A Roman Engineer's Tales*

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ABSTRACT

This article is an exercise in the historiography of ancient technical artefacts, beginning from the examination of a second-century A.D. *cippus inscribed with the story of a Roman engineer, Nonius Datus, who designed and supervised the construction of an aqueduct in Algeria. The first section looks at the aqueduct from the point of view of the history of engineering. The second traces the history of the inscription as a document in the debate about imperialism and technology. In the third section, the focus is on what Datus himself was trying to communicate. The conclusion makes a case for considering ancient technical artefacts from multiple perspectives.*

Our story begins in a northern Algerian town called Tazoult. When Algeria was still a colony of the French, Tazoult was Lambèse, and when today's France was still a territory of the Roman Empire, it was Lambaesis. By A.D. 81, the town boasted a legionary camp,[1] and later Trajan made it the permanent base of the Third Legion Augusta.[2] It became a *colonia* between A.D. 197 and 252.

Lambaesis has been labelled 'the military capital of the whole of Roman Africa'. Seen from the air, it looks the part. The town is laid out along a 'military-style' grid of perpendicular lines centred on the intersection of two main avenues.[3] Urban amenities included an amphitheatre, sanctuaries of Asklepios and Mithras,[4] and a water distribution system fed by one or two aqueducts built by the army.[5]

* I would like to thank the Editor of *JRS* and three anonymous readers, as well as Jen Baird, Christy Constantakopoulou, Catharine Edwards, John Henderson, Daryn Lehoux, Geoffrey Lloyd, Simon Schaffer, and seminar audiences at Cambridge, Frankfurt, London, and Manchester.

[1] See L. Leschi, 'Inscriptions latines de Lambèse et de Zana', *Libyca* 1 (1953), 189–205 = *AE* 1954, 137.

[2] M. Benabou, *La Résistance africaine à la romanisation* (1976), 208–11, 214–17; Y. Le Bohec, *La Troisième Légion Auguste* (1989).

[3] Benabou, op. cit. (n. 2), 109, 422–3, 557, 563 (quotation). Cf. J. Gascou, *La Politique municipale de l'empire romain en Afrique proconsulaire de Trajan à Septime Sévère* (1972), especially 152–6, 194–5; F. Rakob and S. Storz, 'Die Principia des römischen Legionslagers in Lambaesis', *Mitteilungen des deutschen archäologischen Instituts. Römische Abteilung* 81 (1974), 253–80; M. Janon, 'Lambaesis: ein Überblick', *Antike Welt* 8.2 (1977), 3–20; N. Benseddik, '*Lambaesis* (Lambèse). Un camp, un sanctuaire. Mais où était la ville?', in M. Khanoussi (ed.), *L'Afrique du Nord antique et médiévale* (2003), 165–79. Photo in A. Laronde, *L'Afrique antique. Histoire et monuments* (2001), 140–1.

[4] B. D. Shaw, 'Soldiers and society: the army in Numidia', in idem, *Rulers, Nomads, and Christians in Roman North Africa* (1995, 1st edn 1983), 149: Mithraeum unique in North Africa, but cf. J. Heurgon, 'L'œuvre archéologique française en Algérie', *Bulletin de l'Association Guillaume Budé* 15 (1956), 17.

[5] *CIL* VIII.2572, 2657–2663 (2661 has a tunnel, *perforato monte*). Cf. M. Janon, 'Recherches à Lambèse', *Antiquités africaines* 7 (1973), 193–254; P. Aupert, *Le Nymphée de Tipasa et les nymphées et 'septizonia' nord-africains* (1974), especially 97–101; P. MacKendrick, *The North African Stones Speak* (1980), 224–6; Benseddik, op. cit. (n. 3).

JRS 101 (2011), pp. 143–165. © *The Author(s) 2011.*
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doi:10.1017/S0075435811000098

https://doi.org/10.1017/S0075435811000098 Published online by Cambridge University Press

Lambaesis was rediscovered in the mid-nineteenth century by the French army, who had a camp in nearby Batna. According to reports, the French officers felt an immediate sense of affiliation with the place, and renamed the eastern gate to their encampment 'Lambaesis gate'.[6] In October 1866, a servant of the local landowner Monsieur Médan discovered that a small stone column, which may have been re-used as part of a wall around 400 m east of the so-called Lambaesis Praetorium, was covered in writing.[7] By 1868, the column (more accurately, a cippus) had been excavated. According to Wilmanns, who transcribed the text for the *Corpus Inscriptionum Latinarum*, the cippus had originally been hexagonal,[8] but only three sides were now extant. Each side was headed by the relief of a now faceless woman, labelled with the name of a virtue inside a *tabula ansata*.[9]

Starting from the left, the text says:

> PATIENTIA … [Varius Clemens Valerio] Etrusco: 'et Salditani civitas splendidissima et ego cum Salditanis rogamus te, domine, uti Nonium Datum, veteranum leg(ionis) III Aug(ustae), libratorem, horteris veniat[10] Saldas, ut quod relicum est ex opere eius perficiat.' Profectus sum et inter vias latrones sum passus; nudus saucius evasi cum meis; Saldas veni; Clementem procuratorem conveni. Ad montem me perduxit, ube cuniculum dubii operis flebant, quasi reliquendus habebatur, ideo quot perforatio operis cuniculi longior erat effect(a) quam montis spatium. Apparuit fossuras a rigorem errasse, adeo ut superior fossura dex/ [over to the second side] VIRTUS /tram petit ad meridiem versus, inferior similiter dextram suam petit ad septentrionem: duae ergo partes relicto rigore errabant. Rigor autem depalatus erat supra montem ab orientem in occidentem. Ne quis tamen legenti error fiat de fossuris, quot est scriptum 'superior' et 'inferior', sic intellegamus: superior est pars, qua cuniculus aquam recipit, inferior, qua emittit. Cum opus adsignar(em), ut scirent, quis quem modum suum perforationis haber(et), certamen operis inter classicos milites et gaesates[11] dedi et sic ad compertusi/ [over to the third side] SPES /onem montis convenerun(t). Ergo ego, qui primus libram feceram, ductum atsignaveram, fieri institueram secundum formam,

[6] M. Dondin-Payre, 'L'*exercitus Africae* inspiratrice de l'armée française d'Afrique: ense et *aratro*', *Antiquités africaines* 27 (1991), 141–9, and 'L'armée d'Afrique face à l'Algérie romaine: enjeux idéologiques et contraintes pratiques d'une œuvre scientifique au XIX^{e} siècle', in M. Khanoussi, P. Ruggeri and C. Vismara (eds), *L'Africa romana 13* (2000), 739.

[7] M. Cherbonneau, 'Observations sur l'inscription administrative de Lambèse', *Recueil des notices et mémoires de la société archéologique du Département de Constantine* 12 (1868), 479–85; R. Cagnat, *Musées de l'Algérie et de la Tunisie: Lambèse* (1895), 67–71.

[8] A hexagonal socket was also found. Th. Mommsen, 'Tunnelbau in Saldae (Bougie) unter Antoninus Pius', *Archäologische Zeitung* 28 (1871), 5: socket may have been triangular. The finds from Lambaesis include hexagonal bases: R. Lugand, 'Inventaire des objets conservés au Musée de Lambèse', *Recueil des notices et mémoires de la société archéologique du Département de Constantine* 58 (1927), 119–98; and hexagonal cippi: e.g. *CIL* VIII.2783, 2786, 2914, 4008 (photos in J.-M. Lassère, 'Recherches sur la chronologie des épitaphes paiennes de l'Africa', *Antiquités africaines* 7 (1973), fig. 34), mostly funerary monuments of soldiers from the Third Legion Augusta. Cf. also Le Bohec, op. cit. (n. 2), 87, 89.

[9] I use the text in *CIL* VIII.2728 (ed. G. Wilmanns (1881), 323) = *ILS* 5795, with the corrections of *CIL* VIII.18122 (supplement part II, eds R. Cagnat and J. Schmidt, with the commentaries of J. Schmidt and H. Dessau (1894)). Translations are mine unless otherwise indicated. The stele is 1.75 m high, each of the sides 0.45 m long. *CIL* VIII.18122 reports that, 'The images of *Patientia* and *Spes* are decently attired, but *Virtus* has the right breast naked, in the guise of an Amazon, and a band on her arm'. On the history of *CIL* VIII, J. Irmscher, 'Genesi del *CIL* VIII: *Inscriptiones Africae Latinae*', in A. Mastino (ed.), *L'Africa romana* 4 (1987), 323–9.

[10] J.-P. Laporte, 'Notes sur l'aqueduc de *Saldae* (Bougie)', in M. Khanoussi, P. Ruggeri and C. Vismara (eds), *L'Africa romana 11* (1996), 747: the phrasing indicates that, Nonius being a veteran, the legionary legate had no power to *order* him to go to Saldae.

[11] Wilmanns (*CIL*, cit., 323 n. 6), following Mommsen, op. cit. (n. 8), 7–8, took this to mean 'mercenaries', as in Polybius 2.22. K. Grewe, *Licht am Ende des Tunnels: Planung und Trassierung im antiken Tunnelbau* (1998), 136 translates 'Soldaten aus gallischen Hilfstruppen', 138; Laporte, op. cit. (n. 10), 750–1 and notes: name derives from their characteristic weapon, the *gaesum* (cudgel).

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qu(a)m Petronio Celeri pro(curatori) dederam, opus effectum aqua missa dedicavit Varius Clemens proc(urator).
Modios V.[12]
Ut lucidius labor meus circa duc(tum) hoc Saldense pareret, aliquas epistulas subieci.
Porci Vetustini ad Crispinum: 'Benignissime, domine, fecisti et pro cetera humanitate ac benivolentia tua, quod misisti ad me Nonium Datum evocatum, uti tractare[m] cum eo de operibus, quae curanda suscepit. Et ideo, quamquam tempore urguerer et Caesarea festinarem, tamen Saldas excucurri et aquae ductum bene inchoatum, sed magni operis inspexi et quod absolvi sine curam Noni Dati non potest, qui it simul diligenter et fideliter tractavit. Et ideo rogaturus eram, concedere nobis, uti mensibus aliquis rei agendae immoraretur, nisi incidisset (in) infirmitatem contractam …'

ENDURANCE. COURAGE. HOPE. Varius Clemens to Valerius Etruscus: 'Both the people of Saldae, a most splendid town, and I, together with the people of Saldae, beg you, o lord, to urge Nonius Datus, veteran of the third legion Augusta, surveyor, to come to Saldae, in order to complete what remains [to be completed] of his work.' I left and on the way I suffered [the attack of] brigands; I escaped naked and wounded with my [men]; I came to Saldae; I met Clemens the procurator. He took me to the mountain, where they were crying over a tunnel, uncertain about the work, and thinking almost of abandoning it, because the tunnel excavation work had turned out to be longer than the width of the mountain. It became clear that the segments that had been dug departed from a straight line, to the point where the upper segment inclined to the right and was turned towards the south, [while] the lower one similarly inclined to its right towards the north: therefore both parts, having abandoned the straight line, were going astray. Now the straight line was marked off with stakes over the mountain from east to west. In order for the reader to make no mistake about the entry points, designated 'upper' and 'lower', let us understand it this way: upper is the part where the tunnel receives water, lower, where it discharges it. Having allocated the work so that they knew, everyone, what their portion of the excavation was, I set up a competition about the work between the navy men and the mercenaries and in this way they met in [the middle of] tunnelling through the mountain. Therefore I, who had first made the survey, had decided on the route of the aqueduct, had arranged for it to be done according to the plan which I had given the procurator Petronius Celer, completed the work. Having released the water, the procurator Varius Clemens dedicated the [aqueduct].
5 *modii*.
So that my labour about this aqueduct at Saldae is seen more clearly, I have placed some letters below. [Letter] of Porcius Vetustinus to Crispinus: 'O most good-natured lord, in conformity with your humanity and benevolence, you sent me the reservist Nonius Datus, so I could deal with him about the works, which he undertook to take care of. And for this reason, although I was rushed for time and hurrying to Caesarea, nevertheless I made a detour to Saldae and inspected the aqueduct, [which was] definitely unfinished, but [a thing] of great achievement, and that cannot be completed without the supervision of Nonius Datus, who dealt with it both diligently and loyally. And for this reason I was going to ask that you grant us that he stays to do this thing a few months, if he does not fall ill …'

The events described in the inscription have been reconstructed by, among others, Brent Shaw and Jean-Pierre Laporte:[13] in the late 130s the commander of the Third Legion

[12] The number of *modii* is centred, almost by way of conclusion, and the lettering below this line is more crowded than above. It is possible that the remaining part of the text was added later.
[13] B. D. Shaw, 'The noblest monuments and the smallest things: wells, walls and aqueducts in the making of Roman Africa', in *Environment and Society in Roman North Africa: Studies in History and Archaeology* (1995, 1st edn 1991), 69–70; Laporte, op. cit. (n. 10), 739–52; on the people involved see Le Bohec, op. cit.

