COLLÈGE DE FRANCE
1530

PROFESSOR JEAN-PIERRE BRUN

CHAIR IN TECHNIQUES AND ECONOMIES IN THE ANCIENT MEDITERRANEAN

RESEARCH INTERESTS

1. WINE AND OIL

From the 1980s, most of the farm excavations I have directed have yielded oil and wine production facilities. I worked on oil production and viticulture in the province of Gallia Narbonensis between 1975 and 2000, surveying and excavating oil mills in La Garde (Hyères), Taradeau (Var) and Entremont (Bouches-du-Rhône), along with wineries at the Grand Loou *villa* in La Roquebrussanne, in those of Pardigon 3 and Rue du Port in Cavalaire, in the *villa* of La Croix-Valmer, in that of the Toulons in Rians, that of Mesclans in La Crau, and in the secondary conurbation of Pignans.

-Entremont (Bouches-du-Rhône)

In the course of the 2nd century BC, a dozen Salluvii fortified settlements were equipped with lever presses: La Courtine d'Ollioules (Var), le Baou de Saint-Marcel, Beaumajour in Grans, Pierredon in Éguilles, Constantine in Lançon, Entremont in Aix-en-Provence, Glanum in Saint-Rémy (Bouches-du-Rhône). In Entremont, a dozen blocks of oil - and perhaps wine - presses were identified. The press in plot III, 1-2, presumably for the extraction of oil, was positioned obliquely because the tree trunk used as a lever was built into a corner of the room. The oil was stored in six jars inside an adjacent room. The oil mill was destroyed when the city was captured by Roman troops, probably in 90 BC.

- Costebelle in Hyères (Var)

The farm, located two miles north of the Greek city of Olbia, included an oil pressing facility in the 1st century BC. In the late 1st or in the 2nd century AD, a second oil mill replaced the original system; it seems to have been functional until late Antiquity.

- Saint-Michel, in La Garde (Var)

This *villa,* dating back to the establishment of a colony in Arles, was fitted with an oil mill by the early 1st century AD, and extended several times. In the first half of the 2nd century, a much larger oil mill was built, resulting in the destruction of the older structures. This remarkable installation, with its six presses and as many tanks, is of a type only found elsewhere in Africa. It was in use for about one and a half century; the settling tanks were filled in the second half of the 3rd century.

- Le Grand Loou I, La Roquebrussanne (Var)

The Grand Loou I *villa*, founded in the mid-1st century BC, expanded in the second half of the 1st century AD to the point that construction covered 3500 sq. m. The remains of wine production discovered do not predate the early 2nd century. Towards the middle of the century, the winery included a concrete floor crusher with its collection basin, two lever-and-counterweight presses and their tanks, and two cellars housing 68 large jars used for maturing. The villa was abandoned in the late 2nd century.

- The *villae* in the Bay of Cavalaire (Var)

Cavalaire Bay - which probably housed the *portus* of Heraclea Caccabaria, features a string of *villae* dotted along the shore. I excavated four of them between 1983 and 1993. Moving westwards, one first finds the *villa* in Pardigon 2 (La Croix-Valmer), which dates back to the second half of the 1st century BC. A first *villa* was built at the time of Augustus; this was largely destroyed by subsequent states, and nothing is known of its production facilities, but we do know it housed a Dressel 2/4 amphorae workshop, meaning it was most probably already producing and exporting wine at the time. The original buildings were razed under Nero and a new, luxurious *villa* was then built, with a front gallery and baths. The northern part of the site was dedicated to wine production: one can note the presence of a large buttressed wine storehouse and *dolia*. The villa was inhabited without interruption until the 5th century, but the ups and downs of viticulture during this long period could not be traced. The house, which was burnt down in the first half of the 5th century, was partly rebuilt shortly after, and ultimately deserted in the mid-6th century.

The Pardigon 3 *villa*, founded under the Flavians, stood 500 m to the west. The buildings, which covered an area of 2000 sq. m., were adapted over time, but not remodeled. From the outset, they included a house with a front gallery, corner towers and garden courtyard surrounded by a peristyle; to the north was a vast buttressed wine storehouse 52 m long and 12 m wide. On the western end, it housed crushers and a press; on the eastern side, two tanks and around one hundred jars. The villa was abandoned in the first half of the 3rd century AD.

