inclusively from AD 79, and therefore whether his uncle was born in AD 23 or 24. The equestrian career path was ten years of military service, so Pliny’s would have begun in around AD 46 and ended in 55 or 56. Since we know that Pliny then left the service and went into semi-retirement under Nero, not returning to service until Vespasian’s rule in AD 70, the term “within 22 years” may be linked with the official end of his service and his decision to retire. This would have been a major transition in Pliny’s life. After that time, he wrote and perhaps became a man of leisure, touring his estates, and presumably talking to his overseers. It seems possible that during this period of his life he saw or was informed of this novel type of wine press, recently invented, although it was not necessarily used on estates which he himself farmed. It is, therefore, quite possible—although this remains purely speculative—that when writing the “Natural History” in AD 77 or 78, he may have recalled that this had happened shortly after his retirement from military service, around AD 55–56, and thus dated the direct-screw press to “within the last 22 years” for this reason.

Drachmann raises the issue of a seemingly conflicting date indicated by Vitruvius, who casually mentions the existence of presses with and without a screw:

Ipsum autem torcular, si non cocleis torquetur sed uectibus et prelo premetur, ne minus longum pedes XL constituatur; ita enim erit uectiario spatium expeditum.90

Vectibus et prelo—terminology strikingly similar to Pliny’s detrahebant [...] uectibus describes a lever (prelum) being lowered by a man using hand-spakes (uectes). The fact that Vitruvius specifies a smaller room for a press with a screw seems to suggest that he is referring to a much smaller direct-screw press when he writes cocleis torquetur. This appears to match Pliny’s description of the direct-screw press minore torculario aedificio. Drachmann concludes that “Vitruvius

90 Vitr. De Arch. 6.6.3 (“This press, if not turned by screws but pressed by hand-spakes and a lever, will occupy no less than 40 feet. For thus there will be space for the hand-spake worker”).
is speaking of direct-screw presses”, that is, those without a lever.\footnote{Drachmann 1932, 126. Frankel comes to the same conclusion: Frankel 2016, 565.} This is, of course, problematic since Vitruvius’ \textit{floruit} was at least half a century earlier than the date at which Pliny says the direct-screw press was invented.

Vitruvius, however, is not necessarily talking about a direct-screw press. He does not say anything about the size of the building but refers specifically of the \textit{length} of the room (\textit{ne minus longum}), and of allowing room for a man who is working the hand-spakes (a \textit{uectiarius}) to be positioned at the end of its length. Cato’s lever-and-drum press is 11.8–12.7 m in length, including the very long hand-spakes. This accords well with Vitruvius’ requirement of 11.8 m (\textit{ne minus longum pedes XL}). A lever-and-screw press, however, even with a lever of the same length, would not require the 4.4–5.3 m hand-spakes or room for the \textit{uectiarius}. Two much shorter spakes would instead radiate, star-like, from each side of the rod.\footnote{Bernard 1788, 421 describes the length of such hand-spakes as “cinq pieds”, equivalent to 1.6 m. The hand-spakes on the Aquileia relief (fig. 7) appear to project a similar distance, or about a man’s height, on each side. These 1.6 m hand-spakes are thus much smaller than Cato’s 4.4–5.3 m \textit{uectes}.} As noted above, Pliny does not use the term \textit{uectes} to describe such spakes used to turn a screw, but rather \textit{stella}. Close attention to Vitruvius’ passage also shows that the primary contrast is between the two verbs \textit{premetur} and \textit{torquetur}: one press is operated with a pushing motion, which requires the \textit{uectiarius} to have room to take up a position at the end of the press (fig. 4); the other is operated by a turning motion, which requires space at the sides for press operators to walk in a circle to turn the \textit{stella}, but less length. The length of the building, therefore, need not be much more than the approximately 7 m long lever. Vitruvius must be referring to the requirements of such a press rather than to the very much smaller, square direct-screw press, generally measuring no more than about 2 m (see below). There is thus no need to question Pliny’s dating of the invention of the direct-screw press to the mid-1st century AD based on the Vitruvius passage.

While much attention has been paid to the valuable date thus given, this has overshadowed the elegant symmetry with which Pliny emphasizes the contrast between the group of lever-and-screw presses previously described, and this, his final group, the direct-screw presses – refuting, at least insofar as this passage is concerned, modern critiques of Pliny’s Latinity (see above). Each description begins with an almost identical chronological formula (\textit{intra C annos / intra XXII hos annos}); this is followed by a form of the verb \textit{inuenio} (\textit{inuenta/ inuentum}); and, finally, an elaboration of the key feature of how each type works. Indeed, within each elaboration lies a further symmetry – each begins with an
ablative of description (*stella adfixa / parvis prelis*) and then follows a locative ablative (*aliis / minore torculario aedificio*). The symmetrical arrangements can be expressed schematically as follows:

\[
\text{intra C annos} \\
\text{inuentum} \\
\{\text{adfixa ... stella}\} \\
\{\text{aliis}\}
\]

\[
\text{intra XXII hos annos} \\
\text{inuentum} \\
\{\text{paruis prelis}\} \\
\{\text{minore torculario aedificio}\}
\]

It must be noted, however, that grammatically these phrases are not entirely parallel. *Inuentum*, like its complement earlier in the passage (*inuenta*), is the main verb of this sentence, a perfect passive participle with its auxiliary verb (in this case *est*) elided. Its usage, however, is quite different. The implied subject cannot be *prelum*, parallel to *prela* being the implied subject of *inuenta* earlier, because two words later, *prelis* appears, describing the subject of *inuentum*. As will be seen in the next section, here *prelis* can only mean “presses” (rather than “levers”), and so “a press has been invented that has small presses” makes little sense. The solution is to be found in a meaning of *inuenio* that is not easily translatable into English, which approximates to “to find a way”, “to devise”.93 We have therefore translated “a way has been devised”, which is necessary for the proper construing of the infinitives *urguere* and *construere*, discussed later, that complete the action of the main verb, *inuentum [est]*.