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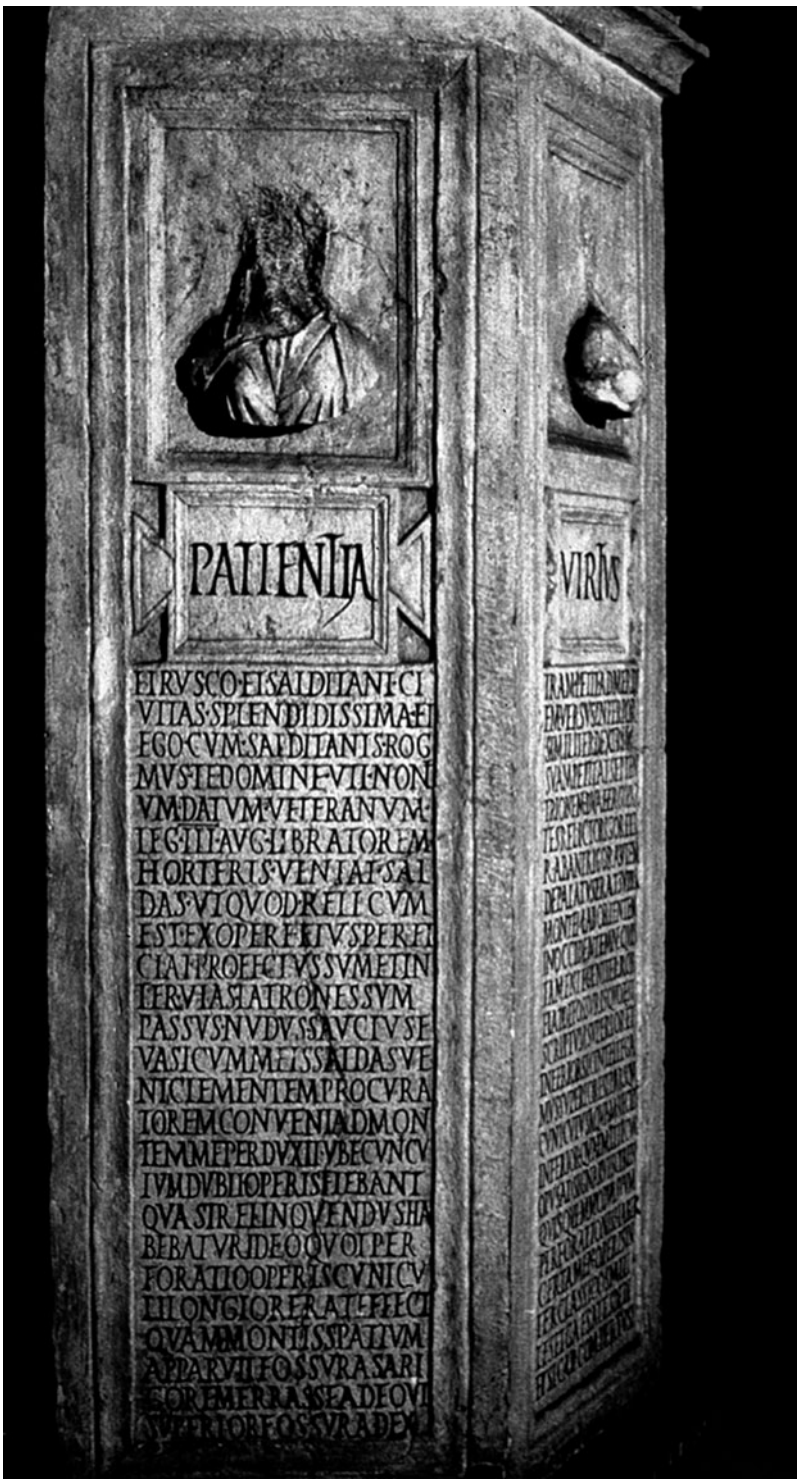


FIG. 1. Photo of cippus of Nonius Datus. (*By kind permission of Professor Klaus Grewe*)

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Augusta seconded Nonius Datus, a legionary with engineering expertise, to Petronius Celer,[14] *procurator Augusti* in Mauretania Caesarensis (the neighbouring province), in order to help build an aqueduct in the town of Saldae. In A.D. 137 Nonius Datus, having surveyed the surrounding territory, gave Celer a *forma*, or plan, outlining the route of the aqueduct. Between A.D. 146 and 150, Q. Porcius Vetustinus,[15] who had succeeded Celer, appealed to the then military commander, L. Novius Crispinus,[16] to send Nonius back to Saldae, evidently because of problems with the construction. Again in the early 150s, the then *procurator Augusti* T. Varius Clemens asked M. Valerius Etruscus,[17] the legionary commander, to send Nonius to Saldae again, to complete the tunnel. The aqueduct was finally inaugurated in A.D. 152, 153, or shortly afterwards.

Saldae is today's Bejaïa (Bougie under the French), situated on the Mediterranean coast, and serving as a port for the agricultural production of the hinterland. Unlike Lambaesis, the site had been occupied since at least Punic times, but between 27 and 25 B.C. it was established by Augustus as a *colonia* for the Seventh Legion Immunis.[18] Thus, Saldae was not provided with an aqueduct until more than a hundred years after its Roman (re)foundation.[19]

The Lambaesis inscription has attracted attention for a long time, and although its general contents are clear, a number of questions remain open. For instance, given that the *modius* was a unit of measurement for *dry* volumes, to what does '5 *modii*' refer?[20] Again, if three sides are now destroyed, what are we missing? What completed the sextet of virtues? How did Nonius Datus' story really end? In this article, I will not so much attempt to resolve open questions, as review the various stories that have been told of the inscription. I will start with engineering tales — how the inscription has been used to write the history of Roman water supply systems. My second story will look at the cippus from a different angle — specifically, how through the centuries, aqueducts and infrastructures in general have been viewed and used as tools of empire. Finally, I will tease out one last account: Nonius Datus' own.

I THE ENGINEERING TALE

It is in its capacity as a source of information about Roman aqueducts in general, and ancient tunnels in particular, that Nonius Datus' inscription is most frequently

(n. 2), 381–3; B. E. Thomasson, *Fasti africani. Senatorische und ritterliche Amtsträger in den römischen Provinzen Nordafrikas von Augustus bis Diokletian* (1996).

[14] Petronius Celer was *procurator Augusti* in A.D. 137: *AE* 1976, 738, from Cherchell (Caesarea); Laporte, op. cit. (n. 10), 739.

[15] *CIL* II.4240, no date, from Tarragona: Porcius Vetustinus perhaps a *flamen*.

[16] Crispinus in *CIL* VIII.2542 (A.D. 147); 2652 (A.D. 148); 2693 (between A.D. 147 and 149); 18214; 18234; Wilmanns in *CIL*, cit., 323 n. 10.

[17] *CIL* III.5211–5216, all from Celeia in Noricum: T. Varius Clemens was *procurator Augusti* for Mauretania Caesarensis. The editor infers a date of A.D. 152. Laporte, op. cit. (n. 10), 746, suggests A.D. 153. *CIL* VIII.2543, dated to A.D. 152, refers to Etruscus, as do the virtually identical *ILAlg* I.3875 and 3876, which mention repairs to a road, rebuilding bridges and draining marshes. See also M. Le Glay and S. Tourrenc, 'Nouvelles inscriptions de Timgad sur des légats de la troisième légion Auguste', *Antiquités africaines* 21 (1985), 116–18; H. Jouffroy, *La Construction publique en Italie* (1986), 204, 234; M. Christol and A. Magioncalda, *Studi sui procuratori delle due Mauretanie* (1989).

[18] *CIL* VIII.8931, 8933, 20683. Cf. S. Gsell, *Atlas archéologique de l'Algérie* (1902/11) *s.v.* Bougie; J.-M. Lassère, *Ubique populus. Peuplement et mouvements de population dans l'Afrique romaine de la chute de Carthage à la fin de la dynastie des Sévères (146 a.C.–235 p.C.)* (1977), 381.

[19] Benabou, op. cit. (n. 2), 55–6, 142, 404, 407; MacKendrick, op. cit. (n. 5), 179.

[20] Wilmanns (*CIL*, cit., 323 n. 7): earth excavated for the tunnel. Laporte, op. cit. (n. 10), 752: an offering of grain to the divinities.

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cited.[21] Although probably not the most impressive from a purely technical point of view,[22] the tunnel of Saldae is the only case from antiquity where we have direct, detailed information from the person in charge of the works. Today's foremost ancient tunnel expert, Klaus Grewe, sees the inscription as the authentic voice of an ancient engineer,[23] speaking to us from the remote past.

The main question engineering tales are poised to answer is, how was the technical artefact made? In particular, how was the Saldae tunnel produced? The inscription does not provide a full answer to that. We know that there was a plan, but not what kind of plan — whether more or less geometrized, more or less plentiful in details of the actual construction. Datus does not specify whether the tunnel was cut into the rock, or dug out and built with bricks.[24] He does tell us that he rectified the mistake through *depalatio*, but in order to understand what that means, we have to look outside the inscription, at the collection of texts known as *Corpus Agrimensorum Romanorum*. Some of them illustrate a procedure referred to as *cultellare*, which was employed to solve the same problem, i.e. how to determine lengths on uneven ground, such as a path that goes over a mountain.[25]

Despite the difference in terminology, the similarities in what is likely to have been the procedure hint at a connection between the *Corpus* and Datus' practice. Moreover, he characterizes the mistake made in digging the tunnel as *a rigore errare*, which echoes land-surveying terminology.[26] None of our extant Latin treatises, however, deals with the excavation of tunnels. The one extant solution to the problem is in Hero of Alexandria's *Dioptra*, written in the first century A.D.: 'one wishes to dig through a mountain in a straight line, the mouths of the tunnel being given in the mountain.'[27] Hero instructs the reader to surround the irregular contour of the mountain with a circuit of straight lines, intersecting at right angles. All this is made possible by the *dioptra*, which allows the user to align points and create perpendiculars at will.

Once the surveyor has walked around the mountain from point B, and reached the position at KΛ, Hero instructs him to look for the other 'mouth' of the tunnel, i.e. point Δ. 'And I set the dioptra upon the line KΛ making sure that the ruler is always fixed on some point on the [line] KΛ, until the point Δ appears in a perpendicular position to the

[21] e.g. L. Sprague de Camp, *The Ancient Engineers* (1963), 195–6; J.-P. Adam, 'Groma et chorobate', *Mélanges de l'Ecole Française de Rome* 94 (1982), 1003–29; Grewe, op. cit. (n. 11), 135–9 and 'Tunnels and canals', in J. P. Oleson (ed.), *The Oxford Handbook of Engineering and Technology in the Classical World* (2008), 329–33; J. G. Landels, *Engineering in the Ancient World* (2000²), 52–3; M. J. T. Lewis, *Surveying Instruments of Greece and Rome* (2001), ch. 10; R. Nini, 'L'acquedotto Formina di Narni. Il traforo di Monte Ippolito: sistemi di scavo antichi e moderne ricostruzioni', *In binos actus lumina. Rivista di studi e ricerche sull'idraulica storica* 1 (2002), 79–90.