Two kilometers away, another winemaking *villa* was active during the first two centuries of our era. Finally, a kilometer beyond, under the town of Cavalaire (Rue du Port), stood another large winemaking *villa* with two crushers, two lever presses, three tanks and a great many jars. Its chronology extends from the late 1st century AD to the time of Constantine.

The evolution of these four sites sheds light on the history of viticulture. One *villa* dates back to the *deductio* of the colony in *Forum Iulii*, and very quickly produced wine (Pardigon 2), while the other three were only founded under the Flavians. For at least a century, all of them produced wine. In the late 2nd or early 3rd century, two of the *villae* were abandoned, leaving two larger ones which grew at the expense of the others.

- L'Ormeau in Taradeau (Var)

In 1979 and 1980, two farms forming a hamlet were excavated on the western flank of Saint-Martin hill in Taradeau. In farm A, a winery and oil mill were built under the Flavians. Farm B, located a dozen meters north, was profoundly altered by the construction of an oil mill under the Flavians. Both farms were abandoned in the early 3rd century.

- Saint-Martin, Taradeau (Var)

Founded in the second half of the 1st century BC - probably as part of the Forum Iulii colony's *deductio,* the *villa* gradually developed. It reached its maximum extent at the end of the 1st century AD: a residence, built around a garden surrounded by a portico, with farming installations to the east. At some point in the 2nd century, probably in the second half, the *pars urbana* was turned into a winery and water mill for flour grinding, while the former *pars rustica* was fitted with an oil-making facility (mill and press). The former living quarters now housed four crushers, their four tanks, two lever-and-winch presses (subsequently transformed into screw devices), their two tanks and a cellar containing jars. The installation was completed by a rectangular structure featuring two boiler bases and thought to be a *defrutarium*. A further production facility added a crusher, a press and two adjacent tanks to the first installation. Wine production seems to have carried on without interruption from the 2nd to the 4th century. The tanks and *dolia* were filled in the 5th century, while the *villa* remained in use until the 6th century.

-The Toulons / The Vicarie, Rians (Var)

Located in the northwest of the city of *Aquae Sextiae*, the Toulons *villa* was built in one go shortly after the mid-1st century on a hill overlooking agricultural lands; it seems to have replaced a smaller farm, founded in the Augustan period at some distance northwest. The farm buildings have been mostly excavated. Covering an area of 8000 sq. m, they are organized around two courtyards. In the northern courtyard, two symmetrical pavilions house concrete platforms divided into four parts corresponding to two crushers around two lever presses operated with winches. The southern courtyard is bordered on three sides by large warehouses containing jars. The north wing is 51.90 m long and 9 m wide. Over 200 jars are arranged in parallel rows, each separated by an alleyway. In the early 3rd century, the press winches were replaced by screws. In the early 4th century, the winery was partly converted into living quarters. The final destruction occurred in the late 4th or early 5th century, when the tanks were leveled and the presses dismantled for salvage wood and metal.

- Pignans (Var)

In 1997, I conducted a rescue excavation which unearthed a section of the road between Telo Martius (Toulon) and Forum Voconii (Les Blaïs in Cannet-des-Maures). On either side were public buildings (baths), raw wool washing workshops and winegrowers' dwellings which were inhabited between the 1st century and the first half of the 3rd century. Four of them feature similar structures: the ground floor houses a crusher, a lever-and-winch press with counterweights and a small storeroom containing at most a dozen jars.

However, any comprehensive study of viticulture and oil production could not be restricted to an area as limited as Gallia Narbonensis, which is why I chose to extend research to other provinces of Gaul, to Italy, Greece, Portugal and then to the whole of the Mediterranean rim.