**paruis prelis et minore torculario aedificio**

A careful reading of this section of Pliny’s passage is of the utmost importance since the direct-screw press which he describes here has been universally hailed by modern historians since the time of Drachmann as the most sophisticated and “efficient” press, which replaced all others. It is therefore essential to revisit what exactly Pliny says about them.

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93 Oxford Latin Dictionary, s.u. *invenio* 6, 6b. Pliny uses the verb in precisely this way at Nat. 33.49.140 (*nos carrucas argento caelare inuenimus*, “we devised a way to emboss travelling-carriages in silver”).
Pliny begins his description of presses of this type by highlighting two features: their small size, and location *minore torcularius aedificio*. To begin with, the translation of *paruis prelis* as “short press-beams” must be categorically rejected. As noted above, the term “beam” is usually used in press contexts to mean the horizontal lever (*prelum*), and the ensuing description *in media directo* makes it clear that Pliny is describing a direct-screw press mechanism, in which there was no beam/lever. Pliny is using the term *prela* here to mean the presses as a whole, not the levers.

Archaeology and ethnography confirm that these types of presses were much smaller in size (fig. 5). Ancient remains indicate that they were around 2 m in length, a mere fraction of the size of lever-and-screw presses, which were around 7 m or even longer.\(^94\) Their smaller size was noted by the 18th century French investigator Rozier, who described a direct-screw press used in Languedoc and Provence as “très commode […] et il occupe peu de place”, in contrast to the larger lever-and-screw press, which was “si volumineux”\(^95\).

In the expression *minore torcularius aedificio*, Pliny, despite White’s translation, is not describing a “press-room”, but a building (*aedificium*) “relating to an olive or wine press” (*torcularius, -a, -um*). Such a building was far from being a “shed”, as it is styled by most English translators (see Appendix), a term which implies a small ephemeral structure in which to store one’s garden tools. A press building was a substantial structure consisting not just of the room in which the press or presses themselves were located, but several other rooms providing spaces for storage, vinification in sunken fermentation jars, facilities for the production of *defrutum*, and work areas. Larger examples, which could extend over 1,000–2,000 m\(^2\) or more, and were often located immediately adjoining the luxurious residence of the owner, also included kitchens, sleeping areas for press workers, and upper-storey viewing galleries.\(^96\) Thus Pliny’s *minore torcularius aedificio* (“in a smaller press building”) – a locative ablative, unlike the immediately preceding ablative of description – says more than just that these small presses take up less space within a room. It implies that these presses are located where the entire press building is smaller. Indeed, their archaeological remains almost

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94 For example, the probable direct-screw press of the Bapteste villa in Gaul, approximately 2 × 1.5 m: Balmelle et al. 2001, fig. 64; that of San Pietro in Casale in Italy, measuring 2 × 1.8 m: Ortali 1991, 186; or the base of the direct-screw press at Valencia in Hispania, measuring approximately 2 × 1.5 m. These can be compared, for example, to the calculated 6–11 m length of lever-and-screw presses at Marroquies Bajos, Munigua, São Cucufate, Milreu, or Torre de Palma: Peña Cervantes 2010, 103.

95 Rozier 1776, 427.

96 Among many examples, see Major Gonzales – Penedo Cobo – Peña Cervantes 2013; for a very large building complex: Mauné 2003.
invariably appear in towns, or at relatively modest farming establishments, where building space was limited.

Ethnographic sources indicate that the small direct-screw presses required a significantly smaller quantity of materials, in the form of good quality wood, to construct, and therefore demanded a much smaller scale of investment. On the other hand, they were weaker, inclined to breakages, and could only press smaller quantities of fruit. A large lever press would press a larger quantity and do so with more force, although it was much more expensive to construct, as emphasized by Rozier, who states that a lever press “presse beaucoup plus mieux et une plus grande quantité de pâte à la fois. S’il n’étoit si dispendieux et si volumineux, je le préférerois”

In the same century, Niebhur described a large Egyptian lever-and-screw oil press which used an artificial beam constructed out of a long hollow box of planks filled with stones. The press builders of this region would have lacked good quality wood for a lever, but rather than resort to a small direct-screw press such as had been known and used there since antiquity, they instead constructed this elaborate framework, presumably because it would have accommodated a larger quantity of olives and applied greater pressure. In Italy and southern France, direct-screw presses were a smaller, less costly option for smaller-scale or even domestic production. They were sometimes located in a kitchen, and could be termed “torchio per la padrona” or “pressoirs ordinaires”. Apart from their ephemeral and mostly wooden construction, this may be a further reason why so few ancient direct-screw presses have been found: excavation has tended to focus on larger villas, which almost invariably used the larger lever presses – indeed, often in groups of two or more – due to the

97 Urban examples at Barcelona (t.p.q of late 3rd century) and Valencia (4th–5th century) in Hispania: Peña Cervantes 2014, 221; 2010, 356–361, 880–882; in Karanis (undated) and Akoris (4th and 6th century) in Egypt: Brun 2004, 177, 181. The small 1st century oil presses in Pompeii and Herculaneum, connected with perfume production (see above), should also be noted in this context.

98 Archaeologists Peña Cervantes and Brun both emphasize that direct-screw presses are characteristically found at small- to medium-sized Roman sites: Peña Cervantes 2014, 221–223, Brun 2005, 160.

99 We exclude from this discussion quite different types of direct-screw presses used in the late antique Levant (see Frankel 1999, 127–137; Waliszewski 2014, 150–154) or those enhanced by wheels and supplementary winches which developed in early modern Europe (see Humbel 1976, 129–152).