[22] The honour probably goes to the sixth-century B.C. tunnel at Samos: e.g. H. J. Kienast, *Die Wasserleitung des Eupalinos auf Samos* (1995); Grewe, op. cit. (n. 11).

[23] Grewe, op. cit. (n. 11), 7, 136.

[24] P. Zanovello, 'Caratteristiche tecniche degli acquedotti romani nelle fonti epigrafiche', in M. Khanoussi, P. Ruggeri and C. Vismara (eds), *L'Africa romana 11* (1996), 674–5. Anonymous, 'Aqueduc de Bougie', *Revue Africaine* 19 (1875), 336 mentions masonry within the tunnel.

[25] Procedure explained in Frontinus, *De arte mensoria* 14.5–11, in B. Campbell (ed.), *The Writings of the Roman Land Surveyors. Introduction, Text, Translation and Commentary* (2000); similarly Hero, *Dioptra* 6. A mention of *depalatio* in a Flavian boundary inscription from Rome: *CIL* VI.1268; *depalatum* in an inscription from Capena, in Latium: *CIL* XI.3932. More references in Lewis, op. cit. (n. 21).

[26] Occurrences of *rigor* in the *Corpus Agrimensorum* too numerous to mention, but see Campbell's useful index, op. cit. (n. 25).

[27] Hero, *Dioptra* 15: ὄρος διορύξαι ἐπ᾽ εὐθείας τῶν στομάτων τοῦ ὀρύματος ἐν τῷ ὄρει δοθέντων. On Hero, see K. Tybjerg, 'Wonder-making and philosophical wonder in Hero of Alexandria', *Studies in History and Philosophy of Science* 34 (2003), 443–66; G. Argoud and J.-Y. Guillaumin (eds), *Autour de la dioptre d'Héron d'Alexandrie* (2000); the *Dioptra* in partial English translation in Lewis, op. cit. (n. 21), 259–86; on the tunnel problem see A. Burns, 'The tunnel of Eupalinus and the tunnel problem of Hero of Alexandria', *Isis* 62 (1971), 172–85.

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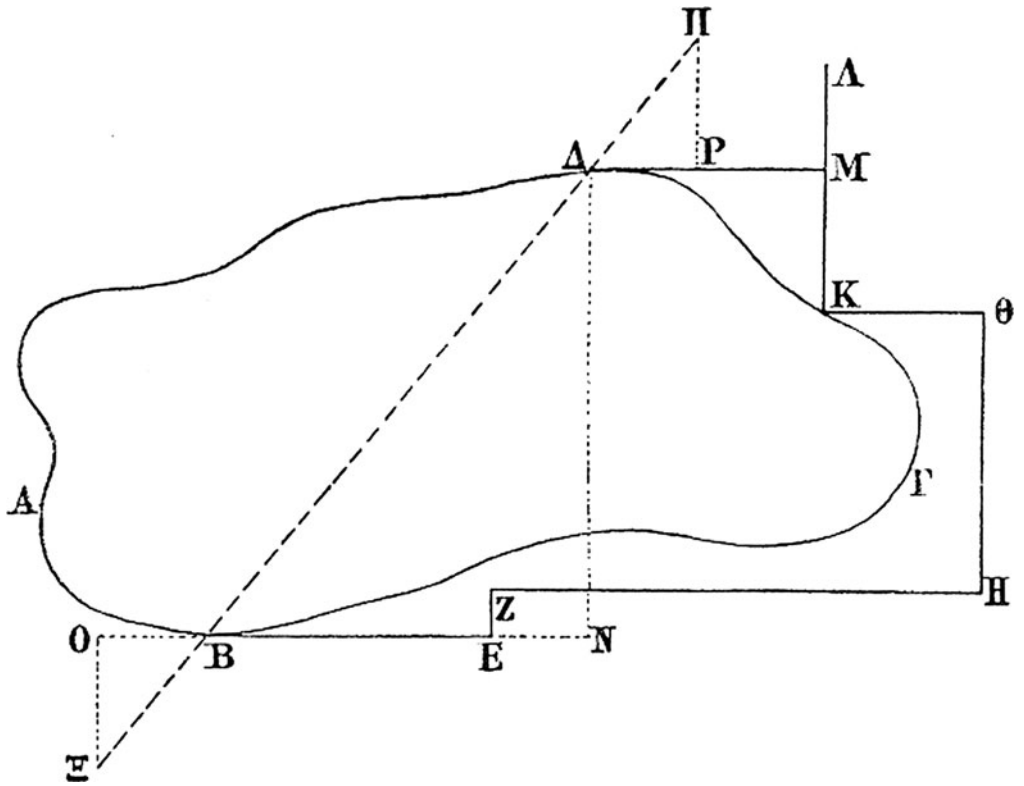


FIG. 2. Diagram from *Dioptra*.

ruler.'[28] The point at which this happens is marked as N. Thanks to a system of triangulation that has been explained earlier (section 8), the *dioptra* allows the user/reader to calculate the length of ΔN and BN. Once these two crucial data are obtained, it is possible to determine the third side of the right-angled triangle BNΔ, i.e. BΔ, which is the tunnel itself. By 'determine' I mean not only that the length of the line BΔ is known, but also that its inclination, i.e. the size of the angles ΔBN and BΔN, is known.[29]

> So we dig on the one hand from the [point] B making the tunnel along a straight line, the [line] BΞ; on the other hand from the [point] Δ along the straight line ΔΠ. Then the remainder of the tunnel is produced by setting the ruler upon the line that we have found, the [line] ΞB, or upon the [line] ΠΔ, or also upon both parts. Producing the tunnel this way, the workers will meet each other.[30]

Did Nonius Datus solve his tunnelling problem along lines similar to Hero's? According to Grewe, given the landscape conditions of any of the extant ancient tunnels, Hero's

[28] Hero, *Dioptra* 15: καὶ παραφέρω τὴν διόπτραν ἐπὶ τῆς ΚΛ - εὐθείας διατηρῶν τὸν κανόνα ἀεὶ ἀποβλέποντα σημείῳ τινὶ τῶν ἐπὶ τῆς ΚΛ, ἄχρις ἂν διὰ τῆς πρὸς ὀρθᾶς θέσεως τοῦ κανόνος φανῇ τὸ Δ σημεῖον.
[29] See Grewe, op. cit. (n. 11), 23.
[30] Hero, *Dioptra* 15: διορύξομεν οὖν ἀπὸ μὲν τοῦ Β ποιοῦντες τὸ ὄρυγμα ἐπ᾽ εὐθείας τῆς ΒΞ, ἀπὸ δὲ τοῦ Δ ἐπ᾽ εὐθείας τῆς ΔΠ. γίνεται δὲ λοιπὸν τὸ ὄρυγμα κανόνος παρατιθεμένου ἐπὶ τῆς εὑρημένης εὐθείας τῆς ΞΒ, ἤτοι ἐπὶ τῆς ΠΔ, ἢ καὶ ἐπ᾽ ἀμφότερα τὰ μέρη. γινομένου τοῦ ὀρύγματος οὕτως ὑπαντήσουσιν ἀλλήλοις οἱ ἐργαζόμενοι.

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method is unfeasible in practice.[31] Despite his relative prestige as the kind of *librator* who would be put in charge of an aqueduct, we do not know whether Datus had read Hero or some Latin version of similar material, or even whether he was acquainted with any land-surveying texts at all.[32] Technical knowledge, including technical terminology, must have been, by and large, communicated and transmitted non-textually, that is, both orally and instrumentally. It is very likely that Datus and his helpers used simple triangulation and instruments such as the *groma*, the *chorobates*,[33] or a type of *dioptra*, without necessarily having what we would call a theory of them.

Several engineering tales have included an assessment of Datus' performance. He is seen both as an example of Roman efficiency, and of Roman *in*efficiency. Leveau reminds his readers that, while the tunnel at Saldae may seem extraordinary because of the survival of the inscription, 'reality is probably much more banal'. He thinks that 'the obstacle causing the delay was nothing of exceptional difficulty'.[34] Landels emphasizes the provincial setting of Datus' aqueduct, in contrast to the complex network described by Frontinus for the city of Rome, as a means of explaining why it was a 'fiasco', at least initially.[35] Laporte, despite thinking that Datus was hardly an exceptional engineer, praises the way he coped with a particularly inefficient workforce:

> It is here that one sees the *librator*'s true technical prowess: to go through some 250 metres of a tunnel which he knows to be too long and not in a straight line; to stop at one point and to decide to head in a precise direction; to do the same in the other tunnel, and to manage to finally rejoin the two parts. Here we have a little masterpiece of triangulation.[36]

There is a whole rhetoric of difficulty in the history of engineering, which allocates merit in direct proportion to how intractable the initial situation was. Some historians see Datus in a positive light not so much because of the scale of the initial problem, or the brilliance of the eventual solution, but because he managed to dig himself out of a rather deep building-site hole.

It has been estimated that the Saldae aqueduct, originating from springs at Toudja, measured overall between 25 and 26 km.[37] The tunnel, known as El Habel, has been estimated as being 86 m deep and around 428 m long, although some sources give a figure of 560 m. It apparently had a shaft near one of the entrances which may have served both as a ventilation conduit, and a way of ascertaining the depth once work had started.[38] The large size of the mountain could go some way towards explaining the workmen's mistake.[39] The aqueduct also included a bridge, of which several piers were still standing in modern times.

[31] Grewe, op. cit. (n. 11), 23–4.
[32] See J.-Y. Guillaumin, 'La signification des termes *contemplatio* et *observatio* chez Balbus et l'influence héronienne sur le traité', in J.-Y. Guillaumin (ed.), *Mathématiques dans l'antiquité* (1992), 205–14.
[33] Described by Vitruvius 8.1–3. Grewe, op. cit. (n. 11), 28: Datus used a *chorobates*. See also Adam, op. cit. (n. 21), 1024–5; Lewis, op. cit. (n. 21), ch. 10.
[34] Ph. Leveau, 'Conduire l'eau et la contrôler: l'ingénierie des aqueducs romains', in M. Molin (ed.), *Archéologie et histoire des techniques du monde romain* (2008), 145 and 'Research on Roman aqueducts in the past ten years', in A. T. Hodge (ed.), *Future Currents in Aqueduct Studies* (1991), 155, respectively. See also Ph. Leveau, 'Saldae', in *Die Wasserversorgung antiker Städte, III* (1988), 218.
[35] Landels, op. cit. (n. 21), 52–3.
[36] Laporte, op. cit. (n. 10), 712–49. Cf. also MacKendrick, op. cit. (n. 5), 207, 247–8.
[37] The most recent study of the aqueduct I have been able to see is Laporte, op. cit. (n. 10). I have been unable to consult S. Hachi, D. Aïssani, H. Djermoune, J. P. Laporte, K. Righi *et al.*, *Sur l'aqueduc antique de Saldae: Source (de Toudja), tracé, techniques utilisées, creusement du tunnel*, Projet de Recherche, C.N.R.P.A.H. Alger, 2006, as seen at http://www.toudja.org; (accessed 22/3/2011).
[38] Lewis, op. cit. (n. 21), 207.
[39] Laporte, op. cit. (n. 10), 726, 744.