With Catherine Balmelle (a DR at the CNRS), we re-examined the issue of viticulture in Gallia Aquitania. In this province, the early use of wooden barrels has deprived archaeologists of one of their favorite clues, namely fragments of jars, and any subtle hint of evidence must be examined if one is to reinterpret older discoveries in agricultural areas. Through our study, it was possible to match more than fifty production facilities with winemaking. The results of our research were presented in a paper for the journal *Gallia* (2001), published as part of a feature on viticulture in Gaul and coordinated by Fanette Laubenheimer and myself. Ten years later, with Matthieu Poux and Marie-Laure Hervé, I directed a feature in the same journal (2011) which focused on viticulture in the Three Gauls in the light of recent research.

Outside Gaul, I have excavated an oil press from the end of the Hellenistic period in the theatre district of Delos (Greece). In Pompeii, I surveyed a specific type of winery - not attached to a farm, but to a tavern, where the innkeeper himself produced wine in two rooms adjoining the tavern and offered it to his customers. In Paestum, the excavation of a pressing facility led me to examine another type of high added-value production, namely perfumes. In Portugal, I studied the farm buildings at the *villa* in Torre de Palma (Monforte, Alentejo) and reached the conclusion that it was a large winery. With this in mind, I reviewed all of the literature available about Roman Lusitania and demonstrated, in an article published in the journal *Conimbriga*, that alongside facilities that were undeniably oil mills, many of the pressing facilities in the province could in fact be attributed to winemaking. The extent of wine production has been undervalued in historiography as a result of the widespread use of wooden barrels for both maturing and transport, which was common as early as the 1st century AD. The omnipresence of oil production across the Mediterranean rim has obscured remains attributable to viticulture, which are often brushed aside: any press is interpreted as having served for oil production. I therefore suggested a number of distinguishing criteria to help reassess winemaking facilities previously interpreted as oil mills, or vice versa. A comparable reassessment system has been proposed for Africa, notably for the current territory of Algeria. In Italy, conversely, oil tends to be underestimated as a result of the abundant literature devoted to viticulture; in a synthesis presented before the Congress of Sousse (Tunisia) in February 2007, I have attempted to identify the significance and evolution of the production of olives and olive oil in ancient Italy. Most recently, in 2011, I have offered a synthesis of viticulture in southern Italy.

Experimentation

In parallel to my field research, I have sought to gain a better understanding of the Ancients' wine-making methods, as well as of the construction and operation of their presses and cellars. Between 1994 and 2000, André Tchernia and I conducted research in experimental archaeology. Hervé Durand, a winemaker in

Beaucaire, granted us use of his facilities, workforce and significant funds in order to build a winery on the Roman model. The position of the crusher, concrete tanks and eleven jars did not pose much of a problem, given the large number of archaeological examples available to us, but the reconstitution of an ancient winepress was a much more difficult business as I was eager to follow the indications given in a text by Cato the Elder (*Agr*. 18-19). Construction work took place during the winter of 1994, and since the autumn of 1995, the press has been used during grape harvest to test its handling and recreate the exact conditions in which Ancient winemakers worked. We found out that their production process inevitably led to significant oxidation of the musts, which was only partly mitigated in the reduction caused by fermentation. The experience has continues every year since then, with the development and implementation of methods inspired by Columella's winemaking recipes (seawater wine, pitched wine, raisin wine, wine saturated with *defrutum*). A. Tchernia and I published a book entitled "Le vin romain antique" describing the experience and its key learnings. The book received several awards: "Toques et Clochers" in Limoux, "Langhe-Ceretto" in Alba (Italy) and "Best Wine Book World 2000" in Périgueux.

2. PERFUMES

In 1994, while examining the remains of a press uncovered in the forum at Paestum (Italy), I speculated that it should be associated with the manufacture of perfumes, which, as luxury goods, were a source of significant revenues.

Today's perfumes are composed of a base - usually alcohol, essences (essential oils of flowers, for instance), spices, fixatives, colorings and preservatives. In Antiquity, fragrances were fixed on oils, among which ben, sesame, almond and olive oil. Perfumers' workshops required very little specific equipment: their work could be performed with fabric torsion presses, ordinary – often reused -earthenware or metal vessels, and hearths which are often uncharacteristically modest. All of this means that this craft has so far largely escaped the attention of archaeologists.