100 Rozier 1776, 427.

101 Niebhur 1774–1778 I, 151 and plate XVII.

102 Lauvergeon 2004, 29 f.; Humbel 1976, 125 f., who describes how in Languedoc a small direct-screw press was used by housewives to make muscat for family baptisms and marriages; “pressoirs ordinaires”: Bernard 1788, 425.
large scale of harvests to be processed as well as the ample space available.\footnote{Marzano 2013.} At smaller sites levels of both investment and production would have been lower, sometimes considerably so.

Pliny never implies that these smaller machines press more effectively; on the contrary, immediately prior to our passage, in a brief comment about which presses are the most effective (utilius), he recommends a pair of lever presses, and in fact states that their effectiveness is increased by their length.\footnote{Plin. Nat. 18.74.217: utilius binis, licet magna sit uastitas singulis. longitudo in his refert, non crassitudo. spatiosa melius premunt. See now Lewit – Burton 2019.} The eagerness of modern authors to envisage a progressive evolution to better and more sophisticated presses has obscured what is evident in Pliny’s description: these were small presses, used in different contexts from the larger types he describes.

**breuiore malo in media directo**

The screw rod was, as Pliny says, shorter (breuiore) in this type of press, as can be seen from a comparison of figures 5 and 6. Pliny emphasizes the contrast between this short rod and the much longer rod with its extensive screw thread required by lever-and-screw presses (about 3 m in ethnographic examples)\footnote{Amouretti et al. 1984, 394.} through the parallel pair of phrases *mali rugis per cocleas ambulantibus* and *breuiore malo*. Pliny’s use of three different adjectives meaning “small(er)” (*paruis […] minore […] breuiore*) is also clearly emphatic, stressing the smallness of the direct-screw press and its accoutrements compared to the lever press types. This contrast is far more emphatic than Vitruvius’ aside comparing the space required for a lever-and-drum press with that for a lever-and-screw type (see above), thus providing implicit confirmation that Vitruvius was not talking about direct-screw presses.

There are a few textual problems here, but we have followed Mayhoff’s choice of *in media* (over *in medio* in the vulgate MSS) and his emendation of *decreto*, “having been shrunk” to *directo*, “directed”. While “in the middle” (*in medio*) makes perfect sense here, *in media* has the authority of a superior MS tradition, and is grammatically acceptable if we recognize that it modifies *prela*, which is also governed by *super*: “toward the middle of the presses” as well as “above the presses”. This is in keeping with Pliny’s economy of language and concern for artistic balance in the passage. As for *decreto* (so, the MSS), this renders *breuiore* redundant. Mayhoff’s emendation to *directo*, “directed”, is to be preferred for this reason, and because, as always in this passage, Pliny’s focus is on the
action of the presses. Unfortunately, most scholars seem to combine the meaning of the verb *derecto* with the adverb *derecto*, “in a straight line, straight” to yield “running straight down (into) the middle”. All screws would operate in a straight line, whatever the press design. Pliny’s phrase instead refers to a key difference between lever-and-screw and direct-screw presses: instead of being at one end of the press, in direct-screw presses the screw rod is located in the middle of the machine and thus pressed down on the fruit rather than drawing down a lever. Pliny is again describing “how it works”.

**tympana inposita uinaceis superne toto pondere urguere**

In translating *tympana* as “drums”, translators perhaps have in mind the flat, hollow drum-like noise-makers associated with Roman Cybele worship. In Latin press terminology, however, the term “drum” is strictly associated with the large cylinder at the end of Catonian lever-and-drum presses, which was called a *sucula*, and is certainly not present here. In the context of a direct-screw press, the *tympana* are flat, disk-shaped wooden objects, similar in shape to Cybele’s tambourines but entirely different in nature. The use up to modern times of a square or round wooden board in this type of press is well-attested (see figs. 5 and 11).106

The Roman term *uinacea* should be translated by the technical word for this substance, “marc” (adopted from the French). It refers to the grape-matter which has been trodden and is then placed under the press, as made clear by its use in Columella.107 This consists of skins, pips and stalks, as well as any remaining juice.108 It therefore includes but is not limited to “skins” (see Appendix).

The translation of *toto pondere urguere* as “which exert a continuous downward pressure” (see Appendix) must be rejected, since a notable characteristic of this type of press was that its pressure was not continuous. Hero comments: “The pressure they exert is not continuous, or always equally strong. One must take care to give some turns of the screw from time to time to renew the pres-

106 Avitsur 1994, 124 for examples in the 20th century Levant; for similarity in shape to Cybele’s *tymanum* see image at https://commons.wikimedia.org/wiki/File:Bronze_statuette_of_Cybele.jpg. Varro (Rust. 3.5.15) uses the word *tymanum* to describe a circular table-top with a raised edge.

107 Colum. 12.36: *mustum tortium est, quod post primam pressuram uinaceorum [...] exprimitur* (“Pressed must is that which is squeezed out after the first pressing of the marc”).

108 Varro (Rust. 1.54.2) explicitly mentions some of its component parts: *quae calcatae uuae erunt, earum scopi et folliculis subicendi sub prelum* (“when the grapes have been trodden, their stalks and skins should be placed under the press”).
asure.”\textsuperscript{109} Pliny in fact uses the term “weight” (in most places correctly translated) rather than “pressure”.\textsuperscript{110} In purely mechanical terms, this is not quite accurate, since the screw in fact exerts pressure, not weight. Pliny was probably influenced by the fact that weight was an important factor in the action of lever presses.\textsuperscript{111} The use of the verb urguere, rather than its equivalent urgere, is typical of Pliny’s careful style in this passage. Urguere creates an assonantal effect with the final verb, in the next phrase, construere, and thus gives a balanced expression of two actions – the downward action of the screw rod (toto pondere urguere) and (as we shall shortly see) an action which counters the pressure created (construere congeriem).

