10.3.2 The Iron Trade

The town I grew up in after 1950 had around 1000 inhabitants. It was essentially a "sleeping town" for the workers and employes of the factories and businesses in the near-by cities but also still a community of farmers and artisans. Of course there was **black smith** (and a cartwright, glazier, carpenter, ...), and he was working right across the street from my parent's house. Same thing in all the other towns with a farming background. My grandfather actually was the black smith in another small town with less than 1000 inhabitants. So was his father and grandfather.

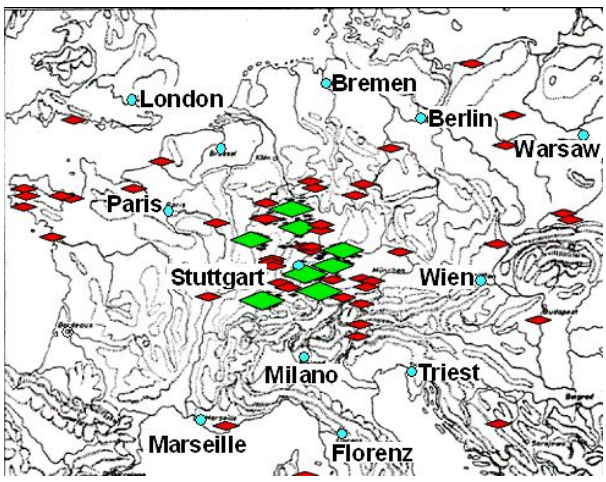
- I'm absolutely sure that any community with more than 500 inhabitants or so supported and needed a black smith ("Schmied" in German) for about 2000 years until - roughly - 1960. The surname Schmid / Schmidt / Schmitt / Schmit is No. 2 on the list of the most frequent surnames in Germany, only bested by "Müller" (you guessed it). It is clear that all those smiths' could not make their own iron / steel but bought it. The major source was the next local smelter "facility" of course, but some long-distance trade with special merchandise also existed.

As soon as people started to make iron in quantities, they also started to trade the stuff. The roots of the iron trade thus go back to distant antiquity; we just don't know all that much about it.
As we have learned in the preceding parts, a smelter makes a bloom, and this bloom should be processed immediately into one or several pieces of iron that can then be used for making products. These iron pieces tend to be more or less standardized for good reasons:

1. The black smith working the bloom (or parts of one) needs to have some idea of what he is going to make. Using the same basic geometry every time makes the work easier.
2. A black smith who has worked a lot of blooms will have developed a good feeling for the quality of the stuff he is banging at. He might be inclined (I'm guessing this!) to use different shapes for different grades.
3. A black smith who has worked a lot of blooms knows that he has to do a lot of fire welding and that the quality of the stuff he is making depends on the quality of the bloom *and* the quality of his work. The iron is of high quality if it can be forged into thin pieces without cracks. Standard shapes thus might have thin parts as quality demonstrators.
4. A black smith who works in a fully organized "industrialized" facility, for example in a Roman iron factory, simply produces the prescribed shape, following the Roman Army standards concerning the shape of iron goods to a dot.
5. Iron slated for export is given shapes that allow easy handling and stacking.

Of course, standards differed between areas / countries and changed many times during the 2000 years or so iron was made in bloomeries. Below I look at some of the better known early European trade standards. More information in **Pleiners** book: Iron in Archaeology - Early European Blacksmiths.

The **double pyramid** or **bipyamidal** bars (German: Spitzbarren; English: double - pointed ingots of continental type) are mostly found in what used to be the Western part of the Celtic heartland - Switzerland, Eastern France, South Germany. They go back to the La Tene period or to about 450 BC - 0 BC / AD. Whole hoards have been found in this area plus the occasional single specimen in Scandinavia, England or somewhere else in Europe.
Here is a map. Red symbols denote single finds / small amounts, big green symbols indicate findings of hoards or large amounts; some major cities are shown for orientation.