The research I conducted in 1994-1995 in Paestum, Delos in 1997-1998 and Pompeii in 2001-2002, and then in 2011 with a team from Valencia (Spain) has meant that ancient perfumeries can now be identified. In every instance, facilities are located in the town center, in or near the forum; they feature vertical presses, with blocks or screws, and *enfleurage* boilers. This research was published in *Mélanges de l'École française de Rome*, in the *Bulletin de Correspondance Hellénique* and in the *American Journal of Archaeology*. Results were also popularized for a broader audience through exhibitions held in Grasse (France) and Mariemont (Belgium) in 2008.

This research took a new turn in 2008 when experimentation in the field of perfume creation started in the fragrances & aromas laboratory of UMR 6001, CNRS / University of Nice. With the assistance of two lecturers (X. Fernandez and J.-J. Philippi) and a research engineer (C. Castel), the *enfleurage* of olive oil, ben oil and sesame oil with flowers (rose, lily, etc.) and resins were experimented according to ancient recipes, mostly those described by physician Dioscorides (1st century AD). These experiments aim to obtain fragrances - potentially marketable

products - and are therefore carried out in partnership with private companies operating in the sector of perfumery and bath oils.

3. CEREAL PRODUCTION AND WATER-POWERED MILLS

Cereal cultivation and processing into flour are important fields of research as they form the essential form of food for the Ancients. Their study also addressed one of historiography's "causes celebres": the extent of water power in antiquity. During rescue excavations in 1996, I explored a Roman *villa* in La Crau, near Hyères (Var) which featured a water mill. This discovery was the starting point for wider research: by gathering documentation, I was able to show that water mills were widespread in rural areas during the Early Roman Empire, even though archaeologists did not know how to identify them. I myself had surveyed no less than three others in previous years without recognizing them as such - Saint-Michel de La Garde, Saint-Pierre-Les Laurons in Les Arcs and in the port city of Toulon. In the following years, I continued my investigations in France, Portugal and Italy.

In an article published in 2006, I overturned the theory based on an alleged infrequency of water power use in ancient times, and argued that as the phenomenon was commonplace, all economic and social conclusions which some historians had drawn were now baseless. Issues of technological history, acceptance of innovations and their impact on economic growth remain central to today's debates: they were the subject of two recent conferences, one in Capri in 2003 (*Innovazione tecnica e progresso economico*), the other at the Pont du Gard in 2006 (*Énergie hydraulique et machines élévatrices d'eau dans l'Antiquité*, edited by J.-L. Fiches and myself).

One new development is of particular interest: preparatory research in view of the final publication of the Saepinum mill and tannery convinced me that this equipment - dated to the Late Empire - is not a flour mill but rather a tan mill in which pestles were set in motion by a camshaft. This new interpretation radically modifies the history of technology: the use of waterpower to grind bark for tanning was until then attributed to Medieval times, as part of the "technical revolution of the Middle Ages". This conviction held by medieval historians stems from archival references to tan mills, the oldest of which date back to the 11th century. Quite clearly, this interpretation is a "source effect": indeed, the application of water power to other uses than grain milling is not evidenced by any written source prior to the Middle Ages, but archaeology is beginning to reveal that it was in use in the Imperial period for milling, sawing marble blocks, and now to produce tan. This explains why the water mill in Saepinum is appended to a tannery, a combination which was to become widespread in medieval and modern times.

4. LIVESTOCK FARMING

Livestock – a source of meat, milk, leather and wool – is a section of economic life which I could not ignore. My investigations took the form of excavating ancient sheep barns along with O. Badan and G. Congès in the Crau plain (between Arles and Fos) during the 1990s. La Crau is a vast rocky plain formed by the delta of the

Durance river during the Tertiary and early Quaternary. Extending over 55 000 hectares between the Rhone, Salon and the sea, it is covered with steppe grassland, where only thyme and dog's tooth grass grow. Excavated sites typically include a group of buildings often inhabited together: several sheep barns (long buildings 40-65 m long and 8-10 m wide), shepherds' dwellings, a bread oven, sometimes a place of worship and a well. Occupation mainly dates back to the Late Empire, between the 1st and 3rd century AD and, similar to the production of wine and oil, reflects the general economic growth of Gallia Narbonensis in that period.