\textit{et super prela construere congeriem}

Since the 1930s, two alternative translations of this phrase have been repeated with little critical consideration. Drachmann interpreted Pliny’s words to mean a wooden “superstructure” of the press itself, containing bricks or stones (fig. 1b), primarily due to his conviction that the direct screw presses were converted from lever presses.\textsuperscript{112} However, Pliny clearly says that this is not part of the presses but something which is “above” them: super prela. Drachmann’s reconstruction was, as Brun regretfully notes, “partout reproduite”\textsuperscript{113}, and even acquired its own name, the “congeries press”\textsuperscript{114}. By 2001, however, it had quietly sunk, un-mourned, from view.\textsuperscript{115} In 1938 Rackham supplied an alternative translation “pile a heap of stones”, which has also been frequently repeated, although in 1998 the congeries was transformed into “a heavy stone weight” (see Appendix).

The idea of the congeries as part of the press itself must be rejected, but Drachmann did recognize its purpose: to counter the upward pressure generated by the downward action of the screw.\textsuperscript{116} This mechanical problem is discussed by

\textsuperscript{109} \textit{Mechanica} 3.18. This problem was dealt with in the 17th to the early 20th centuries by the addition of separate, sometimes metal, machines using a vertical winch and supplementary mechanisms with one or more wheels, but there is certainly no mention of such a device in Pliny. See Rozier 1776, 427; Humbel 1976, 129–159; Avitsur 1994, 127 f., 149 f.; Lauvergeon 2004, 34–46.
\textsuperscript{110} C.f., e.g., Vitruvius uses pressio, “pressure”, to describe the pressure exerted by a fulcrum on a lever (10.3.6, 8.5).
\textsuperscript{111} See mechanical calculations presented by Amouretti et al. 1984, 389–401.
\textsuperscript{112} Drachmann, 1932, fig. 17. Drachmann’s belief will be evaluated in more detail below.
\textsuperscript{113} “(En dernier lieu par White, 1975, fig. 65)”: Brun 1986, 126.
\textsuperscript{114} White 1975, 231.
\textsuperscript{115} Curtis 2001, 393.
\textsuperscript{116} Drachmann 1932, 58, a point also emphasised by Brun 1986, 125 f.
the 18th century commentator Bernard. He describes how the cross-piece (termed *banc*) into which the upper end of the screw was inserted tended to be forced upwards and the whole press was subject to breaking apart:

“Comme, en pressant, l’effort de la vis tendoit à soulever le banc, et comme les montants n’étoient jamais fixés d’une manière inébranlable, les mouvements subits et violents qui leur étoient communiqués par le levier appliqué à la vis, les faisoient briser à l’endroit où ils avoient été affoiblis.”117

It is evident that Pliny is referring to a 1st century solution to this same, immutable problem.

It is hard to see how one could pile a heap of stones on top of a press, particularly a small direct-screw press, and one would imagine that “les mouvements subits et violents” would quickly displace them, at the risk of injury to the press workers. We have been unable to find any ethnographic parallel for a pile of stones to serve this function. Elsewhere in the “Natural History”, Pliny uses the term *congeries* for a mass of piled up material of any sort, only once of stones, including a mass of sand, branches used by bears as a shelter, or material built into an enclosing mound for making pitch or charcoal.118 It should be noted that such a mound for charcoal-making is not merely thrown-together or unstructured, but a carefully built construction of layered wood, earth and flammable material.

Nor does the verb *construere* necessarily mean “to pile up”. Pliny uses it to describe the building of its pyre by a phoenix,119 which could be envisaged as a piling up of materials, but it can also be used simply in the sense of “to build”. Cicero uses this verb for the building of a ship or a house.120 Suetonius uses it to describe granaries which he claims Nero had deliberately demolished with war machines to make way for his Golden House since they would not easily burn because they were robustly built of stone.121 In keeping with the careful phrasing and word choice we have seen throughout the passage, Pliny, by choosing to place side by side the two words *construere* and *congeries*, creates an emphatic alliterative effect similar to his repetition of *ad-* in the phrase *adfixa* [...]*adtol-

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117 Bernard 1788, 427. The cross-piece may also be termed ‘chapeau’ in French.
118 Plin. Nat. 4.1.5, 8.54.127, 16.22.54, respectively; *contra* White 1975, 232, who states that it is “used of any rough assemblage of material especially stone”.
119 Plin. Nat. 10.2.4.
120 Cic. Cato 20.72; he also uses it to express the building of the universe by the gods (with *ferramenta, uectes* and *machinæ*) in Nat. Deor. 1.8.19.
121 *Et quaedam horrea circa domum Auream, quorum spatium maxime desiderabat, ut bellicos machinis labefacta atque inflammatae sint, quod saxeo muro constructa erant*: Suet. Ner. 38.
lente. Pliny has deliberately emphasised the prefix con-, evoking a sense of bringing together or binding, firmness or solidity.\textsuperscript{122} Thus, the phrase means “to build” (not “to pile”) a mass of some sort which holds something together firmly. The assonantal echo of urg\textit{ere} in \textit{construere} also recalls the downward action which creates the upward pressure to counter which the mass must be built.

Remains of 16th to 19th century presses and ethnographic accounts attest a wide variety of solutions to the instability of direct-screw presses. These included the addition of iron bars or bands, the use of very thick cross-pieces and arched side posts or, from the 18th century, the use of masonry wall niches, in which the press was set into a wall and the cross-piece tied into the masonry, a method termed “à chapelle” (or, in Spanish, “de capilla”) (see figs. 11 and 12).\textsuperscript{123}

The 19th century direct-screw press \textit{de capilla} preserved at the Museo del Aceite de Hojiblanca, Málaga, presents a feature which evokes Pliny’s \textit{congeries}: directly above the upper cross-beam of the press, which was tied into the masonry, and within the space of the niche, heavy blocks of wood were inserted to further stabilize the press against the upward pressure created by the pressing action (fig. 12).\textsuperscript{124} While this press employed different technologies from ancient machines, since it used a turning wheel and a supplementary winch mechanism, it provides an example of how another kind of “mass” – not of stones, but of wood – could be used in combination with a stone wall niche for this purpose.

