



C.R. Cockerell and the Discovery of Entasis in the Columns of the Parthenon

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ONE SENSES THAT, among the many chapters in his many books, David Watkin took particular pleasure in writing the one in his 1974 monograph on Charles Robert Cockerell that deals with his subject's travels in the Mediterranean from 1810 to 1817. The young Robert must surely stand as the most Romantic English architect of the classic period of Romanticism: handsome, immensely gifted, lionised by contemporaries of all social classes and many nationalities and, to cap all this, tenacious and fortunate enough to have made major discoveries relating to classical antiquity. Cockerell's accounts of his 1811 expeditions to Aegina and the Peloponnese with John Foster, Baron Haller von Hallerstein and Jakob Linckh read with an excitement more common in the heroic phase of archaeology that began later in the nineteenth century: the sight of the helmeted warrior's face that heralded the excavation of the archaic pedimental figures of the Temple of "Jupiter Panhellenius" (Aphaia) on Aegina; or the fox hole at Bassae, barely wide enough for his head and shoulders to be lowered into, where – brushing aside the sticks and leaves of the fox's den – he glimpsed the first piece of the fallen frieze of the Temple of Apollo Epicurius, subsequently excavated and secured as a jewel in the crown of the British Museum.

Another reason why Cockerell must be placed high in the list of those British architects who, from James "Athenian" Stuart in the 1750s to Francis Cranmer Penrose a century later, were responsible for fundamental advances in our understanding of ancient Greek architectural practice lies in the fact that he appears to have

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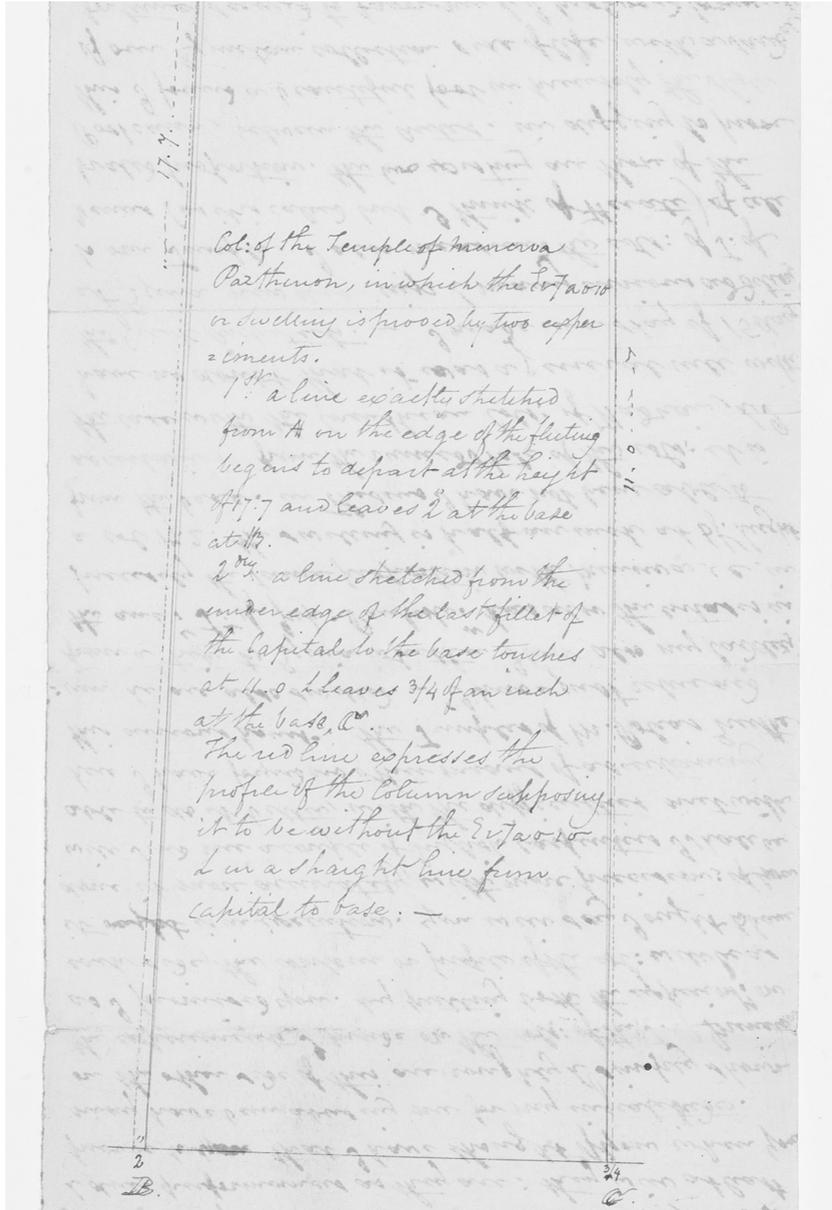
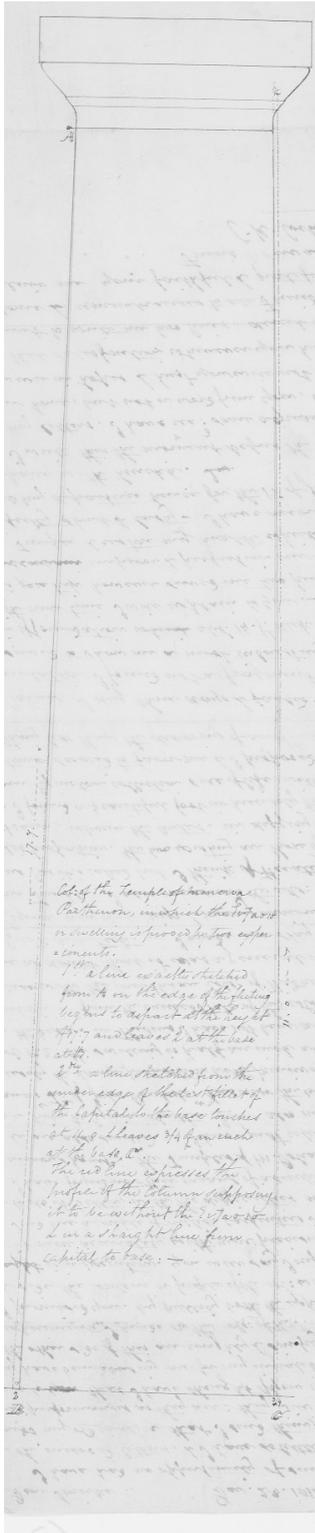