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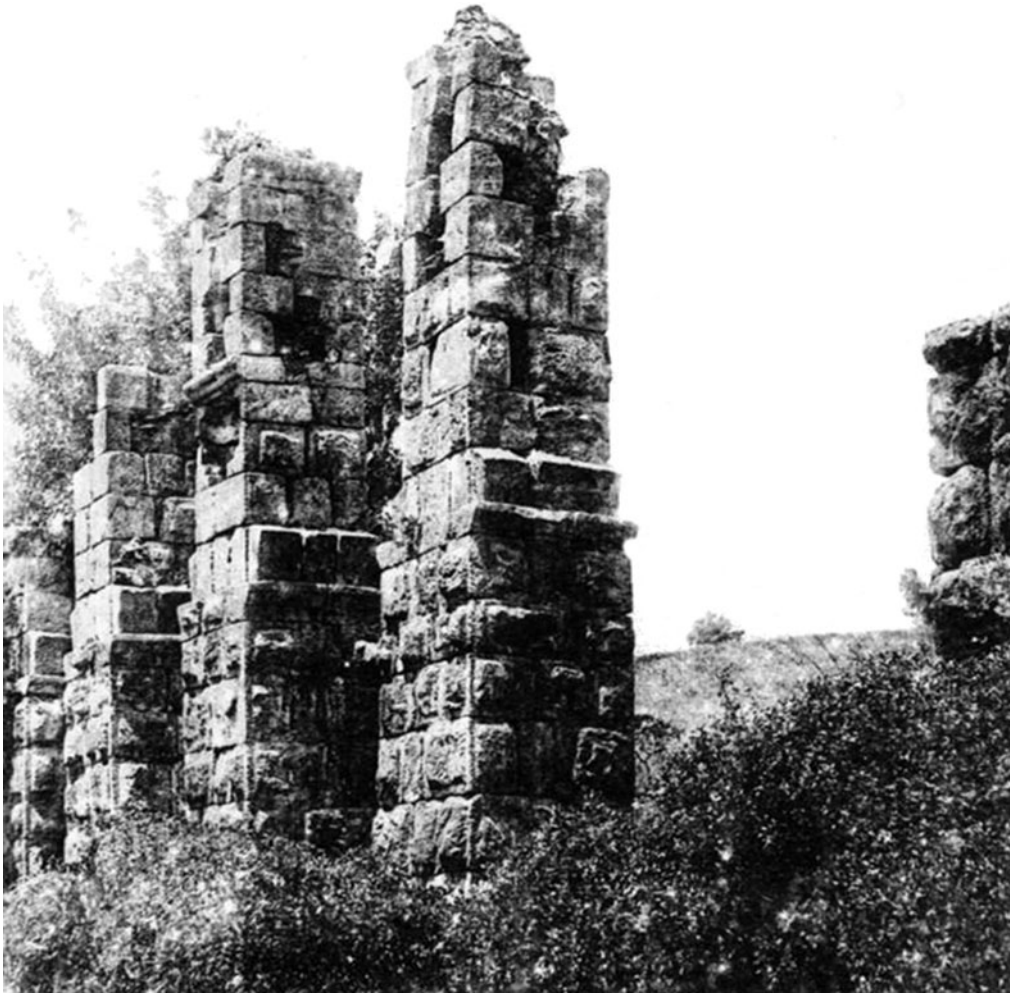


FIG. 3. Remains of piers from the Saldae aqueduct (Mercier, op. cit. (n. 41)).

One of the piers held a plaque with the relief, probably apotropaic, of a double-winged phallus; another may have contained a dedicatory inscription. This need not have been about who built, or paid for, the aqueduct. Pre-Roman North African religion included various water divinities, and in Roman times dedications to the genius of an aqueduct were not infrequent.[40]

One report by a captain of the French *Génie* described a system of reservoirs.[41] Other early observers noticed a gradual decrease in the diameter of the conduit pipes between

[40] Gsell, op. cit. (n. 18) *s.v.* Bougie, 1, item 5, mentions *CIL* VIII.8984; Benabou, op. cit. (n. 2), 274.

[41] M. Mélix [Mélis], 'Note sur les vestiges de l'aqueduc romain venant de Toudja à Bougie', *Recueil des notices et mémoires de la société archéologique du Département de Constantine* 9 (1865), 23–30; E. Dewulf, 'Note sur l'aqueduc de Bougie', *Recueil des notices et mémoires de la société archéologique du Département de Constantine* 10 (1866), 316–19; Anonymous, op. cit. (n. 24); E. Mercier, 'Bougie', *Recueil des notices et mémoires de la société archéologique du Département de Constantine* 30 (1895–6), 316–17; Laporte, op. cit. (n. 10), 718, 721–2, see table III for photo.

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the point of entry at Toudja and the point of exit at Bejaïa, as if not all water from the source had been planned to make its way into town. There may have been secondary conduits supplying water to the countryside, presumably for agricultural purposes.[42] Observing specific similarities between the piers of the Saldae aqueduct and those of the almost contemporary aqueduct at Cherchell, Leveau and Paillet have mooted the idea that Nonius Datus worked on the latter.[43]

Clearly, the engineering tale is destined to remain open-ended. It could be told as a tale of technical triumph, or as a run-of-the-mill account of the laborious making of an average, even mediocre, provincial monument. Several assumptions are at work in either version of the story. Firstly, there is the notion that the information Datus provides, while in need of decodification, is, thanks to its very 'technicality', objective. The inscription has been approached as if it were, for all intents and purposes, a neutral account. Precisely by virtue of this supposed objectivity, the information it contains has been deemed applicable to objects other than the one it refers to. The Saldae aqueduct has become paradigmatic.

Corollary to the first is a second assumption: that there are, by and large, objects raw and simple — that we can tell the story of an aqueduct pretty much in independence of the human agency involved in it. Or rather, that the human agency involved in it is special, in that it is solely aimed at devising and solving technical problems. Representative of this approach is Donald Hill, who writes in his standard textbook: '[This is a] technical history of engineering — social and economic factors are referred to only when they can throw light upon engineering developments.'[44]

Thirdly, and perhaps most pervasively, we encounter assumptions of continuity. Not only in the laws of physics, so that, centuries on, the material obstacles involved in tunnelling a mountain are still the same: there is also a fundamental continuity in human basic needs, which allows us to assess how well something works. A popular expression of this is Sprague de Camp's *The Ancient Engineers*. Within a general evolutionary framework, where (to paraphrase slightly) engineers are *homo erectus*'s secret weapon in his struggle for survival, the author most famous for his science fiction writes: 'Civilization, as we know it today, owes its existence to the engineers. […] The story of civilization is, in a sense, the story of engineering.' Nonius Datus' inscription is recreated thus:

> I found everybody sad and despondent. […] As always happens in these cases, the fault was attributed to me, the engineer, as though I had not taken all precautions to ensure the success of the work. What could I have done better?

De Camp thinks that 'the answer to Datus' question […] is, of course, "Stay on the job and don't wander off for four years at a stretch"'.[45] More recent scholarship reflects similar assumptions:

> [S]ince the same physics governs natural phenomena then as now, computer reconstruction and 'reverse engineering' studies of ancient hydraulic structures offer the possibility of rediscovering the design intent behind archaeological remains. […] In this context, when selected engineering accomplishments of the ancient world are examined and shown to conform to a logical basis based on optimal use of skills and resources, then an ancient version of modern

[42] J. Birebent, *Aquae romanae: recherches d'hydraulique romaine dans l'est algérien* (1962), 467–72; see A. Wilson, 'Deliveries *extra urbem*: aqueducts and the countryside', *Journal of Roman Archaeology* 12 (1999), 314–32.
[43] Ph. Leveau and J.-L. Paillet, *L'Alimentation en eau de Caesarea de Maurétanie et l'aqueduc de Cherchell* (1976), 153.
[44] D. Hill, *A History of Engineering in Classical and Medieval Times* (1984), xiii, reissued in 1996.
[45] Sprague De Camp, op. cit. (n. 21), 13 and ch. 1 in general, 195–6.

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> macroeconomic theory may emerge to demonstrate that application of basic, universal economic principles underlies their technical and administrative accomplishments. […] the passion involved in creation and recognition of hydraulic solutions can be shared across the centuries as perhaps only members of the brotherhood of engineers can understand.[46]

Grewe also envisages engineers as a diachronic community, operating across time with different technologies, but joined in a similar struggle. This perceived continuity informs activities as diverse as those of the real-life or (increasingly) on-line communities devoted to the reconstruction of ancient technologies, and the academic field of experimental archaeology.[47]

The professionals involved in experimental archaeology often claim that they aim to learn something from the process of reconstructing an ancient artefact through the exclusive use of techniques and materials available at the time.[48] On the other hand, the musings about the ancient 'experience' sometimes made by people engaged in experimental, or reconstruction, archaeology, often in the context of high media exposure, are extensively criticized from within the field.[49] In the latter case, the assumption that being surrounded by ancient things (or a close replica thereof) enables insights into the lived experience of the past, is attacked. In the former case, the assumption that *making* the same things (or a close replica thereof) enables insights into the past, is widely accepted. Precisely because basic human needs and the laws of physics do not change, the experience of making — the technician's experience — is seen as more essential, and thus ahistorical, than other types of experience.

II THE (POST-)IMPERIAL(IST) TALE

The second way of looking at the cippus focuses on the fact that Nonius Datus was a Roman military engineer, building a Roman water supply system in North Africa. It uses the inscription as a source for understanding infrastructures and technologies as manifestations, beneficial or sinister, of empire.

The political significance of water supply systems was, of course, not lost on the ancients themselves. Tacitus lists baths as one of the means of enslaving the unsuspecting Britons, and Frontinus triumphantly compares the aqueducts of Rome to the useless pyramids of Egypt.[50] On the other side of the imperial fence, defiant rabbis discuss Roman technologies in an exchange notoriously reminiscent of *that* scene from Monty Python's *Life of Brian*:

> R. Judah, R. Jose and R. Simeon were sitting, and Judah, a son of proselytes, was sitting near them. R. Judah commenced [the discussion] by observing, 'How fine are the works of this people! [the Romans, *ndr*] They have made streets, they have built bridges, they have erected baths.' R. Jose was silent. R. Simeon b. Yohai answered and said, 'All that they

[46] C. R. Ortloff, *Water Engineering in the Ancient World* (2009), 5–6: a comparative analysis of water supply systems across several ancient societies. Cf. also, e.g., Landels, op. cit. (n. 21), 7.

[47] cf. Grewe, op. cit. (n. 11). Popular sites include 'The Hurl' at http://www.thehurl.org (accessed 2/8/2010), 'a worldwide community of catapult enthusiasts pursuing the art, history, science and engineering of hurling!'; or http://www.surveyhistory.org (accessed 2/8/2010), devoted to the history of surveying. See, e.g., A. K. Outram, 'Introduction to experimental archaeology', *World Archaeology* 40 (2008), 1–6.

[48] See, e.g., J. DeLaine, 'Recent research on Roman baths', *Journal of Roman Archaeology* 1 (1988), 22–5; H.-J. Schalles, 'Die Herbergsthermen in der *Colonia Ulpia Traiana* bei Xanten – ein Versuchsmodell römischer Bädertechnik', in J. DeLaine and D. E. Johnston (eds), *Roman Baths and Bathing* (1999), 199–205; F. Yegül and T. Couch, 'Building a Roman bath for the cameras', *Journal of Roman Archaeology* 16 (2003), 153–77.

[49] See, e.g., P. J. Reynolds, 'The nature of experiment in archaeology', in A. F. Harding (ed.), *Experiment and Design: Archaeological Studies in Honour of John Coles* (1999), 156–62.

[50] Tacitus, *Agricola* 21; Frontinus, *De aquis* 16; cf. Pliny the Elder 36.16.75.

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> made they made for themselves; they built market-places to set harlots in them; baths to rejuvenate themselves; bridges to levy tolls for them.'[51]

Such cynicism is patently absent from many later appraisals of Roman imperial technology. Voicing what appears to have been a majority view until well into the twentieth century, Edward Gibbon thought that:

> [Aqueducts] deserve our peculiar attention. The boldness of the enterprise, the solidity of the execution, and the uses to which they were subservient, rank the aqueducts among the noblest monuments of Roman genius and power. […] The solitudes of Asia and Africa were once covered with flourishing cities, whose populousness, and even whose existence, was derived from such artificial supplies of a perennial stream of fresh water.[52]

What did the Romans ever do for us? They gave us clean running water, even at the price of political subordination. Not only are there universal basic human needs — the hierarchy among them is also universal, and being abundantly hydrated trumps more abstract alternatives.

This contrast itself, however, depends on believing that aqueducts and other imperialist technologies *were* useful or indeed necessary, that they really were about 'not just convenience, but salubriousness and even safety'.[53] Yet, as early as the Talmudic passage, it has been pointed out that the great majority of water carried by monumental urban aqueducts went to supply bath-houses. Were those useful, or 'just' a luxury?