Archaeological remains of ancient direct-screw presses are rare, but ancient examples of direct-screw presses which were placed in wall niches have been found in Egypt at Canopus (undated) and Karm el-Baraasi (6th–7th century). At the latter, the square sockets for lodging the cross-piece of the press in the walls on each side of the niche have been preserved (see fig. 13).\textsuperscript{125}

Where ancient direct-screw presses have been found in European contexts, they seem to be placed not inside a niche but against a wall (as in Valencia)

\textsuperscript{122} Lewis – Short, s.u. \textit{cum} IIIIB: “It designates, 1. A being or bringing together of several objects [...]. 2. The completeness, perfecting of any act, and thus gives intensity to the signif. of the simple word.”

\textsuperscript{123} Bernard 1788, 427 f., plate 1.12; Humbel 1976, 127, plate XXII; Brun 1986, 126. For a 20th century traditional direct-screw terebinth oil press with massive cross-piece, see Doğer – Sezgin 2015, fig. 8.

\textsuperscript{124} Our thanks to Yolanda Peña Cervantes for drawing our attention to this example, and her very helpful comments. The arrangement of the press, donated by the Acedo family, has obviously been reconstructed within the museum building.

\textsuperscript{125} Brun 2004, 157 f., 160 f.; Abd el-Aziz Negm 1998. The wall at Karm el-Baraasi was made of mud brick, reinforced with limestone blocks. The press was used for wine production.
**Fig. 11:** Direct-screw press placed in wall niche (“à chapelle”), Moulin Fourville, probably 18th century. Photo courtesy of Moulin Forville Musée Victor Tuby, Cannes.

**Fig. 12:** Direct-screw press placed in wall niche (“de capilla”), with wooden pieces arranged on top, 19th century: Museo del aceite Hojiblanca, Malaga. Photo courtesy of Y. Peña Cervantes.
or in a corner (as in Barcelona), suggesting that they were similarly secured to the masonry. Other examples of screw press remains are located less than 1 m from walls, suggesting that they also might have been tied to or supported

126 Barcelona (4th century): Beltrán de Heredia Bercero 2001, 66–68; Peña Cervantes 2010, 356–361; Valencia (4th or 5th century): Peña Cervantes 2010, 360, 881; similar arrangements are found at Paestum (possibly wedge or direct screw press) and in Egypt, e.g. at Burg el-Arab (4th–5th century): El-Ashmawi 1998, 60–62; Brun 2004, 155–157; Brun – Monteix 2009, 128–130.
by them in some way. This is the case at Moncrabeau (Gaul),\textsuperscript{127} and at Dehesa de la Cocosa (Hispania), where the traces are located in a T-shaped building in which the walls narrow to less than 1 metre on either side of the press base.\textsuperscript{128}

It seems possible that the unusual shape of this building was designed for the purpose of supporting the press. While Roman walls are very rarely preserved to a height which makes it possible to confirm such hypotheses, valuable evidence is offered by the examples at Pompeii and Herculaneum of presses probably used to produce fine oil for perfume making, noted above. The preserved wooden press at Herculaneum III.10 seems to have been attached to the walls with several small rods.\textsuperscript{129} The base of a press was excavated in the \textit{officina olearia} at Reg. VII.4.24–25, and while it is uncertain whether this belonged to a direct-screw or wedge press, either would have been subject to the same problems of upward pressure.\textsuperscript{130} This press base was located in the space between an internal brick wall and a brick pillar abutting the stone side wall, about 30 cm equidistant from each. In the pillar was preserved a large socket (10x13 cm) for lodging the cross-piece of the press.\textsuperscript{131} A stone block 1 m above marks the point where the ceiling passed “above” the press. This exceptionally well-preserved wall attests that during Pliny’s time (and place) this solution was sometimes used.

It seems clear that Pliny must be referring to such built arrangements for stabilising the small press against the upward pressure generated by the action of the screw. \textit{Congeries} could refer to a mass of any material: wood, stone, aggregate or brick, within such arrangements.\textsuperscript{132} Pliny uses the plural \textit{prela}. As with his initial grouping together of different forms of press which all work through the application of ropes and straps on the levers (\textit{ea}), he may thus be grouping together presses which used a variety of different forms of construction (such as a wall niche, placing the press in a corner, or securing the cross-piece of the press to nearby walls) to provide the stabilizing mass expressed by the collective noun \textit{congeries}. Since his focus throughout the passage is on “how it works”, not

\textsuperscript{127} 2nd century: Balemelle et al. 2001, 136 f.
\textsuperscript{128} Undated: Serra Ráfols 1952; Peña Cervantes 2010, 317.
\textsuperscript{129} Each around 6 cm in diameter, but no longer visible due to conservation. This press was used either for clothes or, more probably, from the evidence of a vat for liquid, to produce small quantities of fine oil: Brun – Monteix 2009.
\textsuperscript{130} Mattingly 1990, 77, 87; Brun 2000, 291; Brun – Monteix 2009. The \textit{officina} is identified by a graffito. We are grateful to Gary Ciddor for his advice on this point.
\textsuperscript{131} Jacono 1941.
\textsuperscript{132} Brun offers a reasonable interpretation of \textit{congeries} as some kind of stone aggregate such as \textit{opus caementicium} used to stabilise the press within a wall: Brun 1986, 125 f.
to provide a detailed recipe for construction, Pliny does not give us the ingredients or particulars of the different arrangements but simply says that these sorts of presses need to have some sort of mass above them (super prela) in order to function. There is no need to suppose that this mass is loose, or piled up haphazardly, which would in fact defeat its purpose. He uses a verb which signifies a built arrangement. The combined use of two words prefixed by con- appears emphatic and gives the sense that it is a mass which will hold the press together and prevent it from breaking into pieces.