Fig. 1 C.R. Cockerell (engraved John Horsburgh) The Parthenon seen from the Propylaea c.1813–14, from *Description of the Collection of Ancient Marbles in the British Museum*, Part VI (London: G. and W. Nicol, 1830, frontispiece. (Courtesy of Cambridge University Library)

been the first person of modern times to have visually recorded and perhaps to have observed the entasis (the slight central swelling) of the columns of the Parthenon (fig. 1). Writing from Athens to his erstwhile master, Robert Smirke, on 23 December 1814, Cockerell included on the reverse of his letter a drawing on which the temple's entasis was both shown and approximately measured (fig. 2). In the 1970s, when David Watkin first saw it, Cockerell's drawing was preserved among papers that were still in the hands of his descendants.¹ Although these have since made their way into the collection of the Royal Institute of British Architects, the image has never before been published and the place of this important document in the history of the Parthenon and of what are often called the "optical refinements" of Greek architecture in general has not yet been fully recognised or contextualised. Indeed a number of myths and misunderstandings has grown up around the matter and, as it concerns both one of the most disputed – and now famous – principles of Grecian architecture in general and the monument of the Parthenon in particular, it may be thought appropriate that these should be subjected to critical scrutiny in a volume of essays dedicated to one of the great historians of the classical tradition in architecture.

Cockerell intended his drawing to be little more than a demonstration of the existence of entasis for Smirke and it is therefore not set out in a way consistent with full or entirely correct presentation of data. Indeed, the column as drawn has a slight inclination to the right (bottom to top) but this is principally because it is not

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squared up on a sheet of paper that is itself not quite square.² In his letter to Smirke, Cockerell wrote:

On the other side of this are roughly & simply shown the experiments I made on the cols: of the T. of Minerva as I promised you. By putting both the experimts on each side, the contour or profile of the col: will be as it ought [sic] is in execution. You will say I ought to have done it more accurately, with more precision; if you will send

me a couple of English carpenters I shall be able to do it better, with the difficulties met with here I have found no other way of ascertaining this curious point.³

(opposite) Fig 2 RIBA drawing
CoC/Add/1/28 verso.

Then, on the verso, written within the confines of the column itself (fig. 3), he wrote:

(opposite) Fig. 3 detail of
fig. 2

Col: of the Temple of Minerva Parthenon, in which the *Εντασις* or swelling is proved by two experiments. 1st: a line exactly stretched from A on the edge of the fluting begins to deflect at the height of 17.7 and leaves 2" at the base at B. 2nd: a line stretched from the under edge of the last fillet of the Capital to the base touches at 11.0 & leaves $\frac{3}{4}$ of an inch at the base C. The red line expresses the profile of the column supposing it to be without the *Εντασις* & in a straight line from capital to base.

Cockerell's decision to conduct two separate experiments was in line with good contemporary surveying practice. In the first experiment – illustrated on the left of the drawing – a line (perhaps of string or wire) was held at the top of one of the flutes of the column. The solid black line represents the actual profile of the column and the solid red line (just inside – that is to the right – of the solid black line) the tapering of the column assuming no entasis.⁴ Black and red lines therefore meet at both the bottom and the top of the column. The dotted line (outside both solid black and red lines) then shows the trajectory of Cockerell's string or wire, initially held taught against the top of the flute but leaving the surface of the masonry (as that begins to curve inwards) about 14 feet down (the distance is marked as 17 feet 7 inches, evidently from the base) and continuing on to arrive at the base a full 2 inches outside the masonry. For the second experiment, illustrated on the right of the drawing, Cockerell began by holding his line away from the surface of the column by placing it against the underside of the lowest fillet below the echinus (he marks this distance as $1\frac{1}{4}$ inches away from the shaft of the column). This time the string or wire touched the masonry 11 feet up from the base and parted again to leave the smaller gap of $\frac{3}{4}$ inch from the masonry at the bottom.⁵