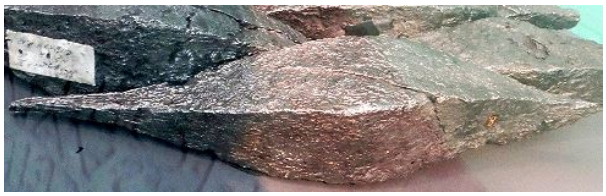


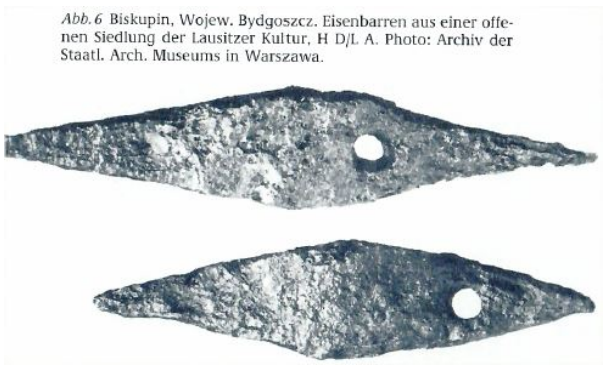
Map of Celtic double pramid irons (Spitzbarren) finds

Source: After a map in a brochure of the Württembergisches Landesmuseum, Stuttgart, Germany

- Interestingly, **Sargon II**, who ruled the **Assyrians** from 722 BC – 705 BC, was in possession of a tremendous treasure of iron that was stored in the palace of his capital Dur Sharrukin, present-day **Khorsabad**. One *Victor Place*, resuming excavations started by *Paul Botta* in 1843, found 160 tons of iron just in storeroom 84. Most of that iron was in the form of *bipyramidal bars* weighing 4 kg - 20 kg. Metallographic investigations by well-known

Radomir Pleiner[2)] showed that this iron was rather non-uniform stuff, a mixture of wrought iron, mild steel and hard steel steel, with plenty of slag inclusions. Interestingly, some tools like hoes and spades, where one would have expected steel edges, tended to be of low-carbon wrought iron.
Ewart Oakeshott takes this as an indication that the Celts originated from Assyria but this view is not popular with historians.
That's what one can find about Sargon's iron. What one cannot find are the present whereabouts of these tons of iron, or more than a handful of pictures. Here is a picture of a Celtic bipyramidal bar, some from present-day Poland, and a **specimen from Khorsabad**





Double pyramid iron bars,
Top: Celtic, South Germany; 5th - 1st century BC
Large picture of other bars
Middle: From the "Lausitz Culture" (1200 BC - 500 BC).
Bottom: Khorsabad; 717- 705 BC
What was made from bars

Source: Top:Photographed at the Special Exhibition Dedicated to the "Celts of the First Millennium BC"; 2012/13 Stuttgart, Germany. Bottom: Internet; Chicago Museum.

I don't know if the early Celtic smiths produced bipyramidal bars because they somehow carried on the tradition of the Assyrians. If not, they must have hit on that shape for reasons that evade us. One might speculate that a bipyramidal bar is he best compromise between a rectangular bar or block (most easy to pack and store) and a drawn-out geometry with thin parts (best to judge quality) but who knows.
One might also speculate that a bipyramidal shape allows the smith easy working. Since he mostly makes small objects like nails of knife blades and not swords, he only needs to heat the thin parts for drawing out a sufficient amount of iron for the task at hand. This is the explanation you find in the "Landesmuseum Halle", together with an impressive illustration .
Celtic double pyramid bars have been extensively investigated too, and were found to be rather heterogeneous. They cover the whole range of carbon and phosphorous iron so typical for these times and must have been the raw material Celtic swords and other objects were made from.

Currency bars look a bit like a half-made swords. Their German name is "Schwertbarren" ("sword bars") and while this name is self-explaining, "currency bars" is not. They were found mainly in England. When Caesar invaded England in 54 BC, he noticed that the early British smelted a bit of tin and iron but imported copper. He also was of the opinion that the British used standardized (more or less) bronze bits and iron staves as a kind of currency instead of coins. Caesar wrote that down in his "De Bello Gallico" and untold numbers of High School students had to suffer through it. In the 19th century Caesar's influence finally lead early archeologists to coin the designation "currency bars" for these peculiar objects.