**The Passage as a Whole**

Pliny employs grammatical and stylistic patterns which add further layers of meaning, often unnoticed by modern readers, particularly when the passage is read in translation. Each press group is described by an expression in the plural (ea, Graecanica, prelis/prela), because in each case Pliny is explaining how several related types group together in terms of “how they work”. He occasionally switches to the singular when describing specific types within a genus; so, for example, he uses arbor to describe each type of lever-and-screw press. The initial verb detrahebant in the opening sentence begins a series of descriptions of action – adfixa, adtollente, urguere – according to which the different types are delineated. Symmetrical pairs are linked or distinguished by matching phrases: the matching chronological delineations intra [...] annos followed by inventa/inventum introduce the juxtaposed lever-and-screw and direct-screw groups, and the deliberately varied use of the synonyms malus and arbor distinguish this pair from the pair of lever-and-screw types. The characteristics of each type are emphasized by the alliterations and assonance of adfixa [...] adtollente and urguere [...] construere congeriem. While at first sight the passage seems to present a mass of undistinguished ablatives – nearly half of the words are in the ablative – these are in fact also carefully arranged. Each section employs an ablative absolute to define how the type works: adtollente [...] arbore; adfixa arboris stella; breuiore malo in media directo. These distinguishing features of each type are introduced by either an ablative of agent (ab aliis) or a locative ablative (aliis and minore torcularia aedificio).
Implications: The True Story of the First Century Press

In light of this suggested translation and, it is to be hoped, improvements in our understanding of what exactly Pliny wrote, we can return to the question of overall interpretation. Pliny clearly intends to outline a variety of mechanisms of action employed in different forms of press, focusing on how they work rather than on the details of construction. While he provides a chronology of their origin – some forms of press are ancient, some were invented 100 years earlier, some are more recent – Pliny does not say or imply that each successive type superseded the earlier types, with a final press type – the direct-screw press – replacing the earlier types in an evolutionary process. His use of the present tense, of ab aliis and aliis, and his description of a design 100 years old as maxime probatur all make clear that the later sorts in no way superseded the ones used before. The section immediately before our passage, in which he discusses the desirable length of a press, emphasising that they should be as long as possible, further reveals that long lever presses had not been replaced by the most recent, small square-shaped direct-screw types. It is, therefore, abundantly clear that the main form of press used in his time was still the lever and not the direct-screw press, as was to remain the case in the Mediterranean for millennia. Even the use of antiqui in relation to the most ancient sort, without a screw, does not necessitate its discontinuation in his own time. A comparison can be made with the parallel passage in Hero’s Mechanica, mentioned above, where he states that there are “many other types of press” which he will not describe because they are so well known, since their “use among the multitude has been widespread and

133 Longitudo in his refer: Nat. 18.74.317.
long-standing”. Like Pliny, Hero tells us that the “long-standing” presses are not obsolete but still widely in use. Vitruvius, in the passage about press rooms quoted above, also assumes that press types both with and without a screw were in simultaneous use and would be known to his readers, requiring no further explanation. In fact, his recommendations for a long building imply that the lever press type without a screw was more likely to be used.

Pliny does not say or imply that each of the three main press types described successively improved upon inferior types in a “step forward”. The interpretation of Pliny’s passage as a description of successive improvements is out of character with the rest of Book 18. Pliny’s approach throughout the Book is to describe a range of existing variants in farming practices, with occasional comments on geographic variations, advantages or suitability of one particular method, or when methods have come into use (whether long ago or recently). A close parallel can be found in his discussion of ploughs, where Pliny also describes several different kinds, all of which work differently. Here, he uses the same term, *inuentum*, mentioning that one type is a recent invention, but there is no suggestion that this most recent one is the best. He says, rather, that each plough is suited to particular situations, for example, for different types of land or with different teams of animals. Although he provides a chronology, the opening statement that “[t]here are several kinds of ploughs” (*vomerum plura genera*) makes clear that the range of types are all currently in use, and indeed, this entire passage is also written in the present tense.135

134 Hero *Mechanica* 3.20.
135 Plin. Nat. 18.48.171–173: *Vomerum plura genera: culter uocatur infixus prae dentali priusquam proscindatur terram secans futurisque sulcis uestigia praescribens incisuris quas resupinus in arando mordeat uomer. alterum genus est volgare rostrati uectis. tertium in solo facili non toto porrectum dentali sed exigua cuspipe in rostro. latior haec quarto generi et acutior in mucronem fastigata eodemque gladio scindens solum et acie laterum radicies herbarum secans. non pridem inuentum in Raetia Galliae ut duas adderent tali rotulas, quod genus uocant plaumorati; cuspis effigiem palae habet. serunt ita non nisi culta terra et fere noua; latitudo uomeris caespites versat, semen protinus inciuent cratesque dentatas supertrahunt. nec sarienda sunt hoc modo sata, sed protelis binis ternisque sic arant.*

(“There are several kinds of ploughs. The part fixed in front of the share-beam is called the coulter, which cuts the earth before it is broken up and marking out the tracks for the future furrows with incisions which the share sloping backward should bite out in the process of ploughing. Another kind is the common share consisting of a beaked lever. A third kind is used in easy soil which is not extended along the whole of the share-beam but has a small spike in the beak. In the fourth kind the spike is broader and sharper, tapered off in a point, and using the same blade both to cut the soil and with the sharp edge of the sides to cut the roots of the weeds. An invention was made not long ago in the part of Gaul called Raetia such that to this kind of plough were added two wheels, which type they call *plaumorati*; the share has the shape of a spade. These
Pliny does not say that the newest press type is the best or the most sophisticated, but rather that it is “small”. He does not say that it is more efficient or productive, and he certainly does not say that a lever is “clumsy” or “space-wasting”.\(^\text{136}\) The primary reason for using a direct-screw was to economize on materials and space, as Pliny tells us, and the choice of technology was based on degree of investment: whether large-scale investment in expensive lever presses for commercial production, by rich owners able to invest considerable sums in large machinery; or small-scale investment in a smaller direct-screw press to process a smaller harvest. This is evident from the ubiquity of lever press remains at wealthy villa sites and in areas of intensive production such as Africa.\(^\text{137}\) A smaller press would be used at a more modest farm which had “a smaller press building”. The view that the direct-screw press was the best or most “advanced” solution is an illusion arising from modern ideas of industrial “progress” toward greater and greater efficiency of production.\(^\text{138}\)