In this letter Cockerell went on to tell Smirke that he had also noted entasis at the Erechtheion and at the Temple of Jupiter Olympius – but that the columns of the Temple of "Theseus" (the Hephaesteion) were too ruinous to detect it. Moreover, he had also taken the opportunity to sail back to Aegina where he had ascertained the entasis at the Temple of Aphaia. He reported the same information to his father, the architect Samuel Pepys Cockerell, in a separate letter dated the same day as that to Smirke, 23 December 1814:

I have also with a great deal of difficulty, since there are no carpenters in this country, been able to ascertain what I mentioned to you in my last viz the entasis or swelling of the Greek columns – from a straight line stretched from the capital to the base the swelling at about a third of the height in the Temple of Minerva is an inch, in that of Egina $\frac{1}{2}$ an inch, thus it is the same proportion. From the ruined state of other monuments it is difficult to ascertain, but I have no doubt that it was a general rule with the Greek architects & it is a most curious fact which has hitherto escaped Stuart & our most accurate observers – indeed it is so delicate that unless one measures it the eye alone cannot perceive it.⁶

A number of questions are raised by Cockerell's drawing and the comments that accompanied it on its way back to London. In this essay it will be asked if he was indeed, along with Haller, the first person to observe the entasis of the Parthenon and, in fact, as is sometimes still suggested, of ancient Greek architecture in general.⁷ Then the question of whether it was really the case that entasis in Greek architecture was discoverable only by measurement and not by the eye will be discussed and, if this was so, why it was that it had been missed by those such as James Stuart and Nicholas Revett, who had claimed to have measured Greek monuments to the hundredth and even the thousandth of an inch.

On the matter of primacy, it should quickly be stated that entasis in Greek architecture had already been published in 1784 by Paolo Antonio Paoli, President of the Noble Ecclesiastical Academy in Rome and author of a series of six dissertations on various aspects of Paestum that were based on the researches and drawings made in the 1750s under the direction of Count Felice Gazzola.⁸ In the fifth dissertation Paoli noted the entasis of the pseudodipteral Temple of Hera I and illustrated a method for how it might be measured (fig. 4). In this temple the entasis is more pronounced than in any other surviving Greek example, as had been made abundantly and famously clear in the views given by Giambattista Piranesi in his *Différentes vues de Pesto*, published posthumously 1778 (fig. 5). Paoli, however, followed previous antiquaries' and architects' opinions by proclaiming that the Greeks had never used the technique and that it had been introduced by the Etruscans. Consequently he called the building at Paestum the "Etruscan Atrium."⁹ Shortly afterwards, the French *pensionnaire* Claude-Mathieu Delagardette, winner of the 1791 Prix de Rome, surveyed the three temples at Paestum, publishing his results in *Les ruines de Paestum ou Posidonia* in 1798–9 (fig. 6). Delagardette reverted to identifying the pseudodipteral temple by its more familiar late eighteenth- and early nineteenth-century name of the "Basilica" but he also could not accept the entasis

Fig. 5 Giambattista Piranesi, *Différentes vues de quelques Restes de trois grands Edifices qui subsistent encore dans le milieu de l'ancienne Ville de Pesto* (1778), Plate 6 (Courtesy of the Faculty of Architecture and History of Art, University of Cambridge)



as a Greek feature and ascribed it to later Roman recutting of the columns.¹⁰

Both Paoli's and Delagardette's works were known to the English scholar-architect William Wilkins whose *Antiquities of Magna Graecia*, published in 1807 after his return to Cambridge from the Mediterranean, included the earliest English-language account of curvature – as opposed to mere tapering (that is hypotrachelion contraction) – in Grecian columns. Of the Temple of Hera I at Paestum Wilkins wrote: “The shafts diminish from their base to the top ... in a curve, which diverges more rapidly from a vertical line as it recedes from the base” (fig. 7).¹¹ His drawing suggests that he studied this curve in terms of a series of diameters in the lower and upper thirds of the column (rather than establishing the entasis by vertical experiments as Cockerell would do at the Parthenon), and that he did not follow Paoli and Delagardette in also attempting to account for the swell at the mid-point. Moreover, Wilkins decided that the pseudodipteral Temple of Hera I postdated the Roman conquest of Paestum. Only the Temple of Hera II he took to be Greek, and of the columns of that building he denied the existence of curvature as a designed feature, saying: “at first sight they have the appearance of swelling in the middle. This deception is caused by decay of stone in the lower parts of the shafts.”¹²

The late eighteenth-century accounts have been largely overlooked by those writing on the history of the discovery of Greek entasis until relatively recently, no doubt in part because the rise in the status of the Parthenon made observation of entasis there a greater focus of attention. The notion that Cockerell discovered the

beauties and impart to me a great deal of interesting information in that art of which they were themselves such illustrious ornaments. Amongst the many observations made by Mr Cockerell upon the architecture of the Parthenon I remember one which seemed very delicate and curious: it related to the entasis or swelling of its beautiful and finely-proportioned columns. With a great deal of difficulty, he measured them, and found by a straight line stretched from the capital to the base that this swell at about one third of the height, equalled one inch. That in the temple of Jupiter at Aegina equalled half an inch, which was in proportion to the other; so that he had no doubt but that there was a general rule on this point with the ancient architects: this protuberance is so delicate that it must be ascertained by measurement: the eye alone cannot perceive it. The fact had escaped Stuart and our other most accurate observers.²³