In his preface to Leveau and Paillet's work on the aqueduct of Cherchell, Mounir Bouchenaki wrote:

> [Leveau and Paillet] have presented, in conclusion, the aqueduct of Cherchell as a manifestation of urban luxury, highlighting in particular the waste of water and the display of domination of the countryside on the part of the city. Without wanting to underplay the contribution of the Roman architects' technical expertise to the buildings of ancient Africa, the debate on the civilizing role of Rome ought to be set in its true context. […] The merit of the present work is to have asked […] different questions, and to invite a re-examination of ancient archaeological remains within a de-colonised framework.[54]

At the end of the same work, in their turn Leveau and Paillet inserted some revealing acknowledgements:

> In the making of a book, the most difficult stage is often not putting the evidence together, or writing, but publication. The academic institutions from which we were hoping to receive support have showed disinterest in our work for economic reasons […], scientific reasons (a monograph which was too specialistic) and ideological reasons (underplaying Rome's 'civilizing role'). […] For us, this work has not been the juxtaposition of accurate technical considerations and trendy ideas; it is the detailed study of a monument which has helped us become aware of the material reality of the exploitation of one society (rural and African) by another (urban and Roman), that is, of Roman colonial actuality.[55]

[51] *Shabbat* 33b, cited in M. Hadas-Lebel, *Jerusalem Against Rome* (2006), 380 (English trans. by R. Fréchet of *Jérusalem contre Rome* (1990)), with discussion 380–7; cf. G. Traina, 'I romani, maestri di tecnica', in E. Lo Cascio (ed.), *Innovazione tecnica e progresso economico nel mondo romano* (2006), 253–69. *Life of Brian* (dir. Terry Jones) came out in 1979.

[52] E. Gibbon, *The History of the Decline and Fall of the Roman Empire* (1776), ch. II (74 ed. D. Womersley (1995)).

[53] Frontinus, *De aquis* 1; cf. L.(-C.) Féraud, 'Histoire des villes de la province de Constantine. Bougie', *Recueil des notices et mémoires de la société archéologique du Département de Constantine* 13 (1869), 113.

[54] Bouchenaki in Leveau and Paillet, op. cit. (n. 43), 6. See also, e.g., Shaw, op. cit. (n. 13), 72–3; A. T. Hodge, *Roman Aqueducts and Water Supply* (2002²), 5–11, 48–9.

[55] Leveau and Paillet, op. cit. (n. 43), 181, cf. also 8, 44, 63, 98–9, 148–9, qualified in Leveau, op. cit. (n. 34,

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Arguably, monumental aqueducts hardly met a real need. They were one among several water supply solutions available to the people of ancient North Africa, given their specific geographical, agricultural, and meteorological circumstances. Urban areas could, and often did, rely on cisterns and wells — Saldae did not have an aqueduct until long after it was made a *colonia*. As for agriculture, arguably many areas were adequately served by 'old' 'native' techniques such as zone-flooding and terrace agriculture.[56]

In this light, Datus' story could be seen as a typical imperialist tale. As Shaw puts it:

> Here are the themes of professionalism and bureaucratic planning: the role of the technical expert in army uniform, the official directives issued from above, planning on the part of a Roman colony and intervention by a provincial governor, all in the cause of providing a town with a supply of potable water. Nonius Datus' celebratory inscription is headed by the merits of the hero of the piece: *Patientia*, *Virtus*, *Spes*, three virtues of hard colonial endeavour if ever there were any.[57]

The background image is a hostile and undomesticated landscape, both nature and people: remember that Datus and his men were attacked by brigands.[58] Remember also the ineffectual despair of the workers at the botched tunnels, and contrast it with the carefully constructed image of Datus' superior management skills.[59] The actual aqueduct, with its multi-span bridge and tunnel, could be seen as a deliberately Roman mark stamped on the territory, wild African nature and men subjugated and controlled by the efficiency and virtue of Roman experts.

But the (post-)imperialist tale is not universally endorsed. The issue of aqueducts and empire has been at the forefront of debate again, thanks to, among others, Andrew Wilson, who, in the general framework of a re-evaluation of the productivity of Roman economy, has shifted attention to the ways in which aqueducts can be described as 'useful', rather than 'luxurious'. He emphasizes that aqueducts fed baths, but also more generally, through fountains for instance, provided increasing urban populations with access to water, thus playing a significant rôle in the growth of towns. Qualifying his earlier position, even Leveau had written in 1991:

> An ancient aqueduct calls for a socio-economic rationale different from ours. It is not a question of denying either the utility of the aqueducts […] nor the connection between

1991), 150, 158–9. More strongly H. Schwartz, 'Patterns of public and private water-supply in North Africa', in J. H. Humphrey (ed.), *Excavations at Carthage 1977* (1981), 54.

[56] Féraud, op. cit. (n. 53), 111: cisterns in Bougie/Saldae; Leveau and Paillet, op. cit. (n. 43), 17–19; E. W. B. Fentress, 'Forever Berber?' *Opus* 2 (1983), 161–75; B. D. Shaw, 'Water and society in the ancient Maghrib: technology, property and development', in idem, *Environment and Society in Roman North Africa: Studies in History and Archaeology* (1995, 1st edn 1984), 131–5, 142–51 (with further references) and op. cit. (n. 13), 76–80, 82–5; D. J. Mattingly and R. B. Hitchner, 'Roman Africa: an archaeological review', *JRS* 85 (1995), 165–213; D. Mattingly, 'From one colonialism to another: imperialism and the Maghreb', in J. Webster and N. Cooper (eds), *Roman Imperialism: Post-Colonial Perspectives* (1996), 49–69; N. Benseddik, 'L'armée française en Algérie: "*Parfois détruire*, souvent construire"', in M. Khanoussi, P. Ruggeri and C. Vismara (eds), *L'Africa romana 13* (2000), 776; M. Casagrande, *Gli impianti di adduzione idrica romani in* Byzacena *e in* Zeugitana (2008), ch. 2. Agennius Urbicus, *De controversiis agrorum* 16–21 (Campbell) describes the contrast between irrigation in Italy and Africa, where people build dams to keep the water, see J. Peyras, 'Les campagnes de l'Afrique du Nord antique d'après les anciens *gromatici*', in J. Desanges (ed.), *Histoire et archéologie de l'Afrique du Nord. Actes du III^e colloque international* (1986), 257–72. Heurgon, op. cit. (n. 4), 23, appropriates these technologies to the Romans.

[57] Shaw, op. cit. (n. 56, 1984), 123. See also R. MacMullen, 'Roman imperial building in the provinces', *Harvard Studies in Classical Philology* 64 (1959), 207–35.

[58] Benabou, op. cit. (n. 2), 144, with some earlier bibliography at n. 126. *Contra* Laporte, op. cit. (n. 10), 747–8.

[59] Incentivizing the workforce through competition was a well-known trick in antiquity: cf. Diodorus 14.41.2–43.4 (Dionysius of Syracuse); Josephus, *De bello judaico* 5.502–9 (Titus); further examples in MacMullen, op. cit. (n. 57), 213.

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> urban expansion and aqueduct building […]. No doubt the peasants did not look at the question of urban health through the same eyes as the municipal aediles.[60]

In response to this, Wilson provides the evidence of North African aqueducts which had both exclusively rural, and rural *and* urban targets — for instance, a water basin near the source of the main aqueduct supplying Carthage must have been built for the rural population to use. Other aqueducts in the region had derivations or access points where water could be drawn, or where it was diverted to cultivated areas. Overall, Wilson indicates that the 'binary opposition between utility and luxury appears too stark' and that 'the very utility of aqueducts increased their ideological impact'.[61]

It appears that scholars in the debate about aqueducts and empire have been relying on different assumptions. Many of the advocates of a de-colonization of the history of Roman water supply systems, especially in the French-speaking world, are overtly political — their assumption is that there is continuity between old and new imperialisms, and this lends urgency and relevance to a political reading of ancient technologies.

Contributions such as Wilson's, on the other hand, avowedly steer clear of an excessive emphasis on ideology, laying claim to a new sort of economy-based neutrality. Thus, he emphasizes that, by fostering urbanization, and thus economic growth, aqueducts were useful. Yet, the key here, in my view, is not simply that aqueducts were useful, but that they were *seen* to be useful — not just that there was economic growth, but also that its effects were noticeable at the time.[62] Such a line of argument, albeit plausible, is not easy to substantiate. For a technical artefact to be not just useful, but be *seen* as useful, there has to be consensus, on the part of *both* makers/commissioners *and* users of the artefact, first, as to what the function of the artefact is, and second, that such function(s) are valuable and preferable to cheaper, less disruptive, more traditional alternatives. It may be more problematic to reach agreement on the first point than the second, especially in contexts where specific technical artefacts are 'new' and come ready-wrapped in a political package.

There is a second chapter to the (post-)imperialist tale.[63] Nonius Datus' cippus is no longer in Tazoult (which used to be Lambaesis):[64] it now stands in front of the council hall of Bejaïa — the town that used to be Saldae. How did it get there?

[60] Leveau, op. cit. (n. 34, 1991), 158–9.

[61] A. Wilson, 'Water supply in ancient Carthage', in J. T. Peña *et al.*, *Carthage Papers. The Early Colony's Economy, Water Supply, a Public Bath, and the Mobilization of State Olive Oil* (1998), 81, 90–3 (*contra* Shaw, Wilson doubts that major cities in North Africa could exist without aqueducts), and op. cit. (n. 42), 319–23, with an appendix by Leveau, and 'Hydraulic engineering and water supply', in J. P. Oleson (ed.), *The Oxford Handbook of Engineering and Technology in the Classical World* (2008), 308, respectively.

[62] On economic growth see, e.g., K. Hopkins, 'Taxes and trade in the Roman Empire', *JRS* 70 (1980), 101–25 and 'Rome, taxes, rents and trade', in W. Scheidel and S. von Reden (eds), *The Ancient Economy* (2002, 1st edn 1995), 190–230; A. Wilson, 'Machines, power and the ancient economy', *JRS* 92 (2002), 1–32; R. B. Hitchner, '"The advantages of wealth and luxury". The case for economic growth in the Roman Empire', in J. G. Manning and I. Morris (eds), *The Ancient Economy. Evidence and Models* (2005), 207–22. On the difficulty of defining economic growth see, e.g., P. Millett, 'Productive to some purpose? The problem of ancient economic growth', in D. J. Mattingly and J. Salmon (eds), *Economies Beyond Agriculture in the Classical World* (2001), 17–48; R. P. Saller, 'Framing the debate over growth in the ancient economy', in Manning and Morris, op. cit., 223–38, especially 228–32, 236 on standards of living; in general L. Foxhall, *Olive Cultivation in Ancient Greece: Seeking the Ancient Economy* (2007).

[63] For the reception history of the cippus I have relied extensively on M. Dondin-Payre, 'L'utilisation symbolique des monuments archéologiques d'Algérie: l'arc de Caracalla à *Cuicul*; le cippe de *Nonius Datus*', in M. Khanoussi, P. Ruggeri and C. Vismara (eds), *L'Africa romana 12* (1998), 1067–99 and op. cit. (n. 6, 2000) and Benseddik, op. cit. (n. 56). Apart from a brief mention in Grewe, op. cit. (n. 11), 138, the after-life of the cippus does not seem well-known outside the Francophone world. Hence, I think it is a good idea to sketch it out here, supplementing Dondin-Payre and Benseddik with my own remarks and observations.

[64] Copies in the Museo della Civiltà Romana in Rome, the Naval Museum in Mainz, and the Museum in Algiers: Dondin-Payre, op. cit. (n. 63), 1078 n. 30; cf. B. Pferdehirt, *Das Museum für antike Schiffahrt* (1995), 69–71.