The concept of the direct-screw as the final destination in a march of progress originally arose from Drachmann’s vision of a hypothetical “man [who] wanted to transform an already existing lever press into a direct screw press”, a situation for which we have no evidence whatsoever. Although archaeology provides scattered evidence of presses using lever and weight or weights being converted during the Roman period for use with a screw,\(^\text{139}\) there is none at all for their widespread conversion to direct-screw presses, although admittedly this would be relatively hard to trace archaeologically. Drachmann in fact based his hypothetical reconstruction of the transformation of lever-and-screw presses to direct-screw presses on a misinterpretation of ethnographic evidence reported by Paton and Myres in their study of late 19th century Greek presses. Drachmann mistook the replacement of a lever-and-screw press with a modern steam and hydraulic press...
at Kalymnos for the replacement of the older press with a direct-screw press.\textsuperscript{140} The orderly evolution in antiquity toward an ideal and “more efficient” type, the direct-screw press, should finally be laid to rest. There is, quite simply, no textual, ethnographic, or archaeological evidence for such a progression.

Pliny gives us a picture, which is well-supported by both archaeology and ethnography, of different technologies being used simultaneously, depending on circumstances. Equally importantly, he records details of Roman press use and terminology which are not attested anywhere else: the terms which could be used for the wooden screw rod (\textit{malus} or \textit{arbor}), and its upper part, carved into a continuous screw, which he terms the \textit{coclea}; the arrangement of hand-spakes to operate such a screw rod, which he calls the \textit{stella} rather than \textit{uectes}; and the \textit{arcae lapidum}, otherwise unknown for the Roman period (since they would leave no archaeological trace). Pliny further records as early as the 1st century AD the existence of “smaller” direct-screw presses, which can be barely discerned in any archaeological contexts of such an early date, and only in very few fragmentary remains in any western Mediterranean contexts of the Roman period. He is also our only written source for the existence by the 1st century of solutions to the problem of instability in small direct-screw presses, although he does not describe their details. Most importantly, Pliny records that both fixed screw rods and screw rods lifting mobile counter-weights were used in the Roman empire, a fact of which we would otherwise be entirely ignorant since only the latter have left clear archaeological remains. Pliny’s unambiguous statement has been much-neglected due to confusion over the sense of the comparison which he draws, and for this reason a connection has not been made between his descrip-

\textsuperscript{140} Drachmann, 1932, 58 (“Paton [sic] tells us how the old-fashioned lever and screw press at Kalymnos was displaced by a direct screw press about 1890”). White 1975, 232 takes this up, repeating the same phraseology (“which was replaced by a direct-screw around 1890”), and adds – quoting a footnote in Paton – Myres – that “it had recently been converted into a more modern type”. For “steam and hydraulic presses” which have “lately been introduced” to the islands of the region, see Paton – Myres 1898, 210. As for the direct-screw presses used on the Greek islands, which Paton – Myres say were “much more effective and elaborate” and one of “several stages of advance” (note again the industrial-era assumptions about “progress” here), this is not in contrast to lever presses but rather to what they designate as “the simplest oil-press”, used in many Turkish villages, in which men simply stood on a wooden plank over a trough, pressing the oil with their own body weight (a contemporary version of this traditional method, with the olives placed inside a bag, can be viewed on YouTube at https://www.youtube.com/watch?v=ZzrsHwfQtaQ&amp;t=410s). And despite their industrial-era teleological prejudice about “progress”, Paton – Myres 1898, 211 do admit that in the lever-and-screw press at Kalymnos, “the screw acts […] with \textbf{increased effect}, by means of a long lever”, although it was “probably very archaic” (emphasis added).
tion and the ethnographic examples of lever-and-screw presses fixed by *taissons*. We must, however, consign to overdue oblivion the fantastical press weighted by a *stela*, the precarious “heap of stones”, and the mythical presses “invented in Greece”.

Over the last century, as we have seen, Pliny’s carefully chosen phrases have been mangled without due attention to their real meaning and his finely crafted grammar ignored. As has been seen here, by using the tightest of sentence structure and strong symmetries which convey meaning implicitly as well as explicitly, and in spite of the relative poverty of the Latin technical vocabulary, in the space of a mere 52 words Pliny provides a precise summary of the key mechanical features of four types of press used in his own time, with comments on their date of origin and their use. This is a description of vital importance to us since it is unparalleled in any surviving Latin text. Throughout the passage under examination here, Pliny’s well-informed voice rings true, if only we are prepared to listen without preconceptions.

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## Appendix

Translations from J.-P. Brun, *Le vin et l’huile dans la Méditerranée antique*, Paris 2003, 59; A. G. Drachmann, *Ancient Oil Mills and Presses*, Copenhagen 1932, 50, 53, 57; J. F. Healy, *Pliny the Elder on Science and Technology*, Oxford 1999, 164 f; J. W. Humphrey – J. P. Oleson – A. N. Sherwood, *Greek and Roman Technology: A Sourcebook*. London and New York 1998, 156; H. Le Bonniec – A. Le Boeuffle (eds.), *Pline l’Ancien. Histoire Naturelle*, Paris 1972, 162; H. Rackham, *Pliny. Natural History*, Harvard 1938, vol. V, 387 f.; K. D. White, *Greek and Roman Technology*, London 1984, 70.