Since it was in the autumn of 1813 that Hughes was in Athens, at first sight it appears that Haller and Cockerell were already informing interested visitors about the Parthenon's entasis on site by November of that year. An alternative reading of the passage, however, could be that Hughes' recollection of the specific discussion of entasis with Cockerell (in other words all the text from the phrase "Amongst the many observations" onwards) did not come from that occasion but rather from his memory of subsequent conversations. It is, indeed, more than likely that the discussion of this point took place very much later, once both men were back in England. Evidence for this can be found in the fact that Hughes' words at the end of the extract given here read almost verbatim as those of Cockerell in the letter, quoted above, written from Athens to his father on 23 December 1814 ("I have no doubt that it was a general rule with the Greek architects & it is a most curious fact which has hitherto escaped Stuart & our most accurate observers – indeed it is so delicate that unless one measures it the eye alone cannot perceive it"). Elsewhere in his *Travels*, Hughes quoted liberally from letters home to which Cockerell gave him access when the book was in preparation and this is surely another instance where the Cockerell letter was the source. That this conversation did not take place in Athens in November of 1813 seems to be confirmed definitively by the comparison Hughes mentioned of the Parthenon with the Temple of "Jupiter Panhellenius" on Aegina, to which Cockerell – so he informed his father, also in the December 1814 letter – had only *recently* returned to measure the entasis.²⁴

Publication of Hughes' *Travels* led to a stinging letter of rebuke by Allason in *The Quarterly Journal of Science, Literature, and the Arts* in 1821. Pointing out that Hughes had left Athens well before the discovery of entasis at the Parthenon was made towards

the end of 1814, Allason suggested that the expression “the eye alone cannot perceive it” (which, as we have seen, was in fact a direct quotation from Cockerell himself) was a conscious attempt to undermine his own claims to primacy.²⁵ “It was myself who first noticed this peculiarity,” wrote Allason, going on to say that he had told others including Haller, Cockerell and Louis Fauvel (French Consul in Athens) about it, the latter two of whom “constantly opposed my ideas on the subject.” According to Allason, it was agreed that Cockerell and Haller should test out the theory by making the measurements, forwarding the results to Allason. Although he said he had written to remind Cockerell of this agreement from Naples, it was over a year later that Allason received through Robert Smirke “an admeasurement of the columns of the Parthenon, confirming my opinions in every particular.” Since Figure 2 does indeed come from a letter addressed by Cockerell to Smirke, there is reason to think that Allason’s account contains more than a modicum of truth. There is no way of knowing, however, whether Cockerell had merely shown initial scepticism about Allason’s suggestion or had disagreed vehemently, as the latter suggested, nor whether the agreement to communicate was indeed a firm commitment, nor whether Allason’s letter from Naples was ever received by Cockerell. On the other hand, Figure 2 makes it certain that Cockerell succeeded in proving the existence of the entasis by measurement whereas Allason had failed to do so. It also seems to be the case that Cockerell never himself claimed primacy in the discovery.²⁶ Allason, by contrast, had by his own admission been sent a copy of Cockerell’s drawing by Smirke by early 1816, and had deliberately omitted to mention this when first publishing his claims in 1819 – at which time he had even slighted Cockerell by implication: “It may however be proper to state, that this circumstance has likewise escaped the observation of more recent travellers [than Stuart and Revett], who, from a long residence at Athens, may be presumed to have had greater facilities of ascertaining every minute circumstance relating to those splendid ruins.”²⁷

The circumstances surrounding the events of late 1814 are likely, then, to remain no more clear than this, and we should turn finally to the broader question of the extent to which entasis was visible or measurable in Greek architecture. In the later eighteenth- and early nineteenth-century period Allason appears to have been unique in his claim that entasis was “so very apparent . . . in all the remaining Antiquities of Greece.” It went unrecorded in the earliest detailed surveys made in Greece: by Stuart and Revett and by Julien-David Leroy in the early 1750s.²⁸ More surprisingly, perhaps, given the extent of the entasis at the Temple of Hera I at Paestum, it was not noticed by the Italian, French and British draftsmen whose surveys were drawn together in