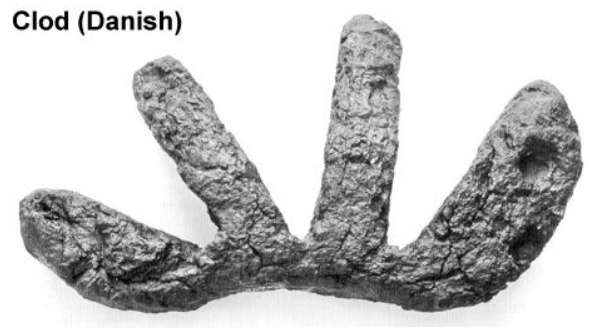
Celtic currency bars; around 200 BC

Source: Photographed at the "Special Exhibition Dedicated to the Celts of the First Millennium BC"; Stuttgart, 2012/13

- Currency bars may have been used as a kind of money but this is open to some doubt, as in the case of the Etruscan / Greek **oboli**. They certainly were also just the raw material that a smith bought from some merchant - obviously paying with some other kind of money. There are around 20 different kinds of currency bars, possibly reflecting different grades of iron, different areas of origin, different smiths, or whatever.
  Currency bars are rather heterogeneous. They cover the whole range of carbon and phosphorous iron so typical for these times, etc., etc. No difference to bipyramidal bars, in other words. They were, as Buchwald points out, "far from being a high quality material fit for swords, sickles or knifes".

So why, oh why? Why this particular shape? I certainly don't know. I can only guess. A drawn-out thin piece of iron does allow a better assessment of quality. The fact that it could be forged into this shape already is a sign of some minimal quality. More important, perhaps (I'm guessing) is that the surface / volume ratio is large, so there is a lot of surface to look at and significant inhomogeneities might have made themselves conspicuous to a trained observer. While you can always bang a thick piece of iron (like a bipyramidal bar) into something thin, the reverse is far more difficult. Currency bars therefore are of limited use.

Just the opposite is true for **billets** or whole small blooms just "wrought" a little bit, and any number of shapes (including weird ones like the "four-fingered blæsterjern" or clod).



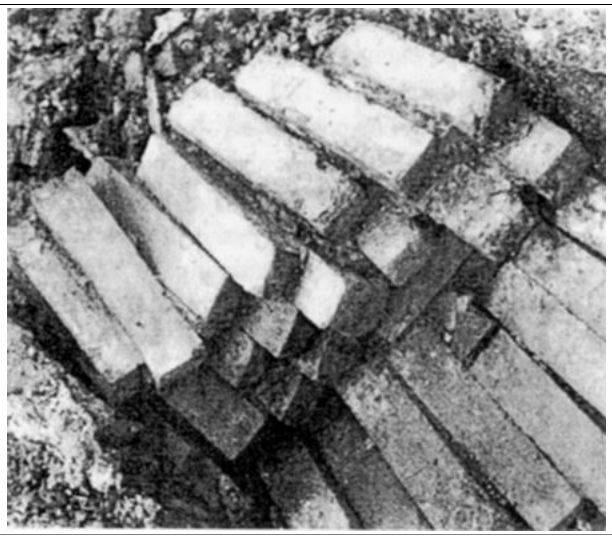
Blooms, billets, and a clod for trading / paying (?)

Source: Peter Crew and Buchwald

- This (British) stuff is still relatively early (long before the Roman occupation) and more or less local. I won't go deeper into what it might mean, partially because I do not have the faintest idea. From a quality point, the hooked billet shown above is relatively solid, not showing obvious welding flaws, but that is not necessarily true for others. The clod is from Scandinavia (essentially Denmark) and was used by farmers to pay their taxes with at least as early as 1500. The cuts obviously allow to assess the quality.

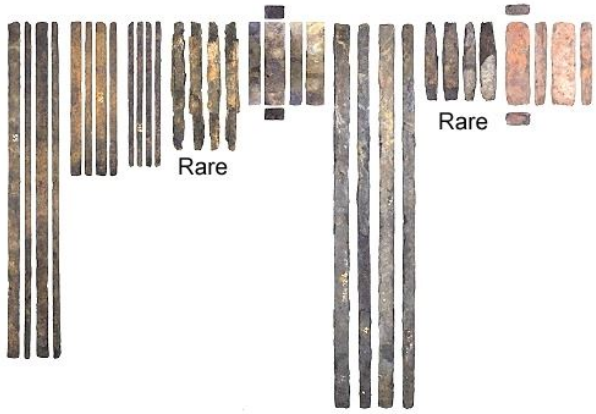
More serious trading started when the Romans were running things in large parts of Europe. This was to be expected; just look at the dramatic increase in average bloom size around 200 AD. We know something about the Roman iron trade from pictures and (presumably) writings and a bit from archaeological finds. This link leads to a paper of **Janet Lang** that describes the Roman iron and steel technology quit nicely
The Romans had rectangular standardized no-nonsense **bars** in several sizes, sometimes stamped. Some of these bars have been dug up but the most miraculous finds are from ships that went down and stayed there for almost 2000 years. There are plenty of Roman iron bars from 16 shipwrecks in the Mediterranean, and some if not most of that iron was most likely made in the Populonia area, between 150 BC - 400 AD.