| Pliny          | Drachmann 1932 | Rackham 1938 | Le Bonniec & Le Boeuffle 1972 | White 1984 | Humphrey et al. 1998 | Healy 1999 | Brun 2003 | Authors |
|---------------|----------------|--------------|-------------------------------|-----------|----------------------|-----------|---------|---------|
| Antiqui [...] ea detrabeant | Our forefathers drew them [the press beams] down | In old days people used to drag down the press-beams | Les anciens abaissaient les poutres | In the old days they used to pull down the press-beams | Our forebears used to pull down the beams | People in olden times used to drag down the press-beams | Les Anciens abaissaient les leviers | Men of old would drag [the levers] down |
| funibus uitiss-que loreis [...] et uectibus | by means of ropes and leather thongs and handspakes | with ropes and leather straps, and by means of levers | à l’aide de cordes, de courroies en cuir et de leviers | with ropes and leather thongs, using handspakes | using ropes and straps and by levers | with ropes and leather straps, and by means of levers | à l’aide de cordes, de câbles de cuir et de barres | with ropes and leather straps and also with handspakes |
| intra C annos inuenta Graecanica | Within the last 100 years there have come into use presses invented in Greece | but within the last hundred years, the Greek pattern of press has been invented | Au cours des cent dernières années, on a inventé les pressoirs grecs | Within the last century the type of press known as the ‘Greek’ has been invented | but within the last hundred years the Greek system was adopted | but within the last hundred years, the Greek pattern has been invented | Au cours des cent dernières années, les “pressoirs grecs” ont été inventés | Within the last 100 years “Grec- style” [presses] have been devised |
| Latin                                                                 | Translation                                                                 |
|---------------------------------------------------------------------|-----------------------------------------------------------------------------|
| mali rugis per cocleas ambulantibus                                | spars with furrows running round them in a spiral                           |
|’autour d’un fût, des rainures courent en spirale’                  | with the grooves of the upright beam running spirally                       |
| with a vertical screw run in a spiral                              | in which the grooves of the upright beams running spirally                 |
| with the upright beam fitted with grooves than run spirally        | with the grooves of the upright beam fitted with grooves than run spirally |
| Autour d’un fût, les rainures courent en spirale                   | with the threads of the rod running throughout the length of the screws    |
| ab aliis adfixa arboris stella                                     | some people putting handles on the spar                                     |
| some makers fitting the tree with a star                           | to this ‘tree’ some attach a block of stone                                |
| à cet arbre les uns fixent un bloc de pierre                        | four turning-spikes are fitted to the screw by someone                     |
| les autres une caisse pleine de pierres qui se soulève en même temps que l’arbre | –                                                                             |
| others making the spar lift up chests of stones with it             | à cet arbre, les uns assujettissent un bloc de pierre                      |
| but with others the tree raises with it boxes of stones             | with the star of the pole being fixed in position by some                  |
| les autres une caisse pleine de pierres qui se soulève en même temps que l’arbre | –                                                                             |
| others a box full of stones which rises at the same time as the tree | les autres, une caisse remplie de pierres qui se soulève avec l’arbre      |
| while in other examples the screw lifts up boxes of stones with it  | in some with the pole raising with itself boxes of stones                   |
| a design that is particularly recommended                          | which is especially favoured                                                |
| the latter arrangement being the most highly approved              | a design that is particularly recommended                                  |
| an arrangement which is very highly approved                       | ce qui est très apprécié                                                    |
| quod maxime probatur                                                | ce procédé est très en faveur                                               |
| Within the last 22 years people have invented to press with shorter presses and smaller press houses | intra XXII hos annos inuentum paruis prelis et minore torculario aedificio |
| a scheme has been invented involving the use of short press-beams and a smaller pressing-shed | Au cours des vingt-deux dernières années, on a imaginé d’utiliser des petits pressoirs et un bâtiment moins grand |
| how to use small presses and a less spacious pressing shed          | Au cours des vingt-deux dernières années, on a imaginé d’utiliser des petits pressoirs et un bâtiment moins grand |
| a plan has been devised to use smaller presses and a smaller pressing-shed | [W]ithin the past twenty-two years, a plan has been devised to use smaller presses and a smaller pressing-shed |
| a plan has been devised to use smaller presses and a smaller pressing-shed | Au cours des 22 ans, on a inventé de petites presses et un bâtiment de pressoir moins grand |
| Within the past 22 years there has been devised a way, with small presses and in a smaller press building | Within the past 22 years there has been devised a way, with small presses and in a smaller press building |
| Latin | Drachmann 1932 | Rackham 1938 | Le Bonniec & Le Boeufle 1972 | White 1984 | Humphrey et al. 1998 | Healy 1999 | Brun 2003 | Authors |
|-------|----------------|--------------|-----------------------------|------------|----------------------|------------|-----------|---------|
| breuiore malo in media directo | with a shorter spar straight in the middle | with a shorter upright beam running straight down into the middle | un fût plus court s‘dresse au milieu | with a shorter upright beam running straight down into the centre | a shorter vertical screw projects downwards onto the middle | with a shorter upright beam running straight down into the middle | Un fût plus court étant placé verticalement au milieu | with a shorter rod directed toward the middle |
| tympana inposita uinaeceis superne toto pondere urguere | bearing down with full weight from above on the lid laid on the grapes | and to press down the drums placed on top of the grape-skins with the whole weight | des plateaux pèsent de tout leur poids sur le marc des raisins | placing drums on top of the grape-skins with their full weight bearing down | of the pressing disks, which exert a continuous downward pressure on the grape sacks set beneath | and to press down the drums placed on top of the grape-skins with the whole weight | on presse les plateaux appuyés de tout leur poids sur le marc | to press plates placed on top of the marc from above with all its weight |
| et super prela construere congeriem | and to build a superstructure above the press | and to pile a heap of stones above the presses | et on charge les pressoirs avec des corps pesants | and piling a heap of stones on top of the presses | a heavy stone weight is placed on top of the apparatus [adding to the force of the screw] | and to pile a heap of stones above the presses | et l‘on édifie sur les pressoirs un blocage de maçonnerie | and to build a mass above the presses |