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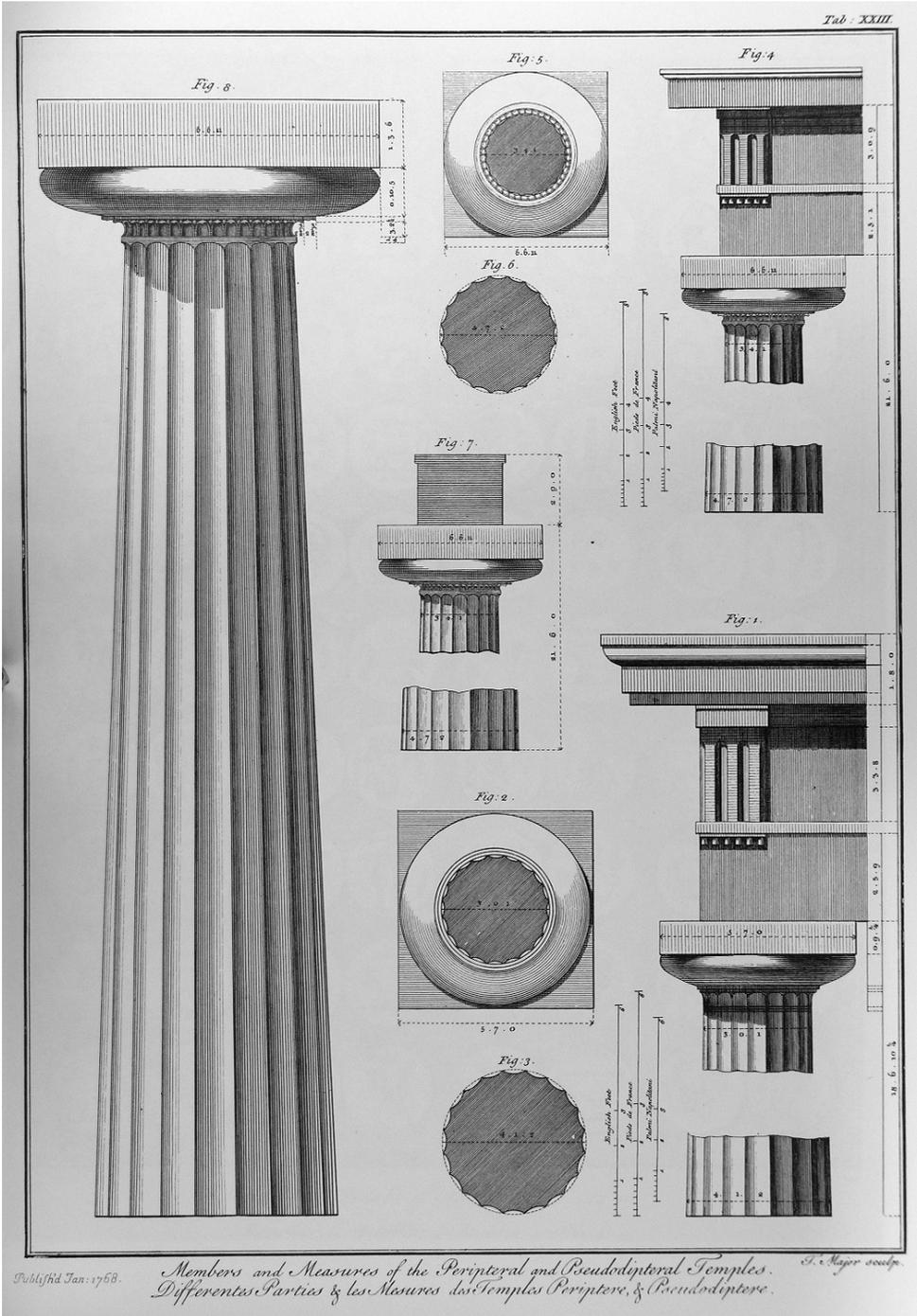


Fig. 8 Thomas Major, *Ruins of Paestum* (London: J. Dixwell, 1768), Plate 23 (Courtesy of the Faculty of Architecture and History of Art, University of Cambridge)

Thomas Major's *Ruins of Paestum* of 1768 (see Fig. 8 on fig. 8).²⁹ Paoli's rendition of a column from the same temple (fig. 4), doubtless based on an earlier drawing by one of Gazzola's architects, shows that the entasis here was not only perceptible but also measurable. However, as has been seen above, neither Paoli nor Delagardette were able to accept this temple in its eighteenth-century state as an original work by Greek architects, whilst Wilkins had explained it as the exception proving the rule that the Greeks had simply not practised a technique ascribed to them by Vitruvius.³⁰ To the eighteenth- and early nineteenth-century antiquary and architect the existence of entasis, both in Roman architectural practice and in that of the Renaissance – where techniques for setting it out were included in almost every treatise from Leon Battista Alberti's *De re aedificatoria* onwards – was beyond dispute. What was at issue was the question of how prevalent the practice was among the ancient Greeks.

In the mid-eighteenth-century revisionist philosophy on the subject of architecture the very principle of entasis was already under attack. In his *Essai sur l'Architecture*, for example, Marc-Antoine-Laugier noted: "Fault: to give a swelling to the shaft at about the third of its height instead of tapering the column in the normal way. I do not believe that nature has ever produced anything that can justify this swelling," and, as a general preamble to this particular observation, it may be noted that in his preface Laugier had said "Vitruvius has in effect taught us only what was practiced in his time."³¹ In the *Anmerkungen über die Baukunst der Alten* of 1762 Johann Joachim Winckelmann tied the aesthetics of a "belly giving no grace to the columns" to the statement that entasis cannot have been used in good Greek buildings.³² Natural and aesthetic ideas were brought together in the work of "Athenian" Stuart's British disciple, Stephen Riou, writing of the Doric order in his *Grecian Orders of Architecture* of 1768:

The diminution of the shafts of columns upwards, gives a gracefulness to their forms, which otherwise they would want. But the swelling in the middle can convey no other idea than that of the columns being oppressed by the incumbent weight. The remains of antiquity cannot furnish examples of the latter practice.³³