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As we have seen, there was a French garrison at Batna. Nearby Lambèse (as it was) was chosen to host a military prison, built in 1851 exactly in a corner of the underlying Roman military camp, its walls utilising old Roman stone blocks as building material. As a result, the ancient graveyards were practically obliterated, to the dismay not only of contemporary scholars, but also of the military officers who had contributed to the initial excavations.[65] It is in this context that our cippus was first recovered.[66]

The French authorities had what one could call an ambiguous attitude to North African antiquities. On the one hand, the French army in North Africa was in charge of much archaeological work: they were requested to draw archaeological maps, and to dig up Roman antiquities.[67] On the other hand, the distinction between valuable and dispensable antiquities was disputed, and control over the activities of individuals was difficult. Our sources report monuments destroyed or defaced, and the evidence for acts of vandalism on the part of French soldiers stretches to the 1960s.[68] Perhaps Datus struck a chord with the army. After its discovery, the cippus was kept in the Lambèse penitentiary.

Where it could have remained, if events in Bougie/Saldae had not taken another turn. As well as archaeological work, the French army in Algeria was in charge of building infrastructures, including aqueducts. For that purpose, they looked to Roman infrastructures as a kind of blueprint — something that had worked in the past and could work again.[69] The two tasks, archaeology and engineering, came together in Bougie after 1871. The French had recently suppressed a revolt in which the local population had been involved, and punished them by confiscating land and imposing restrictions on the use of the Toudja springs. In particular, the town of Bougie obtained one-fifth of the water at the expense of the local rural population. The French army engineers then planned a new aqueduct, which would follow the same itinerary as the Roman one and, in particular, would use the same tunnel. There were, of course, practical reasons for this: there are only so many ways of going from A, springs, to B, town. But we should also note that, by the time the Ponts-et-Chaussées were reconnoitring the aqueduct itinerary and the tunnel, the inscription was already known. In their own words, this was an opportunity to show, bypassing the Arabs, that the French were the direct and legitimate successors of the Roman Empire.[70]

A new aqueduct was built between 1895 and 1896, at 21.6 km rather shorter than the Roman one.[71] There was controversy because it took water away from some local villages;

[65] Dondin-Payre, op. cit. (n. 6, 1991) and (n. 6, 2000) 731–2; Benseddik, op. cit. (n. 56), 790–1. They give different assessments of the rôle played by Colonel Carbuccia: Benseddik calls his arrival 'une malédiction pour *Lambaesis*' (791).

[66] Cagnat, op. cit. (n. 7); Heurgon, op. cit. (n. 4), 8.

[67] Heurgon, op. cit. (n. 4); P. A. Février, *Approches du Maghreb romain* (1989), I, ch. 1; Dondin-Payre, op. cit. (n. 6, 1991); Laporte, op. cit. (n. 10), 713.

[68] A. Poulle, 'Nouvelles inscriptions de Lambèse et de Thimgad', *Recueil des notices et mémoires de la société archéologique du Département de Constantine* 23 (1884), 177–256; Benseddik, op. cit. (n. 56); Dondin-Payre, op. cit. (n. 6, 2000), 742–3.

[69] Different attitudes in Mélix, op. cit. (n. 41); S. Gsell, 'Enquête administrative sur les travaux hydrauliques anciens en Algérie', *Bibliothèque d'archéologie africaine* 7 (1902); Shaw, op. cit. (n. 56, 1984), 124–5; Birebent, op. cit. (n. 42), conclusion.

[70] Anonymous, op. cit. (n. 24), 335–6; Laporte, op. cit. (n. 10), 724; Féraud, op. cit. (n. 53), 106–7; P. Gaffarel (1918) in Dondin-Payre, op. cit. (n. 6, 2000), 744 n. 56: 'Ces importants travaux consolident l'œuvre de nos soldats et de nos colons car ils rattachent le présent au passé et démontrent que la France est l'héritière légitime de Carthage et de Rome.' The rather unusual mention of Carthage, the Phoenician arch-rival of Rome, may be due to the fact that between 1918 (date of the Anglo-French Declaration) and 1920 (the beginning of the French Mandate) the ground was laid for Lebanon to be controlled by the French. I owe this point to Simon Schaffer.

[71] Laporte, op. cit. (n. 10), 718, 725, 761–2.

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also, not all observers were convinced that using the Roman tunnel was a good idea, both because of possible structural weakness, and for sanitary purposes.[72]

In 1895 the local authorities at Bougie requested and obtained from the Cabinet and the Minister for Education and Fine Arts that the cippus be removed from Lambèse to Bougie. While still uncertain as to where exactly it was to be placed, both a letter by the sub-prefect at Bougie to the prefect in Constantine/Caesarea and a notice in a scholarly journal hint at possible motivations. According to the journal, the inscription 'relate les difficultés éprouvées par les Romains dans l'exécution de leur enterprise'. After quoting the town's mayor to the effect that the cippus is a work of art, the letter comments: 'il paraît juste et c'est presque un devoir pour nous de laisser se perpétuer un souvenir que les Romains eux-mêmes avaient jugé digne de livrer à la postérité.'[73] While the trials and tribulations of the ancient military engineer resonated with his modern counterparts, paying Nonius Datus his due tribute took some time. Difficulties in communication were compounded by the apparent reluctance of the head of the penitentiary at Lambèse to let go. A Monsieur Sarazin was sent personally to look for the cippus, and reported back in a telegram to the ministry thus: 'Pierre trouvée penitencier. Directeur rien reçu. Opposition systématique pour transfert. Menace intervention ministère Intérieur. Instructions.'[74]

The threat may have worked, because in 1896 the aqueduct was inaugurated, and the cippus, now situated in front of the town hall, was uncovered in a new format: the three missing sides had been restored and inscribed with the names of the sub-prefect, the city mayor, and the two military engineers responsible for the new aqueduct.[75] You could hardly find a more obvious example of what Dondin-Payre calls 'the French appropriation of Roman works'.[76]

III NONIUS DATUS' TALE

My last story is an attempt to find out what the cippus meant for Nonius Datus himself. What do we know about him? While the name Nonius could derive from any of several Roman proconsuls in Africa with that name between Julius Caesar's time and A.D. 92,[77] 'Datus' is characteristically North African. Names such as Datus or Donatus were frequent in the region and were probably the Latin version of the Punic Mattan, Methen and similar.[78] Through the second century, an increasing proportion of both soldiers and civilians living in Lambaesis had names that could indicate African origin. Even more clearly, epigraphic evidence from Lambaesis sometimes states the place of origin of soldiers of the Third Legion Augusta, and local recruitment appears significant, especially in the period between A.D. 115 and 235.[79]

[72] Dondin-Payre, op. cit. (n. 63), 1098–9.
[73] E. Fagnan, 'Bulletin', *Revue Africaine* 40 (1896), 84; the letter in Dondin-Payre, op. cit. (n. 63), 1096–7.
[74] Dondin-Payre, op. cit. (n. 63), 1078–9, 1096–9 (quotation 1098).
[75] Fagnan, op. cit. (n. 73); Laporte, op. cit. (n. 10), 762 n. 176; Dondin-Payre, op. cit. (n. 63), 1080. A recent photograph of the cippus in Bejaïa in Leveau, op. cit. (n. 34, 1988).
[76] Dondin-Payre, op. cit. (n. 63), 737, 1079 (quotation). See also Heurgon, op. cit. (n. 4); A. Deman, 'Matériaux et réflexions pour servir à une étude du développement et du sous-développement dans les provinces de l'empire romain', in H. Temporini (ed.), *Aufstieg und Niedergang der römischen Welt* II.3 (1975), 3–83; Dondin-Payre, op. cit. (n. 6, 1991); Benseddik, op. cit. (n. 56), 796. Féraud, op. cit. (n. 53), 131 points out that according to oral traditions in Bougie, the medieval Hammadite princes had provided a water supply system, which, in his view, must have followed the blueprint of the Roman aqueduct.
[77] Lassère, op. cit. (n. 18), 159.
[78] L. R. Dean, *A Study of the Cognomina of Soldiers in Roman Legions* (1916), 11–16; I. Kajanto, 'Pecularities of Latin nomenclature in Roman Africa', *Philologus* 108 (1964), 311, and *The Latin Cognomina* (1965), 76, 298; Benabou, op. cit. (n. 2), 502; Lassère, op. cit. (n. 18), 452.
[79] e.g. *CIL* VIII.2567, 2568, 2569, listing home-towns such as Carthage, Cirta, Thimgad, etc. Cf. also Benabou,

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Whether he was a Romanized African or not, Datus does not represent himself primarily in terms of 'ethnic' identity, and, as Lassère points out with reference to the self-declaredly *seminumidam* and *semigaetulum* Apuleius, it is not certain that the ancients themselves always perceived names as making a strong cultural or political statement. We have epigraphic evidence for families of African origin whose children have sometimes African, sometimes entirely Roman names. In the second century A.D., at least some people of Italian descent gave their children 'Punic' names like Datus.[80]

Nonius Datus introduces himself as a technical expert (a *librator*) and a soldier. That the two things are often found together is a well-known, but rarely explored fact.[81] The term *librator* probably indicated specialization in surveying uneven terrain.[82] Pliny the Younger asked Trajan to send him a *librator* 'or an architect', because he was planning to connect a lake near Nicomedia to the sea. Specifically, the *librator* was expected to ascertain the altitude of the lake, and to work out the details of the project. Pliny, moreover, indicates that he should be able to advise about the feasibility of an engineering project, taking into account factors such as (in his case) depth of the lake, volume of water flow, and counter-pressure from the sea towards the lake.[83]

It seems likely that Datus learnt his craft through apprenticeship within the army. The Third Legion Augusta may have trained specialists in survey for the construction of water supply systems; we have at least one inscription referring to a *discens libratorum* (which could mean either trainee or teacher).[84] Again, whoever reads the words on the cippus is struck by the to-ing and fro-ing between *procuratores* and military commanders, and yet, if there were town authorities in Saldae involved in the project, their presence is erased: even the workforce appears to have been drawn from the military.[85]

Indeed, of the three virtues, *Patientia* (the capacity to endure difficulties until one's task is completed) and *Virtus* (ability or efficacy, including the capacity to bring about a desired result) are extremely fitting for both a Roman soldier and an

op. cit. (n. 2), 564; Lassère, op. cit. (n. 18); H. Freis, 'Das römische Nordafrika – ein unterentwickeltes Land?' *Chiron* 10 (1980), 357–90; Shaw, op. cit. (n. 4), 145–7; Le Bohec, op. cit. (n. 2), 70, 74–9, 494–508.

[80] Lassère, op. cit. (n. 18), 457, citing Apuleius, *Apologia* 24.1; 653; L. A. Thompson, 'Settler and native in the urban centres of North Africa', in L. A. Thompson and J. Ferguson (eds), *Africa in Classical Antiquity: Nine Studies* (1969), 145; J. B. Rives, *Religion and Authority in Roman Carthage from Augustus to Constantine* (1995), 162.

[81] In general see, e.g., E. W. B. Fentress, *Numidia and the Roman Army* (1979); D. Cherry, *Frontier and Society in Roman North Africa* (1998).

[82] Inscriptions from Lambaesis relating to *libratores* from the Third Legion: *CIL* VIII.2564 (part of a long list of dedicatees which includes a *mensor — lib* might mean *librarius*, but the link with *mensor*, listed just above, makes *librator* a better possibility in Wilmanns's view), 2568 (Wilmanns reads *lib* as *librarius* but it could mean *librator*), 2884 (*libr*), 2900 (*libr*), 2929 (*lib*), 2934 (*librator*), 2954 (*lib*), 2985 (*lib*), 18086 (*lib*). Near Aïn-Cherchar, an inscription thanking the gods for the completion of an aqueduct, built under military management, and made by a *discens libratorum* (*AE* 1942–3, 93), can be dated to A.D. 226 with the help of another related inscription (*AE* 1973, 646), cf. Janon, op. cit. (n. 5), 248–54. Y. Le Bohec, 'L'armée romaine d'Afrique dans l'épigraphie de 1984 à 2004', in idem, *L'Armée romaine en Afrique et en Gaule* (2007), 478–502, has three further examples, one from Timgad and two from Lambaesis, of *libr-* which could be either. A quick browse through the indexes of *CIL* III (Asia, Greece, Illyricum, with a respectable number of military *mensores*) and *CIL* XIII (Germany) suggests that North Africa had an unusual concentration of military *libratores*. Outside North Africa, we have an example from Rome (*CIL* VI.2454).