5. CRAFTS

While agriculture employed the overwhelming majority of the population, handicrafts, especially in cities, played a key role in supplying both urban and rural dwellers with manufactured items made of metal, ceramic, leather, cloth, etc. My prior experience of agricultural settlements had evidenced how difficult it was to precisely identify the remains of a particular activity, so in 2000, I took the opportunity of my residency in Naples to offer the Pompei Soprintendenza Archeologica to develop a programme on forms of craft attested in cities buried by Mount Vesuvius. Research covers the dual issue of technological history and economic history. How did different crafts assimilate technical innovation - often imported from the Orient - into its traditional know-how? What was the place of various forms of crafts in ancient economic life – how significant were they in relation to largely dominant agricultural activities?

Between 2000 and 2009, I coordinated nine teams in Pompeii and Herculaneum, who worked on dyeing, paint, wickerwork, on iron and lead works, on the production and trade of cured fish, bakeries, perfumeries and tanneries. I have a particular interest in surveying tanneries. We set out to reconstruct the history of the entire block between the 6th century BC and 79 AD. An unintended consequence of our research was the discovery of a 3rd century BC home with a Greek-type banqueting hall (*andron*) decorated with paintings of a new style predating the Pompeian "First style".

Parallel to this research, I thought it would be appropriate to extend our area of work to the city of Saepinum, in Molise, where between 2004 and 2009 I excavated an installation of the Early Roman Empire identifiable as a tannery. The value of this site is that it provides a later group of buildings that is nonetheless comparable to that currently being excavated in Pompeii (as discussed above): the association of a tan mill and a tannery.

6. TRADE INFRASTRUCTURE: FROM MEDITERRANEAN PORTS TO DESERT ROUTES

The Port of Telo Martius

From 1985 to 1993, I directed extensive rescue excavations in several areas of the city of Toulon. These were made necessary when construction work on a conference center, underground parking and residential buildings uncovered several hectares of the urban fabric of the ancient port of Telo Martius. Telo was not a city per se, but rather a secondary conurbation of the city of Arles, whose

territory extended along the coastline between the mouth of the Rhone and the islands of Hyères. Excavations identified both the harbor basin (which yielded, along with vast amounts of ceramic artifacts, five shipwrecks), wood and stone wharves and piers, shops opening onto the harbor, a network of streets, dwellings, an inn, a bakery with a water mill, warehouses and public baths. All of these remains are datable between the late 1st century BC and 5th century AD.

The Ports of Cumae

In 2000, when I was appointed to the Jean Bérard Center in Naples, I was in charge of a research program in Cumae, the primary objective of which was to search for harbors evidenced in literature but now invisible. Cumae is the oldest Greek colony in Italy: it was founded in the second half of the 8th century BC by people from the island of Euboea; with its ups and downs, the city developed during the Archaic, Classical and Hellenistic periods, reaching its greatest extent in the Early Roman Empire and retaining significant importance through to the Byzantine era. The Archaeological Superintendence of Naples and Caserta successively funded research projects to conduct an investigation of the depression south of the acropolis and to the north, along the banks of the former Licola lagoon. Excavations began in 2000 in the southern part, and significant buildings from the Byzantine period were unearthed. Since 2001, research has moved to the northern part of the site and was particularly intensive in 2001-2002 and 2005-2006, with excavation campaigns which lasted between 8 and 11 eleven months a year. Between 2007 and 2012, the work aimed to supplement data for the final publication. Four hectares were surveyed superficially, with some points excavated deeply, resulting in a powerful 6-metre deep stratigraphy covering the whole of the first millennium BC and the first millennium AD. Work focused essentially on clearing the area in front of the ramparts' north gate. Deepest was part of the Iron Age necropolis predating Greek colonization. In the course of the first half of the 6th century, when the walls were erected, the area was re-occupied by an extra-urban sanctuary which was in use for five centuries. In the first half of the 1st century BC, the construction of a large sewer partially destroyed it, and the area subsequently became a necropolis containing monumental tombs and columbaria (68 tombs were excavated, some looted, others intact). In 95 AD, the Via Domitia was built between Rome and Pozzuoli; it was in use throughout the imperial period. The funerary monuments were mostly destroyed at the end of Antiquity to recover building materials and metals.