Thus entasis was effectively ruled out as a Greek architectural design feature at the very inception of the Greek Revival, a cultural position from which it would have eventually to be retrieved by process of scientific observation such as that practised by Cockerell in Athens in 1814.³⁴ It is clear that, if the extreme and contested example of the Temple of Hera I at Paestum is set aside, Greek entasis was far more subtle than many Roman and Renaissance examples of the practice, in some of which the

shaft swells even beyond the diameter of the base of the column making it in consequence far more visible.³⁵ At the Paestum temple the maximum extent of the entasis is 4.8 centimetres over a height of 5.5 metres, or a ratio of $1/100$. At the other extreme comes the entasis of the Ionic order inside the Athenian Propylaea, which has been measured at a maximum of 10 millimetres or even 6 millimetres over a height of about 9 metres, a ratio of $1/900$ or $1/1500$.³⁶ The entasis of the Parthenon's peristyle columns falls mid-way between these two poles, extending to a maximum of 1.6 to 1.7 centimetres over a shaft height of about 9.6 metres, or a ratio of $1/550$ to $1/600$.³⁷ When one considers that, at the time Cockerell visited the Acropolis, the temple was so tightly hemmed in by other buildings that the columns could not be viewed at full height from any distance (see fig. 1), it is no wonder that the entasis was imperceptible to the naked eye and Thomas Allason's suggestion that it was "so very apparent" has to be dismissed as a gross exaggeration.

If further evidence were required of this, it can be found in the accounts of those who succeeded Cockerell and refined the measurement of the Parthenon's entasis during the first half of the nineteenth century. Indeed, William Jenkins, writing in the 1830 supplement to *The Antiquities of Athens*, effectively exonerated Stuart and Revett for not having noted it even when themselves measuring the temple to a fine degree:

The entasis in any instance here given is produced from the bottom of the column, but none has the entasis perceptible to the eye, and scarcely to the rule, so slight is it; from which we cannot but infer, that it never was the intention of the Grecian architects to produce any other effect to the eye of the beholder than that of a straight line; nor are we aware that there is any example now remaining which is an exception, but the columns of the pseudodipteral temple at Paestum.³⁸

Following on from this came the measurements made at the Parthenon (now cleared of the encumbrances around its stylobate), the Erechtheion and the Hephaesteion by Francis Cranmer Penrose in the 1840s, of which he wrote:

the entasis has been so delicately applied that until a comparatively recent period the columns of these temples were supposed to be perfectly straight, and are so represented by Stuart. Indeed, unless an observer, by accident or intentionally, looks exactly along the line of the flutes from the top or bottom of the shaft, the curvature is scarcely appreciable, except by its indirect effects, even to the most practised eye.³⁹

Peering down the flute of one of the columns of the Parthenon whilst perched precariously upon the entablature was, of course, precisely what the young Robert

Cockerell had done in 1814, and one may only imagine his surprise and wonderment at seeing his taught string or wire line depart from the stone arris to reach the platform two inches away from the base of the column. There is no evidence that Cockerell's latter-day biographer, Professor Watkin, was quite so intrepid in investigating what he has called the "baffling optical refinements which cannot be appreciated by the unaided eye" of that great building,⁴⁰ but he is known to have assured himself of the curvature of the stylobate during his own Grand Tour by placing his hat at one end and ascertaining, no doubt from a position on his knees, that it could not readily be seen from the other!

NOTES

I am grateful to Mark Wilson Jones and to David Yeomans for their comments on a draft of this essay, and to Charles Hind of the RIBA Drawings Collection for his assistance with Figure 2.

1. David Watkin, *The Life and Work of C.R. Cockerell* (London: Zwemmer, 1974): 17, quoting the text of Cockerell's comments to Smirke on entasis. See also David Watkin, "Archaeology and the Greek Revival: A Case-Study of C.R. Cockerell," *Late Georgian Classicism: Papers Given at the Georgian Group Symposium 1987* (Roger White and Caroline Lightburn, eds.), 1988: 64–66.
2. The sheet measures 49.7 x 12.8 cm at the bottom but is 13 cm wide at the top. There is, however, also a slight variation in the height of the shaft of the column as drawn by Cockerell, which measures 15 inches and 6 tenths at the left extremity and up the centre, but 15 inches 6.5 tenths at the right edge. If Cockerell had meant by this to have also identified the inward inclination of the Parthenon's columns, he would surely have said so. It was his English successor in Athens, Thomas Leverton Donaldson, who first noticed that optical refinement five years or so later.
3. Royal Institute of British Architects [RIBA], Mss. CoC: Add./1/28, recto.
4. On this (schematic) drawing, the red lines are not, in fact, perfectly straight – as they should be (given that they assume no entasis) – whereas the left solid black line, which should be curved, is more or less or less straight. The right solid black line, however, does display the curve.
5. Francis Cranmer Penrose described the similar method he had used to measure the entasis of the northern of the two central columns on the east front of the Parthenon – and at other Athenian temples: two separate measurements were made by means of a fine harp wire weighted to the maximum. Whereas Cockerell probably had only a rule, Penrose had one with a slide joint and also a Vernier scale, thus gaining him considerably more accuracy (Francis Cranmer Penrose, *An Investigation of the Principles of Athenian Architecture* (1851): 40). It is not clear which column Cockerell measured, since he does not give the overall height (nor show the number of fillets below the echinus), but it was presumably one on the west front. Penrose gave the height of these as 31.43 feet.
6. RIBA, CoC Add./1/26. The description here of the Parthenon's entasis being at the maximum of an inch "at about a third of the height" corresponds with the touching point of Cockerell's line at 11 feet up from the base in the second of the two experiments he conducted.
7. See Howard Colvin, *A Biographical Dictionary of British Architects 1600–1840*, 4th edn. (New Haven and London: Yale University Press, 2008): 260.
8. See Suzanne Lang, "The Early Publications of the Temples at Paestum," *Journal of the Warburg and Courtauld Institutes*, 13 (1950): 48–64, giving Mario Gioffredi or Berardo Galiani as candidates for having made the meas-