[83] Pliny the Younger, *Letters* 10.41 and 10.42 (the exchange is dated to A.D. 111–12); see also 10.61 and 10.62. Cf. Frontinus, *De aquis* 105.

[84] *AE* 1942–3, 93 = 1973, 646, see n. 82. Y. Le Bohec, 'Les "*discentes*" de la IIIème Légion Auguste', in A. Mastino (ed.), *L'Africa romana* 4 (1987), 244, mentions a *discens architecti*. Cf. also *CIL* XIII.7945: a trainee architect with the army, and *CIL* VII.1062: (presumably) the same person, now an architect.

[85] MacMullen, op. cit. (n. 57), 214–17; Fentress, op. cit. (n. 81), 161–71; R. P. Saller, *Personal Patronage under the Early Empire* (1982); P. A. Février, 'Armée et aqueducs', in J. P. Boucher (ed.), *Journées d'études sur les aqueducs romains. Tagung über römische Wasserversorgungsanlagen* (1983), 133–40; Laporte, op. cit. (n. 10), 755, 758.

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engineer.[86] As for *Spes*, imagine the instant of suspense before a catapult hits the target, or a pulley system lifts a huge column, or before the water finally rushes through the conduits and an aqueduct is inaugurated after years of work — perhaps hope *is* the quintessential virtue of an engineer. The three goddesses presiding over Datus hint at the strong moral dimension of both the technical and the military enterprise.

Again, notice how Datus combines technical knowledge, and what one could call management skills. He tells you that he knew both how to build an aqueduct, and how to manage people building an aqueduct. We find the idea that you cannot be a good technician unless you are a good manager elsewhere, for instance in Vitruvius,[87] and it is not unlike what is required of a good military officer, a job which calls for some specialized knowledge (formation, tactics — Roman soldiers were famously intensively trained), but also leadership qualities.

Thus, Nonius Datus introduces himself as an engineer and a soldier, a combination that made sense both in terms of the actual context for training and realization of large-scale technical works, and in terms of the values and *ethos* attached to them. Datus' putative North African origin does not appear to have coloured his self-presentation as much as, in Shaw's words, his endorsement of the virtues of hard colonial endeavour.

But for whom exactly did Nonius Datus write? And what kind of a monument is the cippus — is it funerary? If so, it is unlike other clearly identified funerary material from Lambaesis. Is it a defence against charges of inefficiency? Or a votive to the gods for having finally completed the work?[88] The fact that we only have half of it stimulates, rather than hinders, the imagination, because there is no obvious beginning- or end-point. It is like one long strip of text, not organized in strict chronological order. If we start from *Patientia*, by the time we get to *Spes* we have a flashback. To adapt Valérie Huet's comments on Trajan's Column, time seems to be wrapped around Nonius Datus' monument, along with the story it tells.[89]

Laporte and Shaw have commented on the inscription's tone of self-glorification. We know from various literary examples, especially in the so-called 'technical' literature, that the common strategy of self-glorification could be achieved in a number of ways.[90] Datus chose a specific one. It seems legitimate to assume that his way was comprehensible, and effective, for his intended audience, which, I believe, was the fellow inhabitants of Lambaesis, as much as military or civil authorities. The reader is struck by the abundance of details, not just about the chain of bureaucracy involved,[91] but also about the artefact itself. Take the clarification about which segment of the conduit is upper and which lower — all this, miles away from the actual thing. Who would want to know? Perhaps the people at Lambaesis were particularly attuned to this language, and grasped the significance of its combination of technical expertise and the workings of the imperial machinery, precisely because the great majority of people living in Lambaesis at the time were or had been soldiers, many of them with, or exposed to, some technical knowledge.

[86] On *Patientia* see R. Kaster, 'The taxonomy of patience, or, when is *Patientia* not a virtue?' *Classical Philology* 97 (2002), 133–44. Grewe, op. cit. (n. 11), 7, 138–9.
[87] Vitruvius, Book 10, introduction.
[88] Funerary: Cagnat, op. cit. (n. 7), 70; Dondin-Payre, op. cit. (n. 63), 1077, 1078 n. 30; Grewe, op. cit. (n. 11), 137. Defence: Grewe, op. cit. (n. 11), 326. Votive: Le Bohec, op. cit. (n. 2), 379.
[89] V. Huet, 'Stories one might tell of Roman art: reading Trajan's Column and the Tiberius cup', in J. Elsner (ed.), *Art and Text in Roman Culture* (1996), 9–31.
[90] Shaw, op. cit. (n. 13); Laporte, op. cit. (n. 10), 738. Self-promotion is common in ancient technical discourse — see the seminal work by G. E. R. Lloyd, e.g., *The Revolutions of Wisdom* (1987); most recently J. König and T. Whitmarsh (eds), *Ordering Knowledge in the Roman Empire* (2007).
[91] Parallels in inscriptions about boundary disputes: S. Cuomo, *Technology and Culture in the Greek and Roman World* (2007), ch. 4.

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Non-textual learning such as Datus possessed, especially if it implied skilled manipulation of instruments, must have required the existence of an actual, not simply a virtual, community of experts, probably hierarchically arranged, and identified by its sharing of knowledge, knowledge practices, and the values associated with them. Concretely, there is evidence in the town of several possible *libratores*, a high number of *mensores* and an architect.[92] The importance of the army for Lambaesis' collective identity cannot be overstated: witness the numerous inscriptions relating to soldiers' associations.[93] A significant number of soldiers, or relatives on their behalf, indicate what their rôle in the army was through abbreviations.[94] To the extent to which the inscriptions were there to be seen or read, the existence of 'code' in the form of abbreviations again hints at the existence of a community, people 'in the know', for whom a specific rôle in the army would have been particularly meaningful.

The lettering of Nonius Datus' cippus is reminiscent of another document from Lambaesis: the so-called *adlocutio* inscription, a lengthy report of Hadrian's speeches to the troops on the occasion of his visit in A.D. 128. In modern reconstructions, the engraved *adlocutio* flanked a large-size single column, ultimately modelled after that of Trajan in Rome. Trajan may in fact have been mentioned in the speech.[95] In his address Hadrian praises the technical skill and orderliness in display tactics of the Third Legion Augusta; Nonius Datus' address to his fellow soldiers and veterans revolves around the same display of expertise and soldierly behaviour.

In one fragment, the emperor praises the troops for building a wall. Soldiers were customarily involved in the making of infrastructures: roads, bridges, probably the town itself, with its carefully laid out geometrical grid. Some of the pieces of the inscription specify what unit of the legion they are addressed to, but it is unclear whom Hadrian is talking to here.[96] He specifies that the wall is of the type that one would find built for semi-permanent winter quarters, yet the troops in question completed it in the same time it would have taken to erect a rampart made of turf (a much more manageable material). He even comments on the stones used: large, heavy and different from each other, so that careful matching of suitable stones of unequal size was necessary for construction. The troops also dug a trench, turning rough gravel into a smooth surface.[97]

Wall and trench are represented here in terms of mastery over hard matter, and transformation of the asperities of the landscape. This echoes Nonius Datus' inscription, as well as other building inscriptions of the Third Legion Augusta.[98] In the *adlocutio*

[92] See n. 82; *CIL* VIII.2935 and 2946: *mensor*; *CIL* VIII.3028: *mesor*; *CIL* VIII.3074: *messor*; *AE* 1904, 72: sixteen more *mensores*; *CIL* VIII.2850: architect. Further references in L. Zerbini, 'Gli agrimensori dell'Africa romana', in M. Khanoussi, P. Ruggeri and C. Vismara (eds), *L'Africa romana 12* (1998), 123–33. Cf. also *CIL* VIII.2872, 2874, 2951 (*medicus*), 18314 (*medicus ordinarius*); the Greek epitaph of a doctor may refer to a civilian, see B. Helly and J. Marcillet-Jaubert, 'Remarques sur l'épigramme d'un médicin de Lambèse', *ZPE* 14 (1974), 252–6.

[93] e.g. *CIL* VIII.2556, 2557, 2560–2562, 2564–2570. Self-expression was not limited to 'military' forms: e.g. *CIL* VIII.2581, 2632, 2756. See also H. D'Escurac-Doisy, 'Lambèse et le vétérans de la legio III Augusta', in M. Renard (ed.), *Hommages à Albert Grenier* (1962), 571–83; Lassère, op. cit. (n. 18), 276–8.

[94] Le Bohec, op. cit. (n. 2), 74, 92–106, 110. Several of the extant tombs have soldiers depicted in non-military garb. The 'civilian' funerary inscriptions from the same burial areas concentrate on family links: *CIL* VIII. 3319–4185; cf. 3463, 3506, 4071, 4120. An actor at *CIL* VIII.2803. In general V. M. Hope, *Constructing Identity: the Roman Funerary Monuments of Aquileia, Mainz and Nimes* (2001); E. D'Ambra and G. P. R. Métraux, 'Introduction', in eidem (eds), *The Art of Citizens, Soldiers and Freedmen in the Roman World* (2006).

[95] See M. Le Glay, 'Les discours d'Hadrien à Lambèse', in J. Fitz (ed.), *Limes. Akten des XI. Internationalen Limeskongresses Budapest* (1977), 545–58; Voisin in Y. Le Bohec (ed.), *Les discours d'Hadrien à l'armée d'Afrique* (2003), especially 29–30.

[96] *CIL* VIII.2532 Bb = 18042 Bb, in Le Bohec, op. cit. (n. 95), 87, 124–5. Cf. also J.-M. Gassend and M. Janon, 'La colonne d'Hadrien à Lambèse', *Bulletin d'archéologie algérienne* 7 (1977–9), 239–58. A very small fragment (10.5 in Le Bohec, op. cit. (n. 95), 109) could refer to projectiles of catapults.

[97] References in Le Glay and Tourrenc, op. cit. (n. 17), 111–15.

[98] Roads: see n. 18; bridges: see Le Bohec, op. cit. (n. 82), 478, about a bridge at Haïdra. Jouffroy, op. cit. (n. 17),

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inscription, there is a deliberate emphasis on making things more difficult than they need to be: the wall is not only built, but built quickly. Not only quickly: it is also a semi-permanent type of wall, despite the ephemeral occasion. Even more than that, the stones used are the most impervious type of building material one could use for that wall — but the army's display for the emperor revolves precisely around such extreme technical feats, the building equivalent of racing while wearing full armour. The rhetoric of difficulty we saw deployed in the engineering tales is well in evidence here.

We could press the point further, and draw attention to the parallels between the dazzling *techne* of tactics — Arrian, author of a *Taktike techne*, was a close associate of Hadrian's, and may have been present at the training in Lambaesis[99] — and the dazzling *techne* of aqueduct-building through wild landscapes. 'Ex difficilibus difficillimum fecistis (you made something extremely difficult out of difficult things/ circumstances)', addressed to the troops, might have been written equally of engineering feats, and of horse-riding in formation.[100]

Thus, Lambaesis provided a suitable audience for the engineer's tale of difficulty overcome. Yet, it is not the most obvious location, miles *away* from the aqueduct. We might have expected Datus to set up the cippus in Saldae — indeed, that *was* the right place for it according to its nineteenth-century admirers. We have to keep in mind, however, that the finished aqueduct was dedicated by Varius Clemens — that means that his name, plus that of the emperor, and perhaps of the city notables, would have been on the main dedicatory inscription before Datus' own name, if that was there at all.[101] The cippus in Lambaesis, with its insistence on what *he* did, and the importance of his rôle, may have been a way for the engineer to claim authorship of his work, in circumstances where that authorship would otherwise be effectively denied to him. Thus, Nonius Datus' own tale, in a sense, restores the aqueduct to its maker.