Projects Kymē 1-3 thus shed light on the environmental history in the long-term resolve, and to solve, albeit with a negative answer, the question of the location of ports. It turns out that the cove south of the site could not have been used as a harbor since, as early as the archaic period, the potential site for a port was a beach. Any harbors must therefore, at least from the classical period, have been sited on the east coast of the cape, between Pozzuoli and Miseno.

Caravan trails in the Eastern Desert of Egypt

From 1993 until 2013, a team of papyrologists led by Hélène Cuvigny (DR at the CNRS) and archaeologists including Michel Reddé (EPHE) and I was set up to

explore the forts built by the Roman army along the caravan trail leading from Coptos/Qift to the Red Sea. From 1993 to 1997, we worked on the Coptos/Myos Hormos (Kosseir) trail, searching seven quadrangular forts with a central well and outlying barracks. Built during the Flavian period, they were mostly occupied until the Severian period.

From 1998 to 2009, our research moved to other trails in the Eastern Desert, including one linking Coptos with Berenice, another Red Sea port. A first fort, named Didymoi, built under Vespasian and continuously occupied until about 250, was excavated in 1998-2000. A second fort, named Domitiane and later Kaine Latomia, was surveyed in 2001-2003. Further north in the mountains of Mons Porphyrites, it served as a center for quarrying granite belonging to the Emperor. Occupied from Domitian to Antoninus Pius, it is part of a complex comprising two quarries, a quarrymen's village, stables, forges and a temple.

From 2005 to 2009, we explored two new forts on the road to Berenice, on the same latitude as Edfu. One, Bir Beyzah, dates from the Flavian period; the other, built in 115 AD, was called Iovis. Occupied until the mid-3rd century, it featured wells, cisterns, baths and ovens, essential for the maintenance of troops and caravans carrying goods to the Far East or from India and Ceylon.

Research along the outer limits of the Empire has allowed me to connect it with my work on oil and wine in Italy and Gaul in that, to some extent, they are productions from both regions which followed caravan routes on their way to India. Interestingly, I recently identified a new wine vessel from Campania, which probably contained a costly wine, and which I can now follow on its way from Pompeii to Berenice through the Lipari islands. This has given me a finer understanding of all the bustling trade along these roads during the Early Roman Empire, and allowed me to appreciate the extent of its vibrant pathways.

7. TRADE RELATIONS AND HUMAN CONTACTS: EPIDEMICS

The chance of a rescue excavation led me to work alongside anthropologists on the issue of the epidemiology of infectious diseases in Antiquity. In 1989, we excavated a Greco-Roman farm and its cemetery on the site of a residential development in the town of Hyères, two kilometres from the Greek colony of Olbia (Var). One of the tombs, dating from the 4th century AD, contained the skeleton of a pregnant woman with a perfectly preserved foetus. A thorough study showed that the foetus featured bone alterations which can only be explained by primary congenital syphilis. This is no ordinary finding: since the beginning of the century, the prevalent theory was that venereal syphilis was inexistent in the Old World and had been brought back from America by Christopher Columbus' crew in 1493.

I therefore explored the occasions in which Mediterranean peoples experienced direct contacts with sub-Saharan Africa, where we suggest the original seat of venereal syphilis was located, and under which sociological conditions endemic treponematosis may have mutated into a sexually transmitted disease. Inspired by Hudson's theories, I developed the idea that the urban civilization of Greek - and even more so Roman - times may have formed a favorable environment for the mutation. The disease may have developed to some extent during the Imperial

Period before becoming almost extinct in the Early Middle Ages, as a result of the demographic depression and the arrival of new, exempt populations. The low number of confirmed syphilis cases may be due to a combination of several factors: the use of cremation, extensive destruction of archaeological skeletons (notably in North Africa), lack of paleopathological studies and short life expectancy.