- urements shown in fig. 4, and Dieter Mertens, "The Paestum Temples and the Evolution of the Historiography of Architecture," in Joselita Raspi Serra (ed.), *Paestum and the Doric Revival 1750–1830: Essential Outlines of an Approach* (Florence: Centro Di, 1986): 65.
9. Paolo Antonio Paoli, *Rovine della Città di Pesto detta ancora Posidonia* (Rome: Paleariniano, 1784): 141: "Asseriscono tutti i professori così d'antichità come d'architettura, non essersi trovato mai nelle greche costruzioni un tal metodo, onde lo stabiliscono proprio de' Toscani, e da essi soltanto adoprato."
 10. Claude-Mathieu Delagardette, *Les ruines de Paestum ou Posidonia . . . levées, mesurées, et dessinées sur les lieux, en l'an II* (Paris: Barbon, 1798–99): 70–1: "Nous pensons que ces colonnes ayant paru trop grosses ou trop courtes, les Romains les auront diminuées de diamètre, en leur donnant un certain mouvement dans le galbe et c'est peut-être cette restauration qui aura fait perdre aux cannelures le caractère distinctif des ouvrages Grecs." It should be noted that Delagardette's surname is sometimes given as De Lagardette.
 11. William Wilkins, *The Antiquities of Magna Graecia* (Cambridge: University Press, 1807): 64.
 12. Wilkins, *Antiquities* (1807): 59. Of the hexastyle Temple of Athena (previously known as that of Ceres), which Wilkins took to be Roman as well, he also denied the existence of entasis, writing: "the shafts diminish in a straight line" (65).
 13. Penrose, *Investigation*, 2nd edn. (1888): 23 and 24 note 1. That Penrose did not make this claim in the 1851 first edition on his *Investigation* suggests that knowledge of Cockerell's involvement in the recognition of Greek entasis was not common in the first half of the nineteenth century although, as will be seen later in this essay, the question of primacy in the discovery was fiercely contested in 1821.
 14. William Henry Goodyear, *Greek Refinements: Studies in Temperamental Architecture* (London: Yale University Press, 1912): 22–23. See Adolf Michaelis, *A Century of Archaeological Discoveries*, trans. Bettina Kahnweiler (London: John Murray, 1908): 33.
 15. William J. Anderson and Richard Phené Spiers, revised and rewritten by William Bell Dinsmoor, *The Architecture of Ancient Greece: An Account of its Historic Development being the First Part of The Architecture of Greece and Rome* (London: Batsford, 1927): 119, crediting Cockerell in 1810. The date was changed to 1814 and Allason added from the 1950 3rd edition (revised).
 16. Rhodri Windsor Liscombe, *William Wilkins 1778–1839* (Cambridge: University Press, 1980): 69–70; L. Haselberger, "Old Issues, New Research, Latest Discoveries: Curvature and other Classical Refinements," in L. Haselberger, ed., *Appearance and Essence: Refinements of Classical Architecture – Curvature (Proceedings of the Second Williams Symposium on Classical Architecture held at the University of Pennsylvania, Philadelphia, April 2–4 1993)*, Philadelphia: University of Pennsylvania Press, 1999: 24–25, 27.
 17. William Wilkins, *Atheniensia or Remarks on the Topography and Buildings of Athens* (London: W. Bulmer & Co., 1816): 127.
 18. William Wilkins, *The Civil Architecture of Vitruvius* (London: Longman, Hunt, Rees, Orme, and Browne, 1812): 39 and plate 5 of Section 1, figure 1 (not figure 2, as Wilkins has it). On the same page Wilkins advanced the tentative and – to him more palatable – theory that "if the fillet between the flutings of Ionic columns be the measure of the entasis of Vitruvius, the deviation from a straight line will be scarcely perceptible in the outline of a column." Wilkins' *Vitruvius* was published in two parts in 1813 and 1817 (see Liscombe, *Wilkins* (1980): 255–6, n. 1) and, as it is not clear which parts appeared when, the exact juxtaposition of these passages with publication of *Atheniensia* cannot be ascertained.
 19. RIBA, CoC: Add./1/26.
 20. RIBA, CoC: Add./1/25.
 21. It is worth observing that, in the advertisement to *Atheniensia* (1816): vii, Wilkins commented of the Acropolis: "the architectural details which are wanting in Stuart . . . particulars so desirable to the amateurs and professionals of architecture, are, however, likely to be amply supplied through the exertions of Mr. Robert Cockerell, a gentleman every way qualified for the undertaking."
 22. Thomas Allason, *Picturesque Views of the Antiquities of Pola in Istria* (London: John Murray, 1819): 3.
 23. Thomas Smart Hughes, *Travels in Sicily, Greece and Albania* (London: J. Mawman), 2 vols, 1: 287.