IV CONCLUSIONS

Can we or should we privilege one story over the others? Is one of the tales more accurate, or plausible? I hope it is evident that I do not think we should merge the three strands into a unified, consistent discourse: I accept that we experience dissonance when the stories bounce off each other. I would like to advocate a pluralist history of ancient technology, which would compensate for the paucity of evidence by looking at what we have from more than one vantage point.[102]

We need engineering tales in order not to lose sight of the materiality of our evidence — a technical artefact's function (what it is for) is arguably at least in part determined by its physical structure (the way it is made), not simply by the intentions and wishes of that

196, 203, 205, 207, 209, 211, 212, 214, 216, 232 has other North African inscriptions mentioning building difficulties. Cf. also W. Eck, 'Die Wasserversorgung in römischen Reich: sozio-politische Bedingungen, Recht und Administration', in *Die Wasserversorgung antiker Städte II* (1987), 49–101; B. D. Shaw, 'The structure of local society in the ancient Maghrib: the elders', in idem, *Rulers, Nomads, and Christians in Roman North Africa* (1995, 1st edn 1991) 28; P. Zanovello, 'Le fonti epigrafiche', in G. Bodon, I. Riera and P. Zanovello (eds), *Utilitas necessaria – sistemi idraulici nell'Italia romana* (1994), 99–143; A. Belfaïda, 'Eau et évergétisme en Afrique romaine: témoignages épigraphiques', in M. Khanoussi, P. Ruggeri and C. Vismara (eds), *L'Africa romana 13* (2000), 1589–1601; Casagrande, op. cit. (n. 56).

[99] Voisin in Le Bohec, op. cit. (n. 95), 31–4.

[100] *CIL* VIII.2532 Ba = 18042 Ba, in Le Bohec, op. cit. (n. 95), 84.

[101] cf. Zanovello, op. cit. (n. 98).

[102] A brilliant example of multi-perspective history of science (in this case, Mesopotamian mathematics) in J. Ritter, 'Reading Strasbourg 368: a thrice-told tale', in K. Chemla (ed.), *History of Science, History of Text* (2004), 177–200.

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artefact's user.[103] Physical structures have to be studied and understood. However, tales about ancient engineering would benefit from taking on more radically some of the challenges raised by the historiography of technology of other periods. The notions of technical efficiency and simplicity, or indeed even of basic human needs, have long been historicized. At the very least, we cannot take them for granted: technological choices are never obvious.[104]

Moreover, engineering tales would benefit from the greater attention paid to what happens to artefacts *after* they are produced — in other words, to technologies-in-use — that we currently find both in archaeology and the history of technology of other periods.[105] The assumed continuities that help us understand and appreciate how a technical artefact was produced, should be made explicit and available for discussion, so that, alongside a recognition that some aspects of our material reality have not changed, we can gauge the impact of everything else that has.

Equally, we need imperialist, post-imperialist, and post-post-imperialist tales. They are about some of the principal uses of technology-in-use, and they keep ancient technology relevant for us today. None of the scholars involved in the debate about aqueducts denies that utility (however defined) and luxury (however defined) ultimately co-existed, but they appear to disagree as to which of the two should be considered the true function, which the idiosyncratic, secondary, epiphenomenal function, and how we can even ground that distinction in the evidence.[106] Unlike fields such as the study of religion, language, or funerary practices, where the more nuanced categories of 'creolization' or 'hybridization' are now current,[107] and despite the fact that the notion

[103] See P. Kroes and A. Meijers, 'Introduction. The dual nature of technical artefacts', *Studies in History and Philosophy of Science* 37 (2006), 1–4.

[104] Some examples in, e.g., H. Collins and T. Pinch, *The Golem at Large: What You Should Know About Technology* (1998); a good synthesis in P. Lemonnier, 'Bark capes, arrowheads and Concorde: on social representations of technology', in I. Hodder (ed.), *The Meanings of Things. Material Culture and Symbolic Expression* (1989), 156–71. Cf. also for similar principles applied to ancient economy and technology, Foxhall, op. cit. (n. 62), especially ch. 6, 256–7.

[105] Leveau, op. cit. (n. 34, 1991), 152–3. For technology-in-use see, e.g., D. Edgerton, 'De l'innovation aux usages. Dix thèses éclectiques sur l'histoire des techniques', *Annales HSS* 4/5 (1998), 815–37 and *The Shock of the Old. Technology and Global History Since 1900* (2007); K. Greene, 'Technological innovation and economic progress in the ancient world: M.I. Finley reconsidered', *Economic History Review* 53 (2000), 29–59 and 'Historiography and theoretical approaches', in J. P. Oleson (ed.), *The Oxford Handbook of Engineering and Technology in the Classical World* (2008), 62–90. On the archaeology side see, e.g., C. Gosden and Y. Marshall, 'The cultural biography of objects', *World Archaeology* 31 (1999), 169–78; L. Foxhall, 'The running sands of time: archaeology and the short-term', *World Archaeology* 31 (2000), 484–98; P. M. Allison, 'Using the material and the written sources: turn of the millennium approaches to Roman domestic space', *AJA* 105 (2001), 181–208.

[106] Discussions of agency and function in archaeology in, e.g., J. C. Barrett, 'Agency, the duality of structure, and the problem of the archaeological record', in I. Hodder (ed.), *Archaeological Theory Today* (2001), 141–64; I. Hodder, *Archaeology Beyond Dialogue* (2003), ch. 9, advocating narratives of individual lives in archaeology; I. Hodder and S. Huston, *Reading the Past. Current Approaches to Interpretation in Archaeology* (2003[3]), ch. 5. In history of technology see, e.g., S. O. Hansson, 'Defining technical function', *Studies in History and Philosophy of Science* 37 (2006), 19–22; M. Scheele, 'Function and use of technical artefacts: social conditions of function ascription', *Studies in History and Philosophy of Science* 37 (2006), 23–36; P. E. Vermaas and W. Houkes, 'Technical functions: a drawbridge between the intentional and structural natures of technical artefacts', ibid., 5–18; A. Morton, 'Finding the corkscrew', ibid., 114–17.

[107] See, e.g., Mattingly and Hitchner, op. cit. (n. 56); Mattingly, op. cit. (n. 56) and 'Being Roman: expressing identity in a provincial setting', *JRA* 17 (2004), 5–25; C. Gosden, 'Post-colonial archaeology: issues of culture, identity and knowledge', in I. Hodder (ed.), *Archaeological Theory Today* (2001), 241–61; J. Webster, 'Creolising Roman Britain', *AJA* 105 (2001), 209–25; C. Antonaccio, 'Hybridity and the cultures within Greek culture', in C. Dougherty and L. Kurke (eds), *The Cultures Within Greek Culture* (2003), 57–76; N. Crummy and H. Eckardt, 'Regional identities and technologies of the self: nail-cleaners in Roman Britain', *Archaeological Journal* 160 (2003), 44–69; D. L. Stone, 'Burial, identity and local culture in North Africa', in P. van Dommelen and N. Terrenato (eds), *Articulating Local Cultures: Power and Identity Under the Expanding Roman Republic* (2007), 126–44; A. Wallace-Hadrill, *Rome's Cultural Revolution* (2008).

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of 'creole' technologies is well-established in the history of imperial technologies of other periods,[108] when it comes to ancient large-scale technologies, it seems that we are still somewhat stuck between resistance and assimilation. Simmering underneath these discussions is, inescapably, a discourse about the advantages and disadvantages of empire, the political significance of which goes beyond the confines of academic discourse.[109]

Finally, we need the engineers' own tales — we need to see more people alongside the artefacts. Tales of engineers restore a specific human dimension to the object: that of the makers. After all, the maker knows how the object came into being, and can, in principle, reproduce or maintain it. My underlying assumption in writing Nonius Datus' tale is that there is a good case to be made for the belief that the agency of the maker is distinctive and unlike the agency of other people involved with an artefact. As has been shown in particular for the history of early modern European science, bringing the invisible technician back into the light can change our picture of the technology, or indeed the material culture, of an entire period.[110]

Secondly, reconstructing the technicians' tales adds to our growing understanding of technical knowledge and the way it was communicated and represented in antiquity. Technical literature has experienced a huge revival in the last few years.[111] We are a long way from Mommsen's dismissive:

> without a doubt, Nonius Datus understood levelling (*nivelliren*) better than he did writing. His account is certainly perfectly clear, but clumsy, one moment rambling, the next overtly sentimental, as incidentally is not unusual for a country-fellow and contemporary of Apuleius. The account is not even free from bad grammatical howlers [...] The *patientia* and *virtus* thus were by him, as by several of his later colleagues, hardly applied to the study of grammar.[112]

Indeed, some features of Nonius Datus' self-presentation echo what we find in medical, military, and architectural treatises. But there are also differences: the authors and readers of the technical texts now being intensively analysed, were an élite. While Nonius Datus did not constitute the very bottom of the technical hierarchy (his crew were), he is still an exponent of what we could call a sub-élite in terms of wealth, connections and visibility. Thus, while acknowledging that he shares some characteristics with, say, Frontinus, it is also important to stress that he offers quite a different standpoint from the 'upper-deck' view.[113]

[108] See, e.g., Edgerton, op. cit. (n. 105, 2007).

[109] cf. the exchanges between Dondin-Payre and Benseddik (cited in n. 65); Shaw and Fentress (see Fentress, op. cit. (n. 56), 170–1); J.-M. Lassère, 'Rome et le "sous-développement" de l'Afrique', *Revue des études anciennes* 81 (1979), 67–104; Freis, op. cit. (n. 79); L. A. Thompson, 'On "development" and "underdevelopment" in the early Roman Empire', *Klio* 64 (1982), 383–401; H.-G. Pflaum, 'La romanisation de l'Afrique', in idem, *Afrique romaine* (1978, 1st edn 1972), 375–92, with discussion; Saller, op. cit. (n. 63), 228.

[110] See, e.g., S. Shapin, 'The invisible technician', *American Scientist* 77 (1989), 554–63; P. H. Smith, *The Body of the Artisan: Art and Experience in the Scientific Revolution* (2004).

[111] See, e.g., Lloyd, op. cit. (n. 90); E. Romano, *La capanna e il tempio: Vitruvio o dell'architettura* (1987); J. DeLaine, '"*De aquis suis*?" The "commentaries" of Frontinus', in C. Nicolet (ed.), *Les littératures techniques dans l'antiquité romaine* (1996), 117–45; M. Formisano, *Tecnica e scrittura. Le letterature tecnico-scientifiche nello spazio letterario tardolatino* (2001); A. Novara, *Auctor in bibliotheca. Essai sur les textes préfaciels de Vitruve et une philosophie latine du livre* (2005); König and Whitmarsh, op. cit. (n. 90); K. Volk, *Manilius and his Intellectual Background* (2009); L. Taub and A. Doody (eds), *Authorial Voices in Greco-Roman Technical Writing* (2009).

[112] Mommsen, op. cit. (n. 8), 9.

[113] On Frontinus specifically, see, e.g., DeLaine, op. cit. (n. 110); S. Cuomo, 'Divide and rule: Frontinus and Roman land-surveying', *Studies in History and Philosophy of Science* 31 (2000), 189–202; A. König, 'Knowledge and power in Frontinus' *On aqueducts*', in König and Whitmarsh, op. cit. (n. 90), 177–205.

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Recent scholarship has been anxious to demonstrate that technical authors were fully conversant with the literary traditions of their time, and that they consciously presented themselves as participating in the same culture as their, usually élite, addressees. That has been a welcome counter-point to years of marginalization. What we risk losing sight of, however, are the ways in which Vitruvius, Hero and Galen were different from Cicero, Seneca or Plutarch. In their treatises, and even more in evidence such as Nonius Datus' message to the people of Lambaesis, we can identify a specific epistemology, with its corollary ethical and political facets, which is not reducible to an imitation or aspiration to 'mainstream' 'high' culture. This epistemology, and more generally this *ethos*, celebrate making things, including with one's hands, and achieving concrete results, despite difficulties[114] — in fact, it parades and almost seeks out difficulties. It celebrates service to a patron, a general, the emperor, but also the leadership and authority which derive not from birth or wealth, but from work and ability. The *ethos* of the ancient technician is about identifying with what you do — more specifically with what you make — and, despite the clumsiness of expression that so horrified Mommsen, being proud of it.

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[114] Recent interest in this specific way of relating to the world in best-selling books such as R. Sennett, *The Craftsman* (2008) or M. Crawford, *The Case for Working with Your Hands* (2009).

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