- Here are some bars seen in-situ on the bottom of the Mediterranean.



Roman iron bars in-situ on the bottom of the Mediterranean

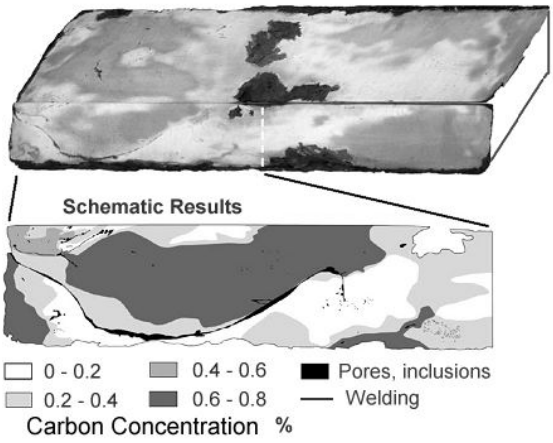
Source: M. Feugères and V. Serneels: "Recherces sur l'economie du fer en Meditérranée nord-occidentale", Monographies Instrumentum 4 (1998) p. 263.



Roman iron bars recovered from the Rhone shipwrecks

Source G. Pagès et al.

- A recent in-depth work[1)] analyzed a number of the Rhone shipwreck bars in great detail; this link leads to the paper. The results are what one should expect by now: it's rather bad iron - by today's standards. The carbon concentration inside a bar varies quite a bit, and there is (inhomogeneous) phosphorous, not to mention pores and slag inclusions and bad welds. Here is a picture:



Etched bar (composite) and data obtained
Large picture with more details

Source G. Pagès et al.

- These iron bars are from 27 BC - 96 AD. They were made to exacting standards and obviously important enough to ship them a few hundred miles. But they simply did no consist of very good iron / steel.
  We are forced to conclude that these bars represent the best the Romans had, at least for general use. Maybe their "Ferrum Noricum" was better. It appears to have been phosphorous-free but we do not yet know enough.

Iron trade has never stopped. It might have been confined to short range and low volume in troublesome times or remote regions, but local smiths always must have had some sources. In the Middle Ages it was more diversified, trading well-defined grades of iron or steel.
However, looking at the iron trade has not helped us to answer the big question from before:

Who discovered steel technology for the first time? When and Where?

- And with *steel technology* I still mean the whole range: Realizing that there are different "grades of iron" called steel, finding a way to sort these different steels from one of more blooms into at least three groups, and so on and so forth.
  As I'm writing this I do not yet know the answer. I do know, however, that the advent of the pattern-welded sword at the beginning of the end of the Western Roman empire (around 375 AD, when the migration period started by the arrival of the Visigoths) demands mastery of steel technology.

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1) G. Pagès, P. Dillmann, P. Fluzin, L. Long: "A study of the Roman iron bars of Saintes-Maries-de-la-Mer (Bouches-du-Rhône, France). A proposal for a comprehensive metallographic approach", Journal of Archaeological Science 38 (2011) p. 1234 - 1252

2) Radomír Pleiner: "The Technology of Three Assyrian Iron Artifacts from Khorsabad"; Journal of Near Eastern Studies, Vol. 38, No. 2 (1979), pp. 83 - 91

3) Zbigniew Bukowski; Warszawa: "Die ältesten Eisenfunde und Eisengewinnung im Bereich der Lausitzer Kultur im Flussgebiet von Oder und Weichsel", in: Frühes Eisen in Europa. Festschrift Walter Ulrich Guyan zu seinem 70. Geburtstag (Deutsch) Hardcover – 1981 by Harold Haefner (Herausgeber); p. 69