24. It is worth noting that Hughes was not consistent with dating within his narrative. For example, on 9 November 1813 he records himself as being both in Athens (*Travels*: 266) and on an expedition to Piraeus (*Travels*: 287).
25. Thomas Allason, "On the Columns of the Athenian Temple," *The Quarterly Journal of Science, Literature, and the Arts*, 10 (1821): 204–6.
26. See Watkin, *Cockerell* (1974): 124, reporting how, in his Royal Academy lectures, Cockerell cited Penrose as the authority on entasis and noting that "he never seems to have followed up his early investigations and analysis of entasis does not form a prominent part of any of his lectures." See also C.R. Cockerell, *The Temples of Jupiter Panhellenius at Aegina, and of Apollo Epicurius at Bassae* (London: 1860): 23–24, where Cockerell merely says that entasis is found in all Doric temples except for that at Bassae, that at the Port on Aegina and at that of Corinth, making no claim for his own earlier role in establishing this understanding.
27. Allason, *Picturesque Views* (1819): 3.
28. See, however, Jacob Landy, "Stuart and Revett: Pioneer Archaeologists," *Archaeology*, 9 (1956): 258: "A brief reference to entasis seems to be made in the second volume of the *Antiquities of Athens*, where it is mentioned that the columns of the Theseum diminish from the bottom by 'a beautiful curved line.'" In this context it is worth noting that Stuart recognised that traces of colour on the Ionic Temple on the Ilissus in Athens were original to the building, yet chose not to pursue the question of polychromy in Greek architecture any further (see David Watkin, "Stuart and Revett: The Myth of Greece and its Afterlife," in Susan Weber Soros, ed., *James "Athenian" Stuart 1713–1788: The Rediscovery of Antiquity* (New Haven and London: Yale University Press, 2006): 39).
29. The drawing on which the engraving of Figure 8 on fig. 8 is based was originally made by Jacques-Germain Soufflot and further refined by Robert Mylne after his visit to Paestum in 1756 (see Michael McCarthy, "New Light on Thomas Major's 'Paestum' and later English Drawings of Paestum," in Serra, ed., *Paestum and the Doric Revival* (1986): 47).
30. See Ingrid Rowland (trans.), *Vitruvius: Ten Books on Architecture* (Cambridge: University Press, 1999): 50 (*De architectura libri decem*, Book III Chapter 3 Section 13: "At the end of the present book I shall record the illustration and method for the addition made to the middles of columns, which is called *entasis* (bowing) by the Greeks, and how to execute this refinement in a subtle and pleasing way.")
31. Marc-Antoine Laugier, *Essai sur l'Architecture* (trans. and ed. Wolfgang Herrmann), (Los Angeles: Hennessey and Ingalls, 1977): 18 and 2.
32. See Haselberger, "Old Issues, New Research" (1999): 25.
33. Stephen Riou, *The Grecian Orders of Architecture* (London: J. Dixwell, 1768): 22. Riou continues: "To begin the diminution from the bottom of the shaft, is the most natural and most approved, especially for the Doric." It is ironic, therefore, that figure A on Plate 1 of Part I of Riou's treatise does show a slight curve a third of the way up on the left side (only) of the Doric shaft.
34. A remarkable exception to this, however, is to be found inside Joseph Bonomi's church at Great Packington, Warwickshire, of 1789–92, where the four corner Doric columns appear to be modelled on those of the Temple of Hera II (Neptune) at Paestum (see Marcus Binney, "A Pioneer Work of Neo-Classicism," *Country Life* 150 (8 July 1971): 110). Binney notes, however, that Thomas Major's rendition of the order of that temple "failed to convey the entasis, or swelling, that gives the columns their distinctive character. At Packington this swelling is very predominant and one is forced to conclude that the designer knew enough to correct the mistaken impression given by Major." Indeed, Bonomi had returned from England to his native Italy in 1783 and in 1784 visited Paestum with the owner of Packington, the Earl of Aylesford, who is known to have been interested in and to have sketched Greek columns. His knowledge of entasis could, therefore, derive from personal observation or conversation, or from Paoli's book (see Peter Meadows, *Joseph Bonomi, Architect, 1739–1808* (London: RIBA, 1988): 7, and David Watkin, "Bonomi at Packington", *The Georgian Group Report & Journal* (1989): 105).

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35. See Penrose, *Investigation* (1888): 39, n. 3: "The entasis of the Parthenon, Theseum and Erechtheum is so much more delicate than it is in the Roman and Revived Classical examples, with which only the earliest travellers in Greece were acquainted, that they seem to have overlooked it altogether."
36. Haselberger, "Old Issues, New Research" (1999): 28. The 6-millimetre claim is an unsubstantiated one by Dinsmoor, whereas the 10-millimetre figure has been firmly established by Manolis Korres.
37. 1.6 to 1.7 centimetres is, of course, somewhat less than the 1 inch measured by Cockerell, equating to about $\frac{19}{100}$ of an inch.
38. William Jenkins, "Further Elucidations of Stuart and Revett's Antiquities of Athens," *The Antiquities of Athens* (London: Priestley and Weale, 1830): 5.
39. Penrose, *Investigation* (1888): 39.
40. David Watkin, "Sacred Cows: The Parthenon," *Perspectives on Architecture*, 23 (June–July 1996): 96.