THEN, THERE WERE MINES

Some Sidelines

Margaret Davies

2020

Why “Some Sidelines”?

Before I had finished Volume 1 of **Then, There Were Mines** it was obvious that my research was unearthing intriguing – but not immediately relevant – areas of interest. None of them seemed to quite fit into the main narrative but were worthy of note in their own right.

The first of these, “Señor Santamaría’s Journey”, tells – in the voice and style of that time – of his visit to the Sierra Almagrera 120 years ago.

And so **Some Sidelines** grew ...

Contents

Señor Santamaría's Journey.

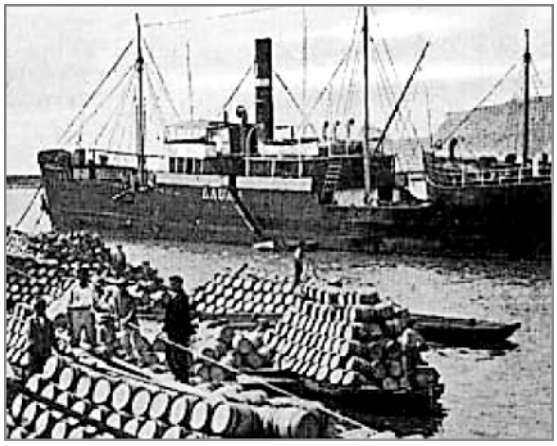
Preface.
I found the following article posted on the web. Making every effort to maintain the author's flowery style, I have translated it from its original Spanish. I surmise that Santamaría was a member of that class of young men who, at the turn of the last century, had independent means and could afford to travel wherever their fancy took them. Despite his high rhetoric and flights of fancy he did at least recognise the travails of the miners themselves. In his article he was courageous enough to describe, in quite graphic detail, their working conditions. I doubt that this won him many friends among the shareholders of the mining companies despite his flattering observations of their industry and innovations. So much of what he describes is still visible today. Follow in his footsteps up the Jaroso Valley to Pico Tenerife and along the ridge to Pico Iberia and then down to El Arteal, where the same abandoned Jaroso pumping station, ruins of mines, unfenced shafts and stunning views are waiting for you to rediscover them.

Note: Despite further research I have been unable to discover anything else about Sr. Santamaria. It seems that, like so many of his contemporaries, he had a great interest in the Sierra Almagrera. In 1901, despite the difficulties of travel, he made the journey from Almería to the Sierra. Once there, he visited the mine Venus Amante and the El Arteal pumping station where he observed the installations and the living conditions of the miners. He recounted his experiences in an article published in ***La Crónica Meridional of August 17- 21 1901****, titled* ***'From Almería to the Sierra Almagrera.'***

It is certainly not my intention to collect impressions of a journey, to make new discoveries, nor to record unknown things. It is, simply, the wish to summarize in a short space my own impressions, formed from seeing things for the first time, appreciating, admiring and slowly and carefully studying them.

The idea of visiting this much talked about region, the region which held the most fantastic attraction for me; the region which, in itself, represented greatness, the embodiment of power and wealth; the region which was the object of many anxieties, struggles and hopes, many satisfied desires and many bitter disappointments. As I said, that idea had for me a certain irresistible charm, a certain strong attraction, not just for now, but ever since I first heard its name. So it was that my satisfaction knew no limits when, on the 12th of this month, I took my seat on the Vera mail coach and was shortly on my way to the mountains.

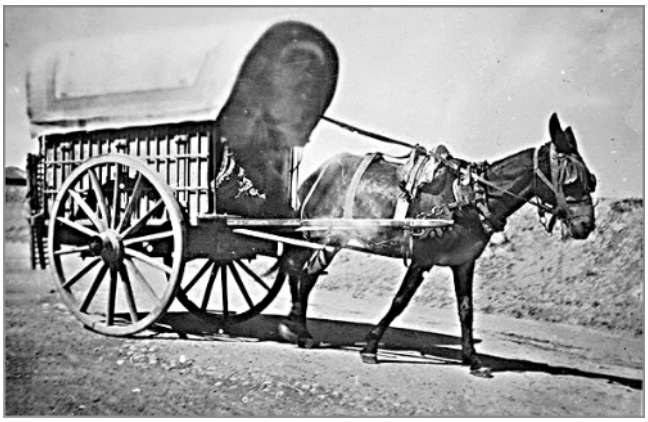
I briefly record the inviting impressions and contemplations of the unfamiliar places seen on the way. No wonder the Almería plain enjoys such fame and with good reason for it comes from the importance of its grape crop. Seen on both sides of the road, even beyond Rioja, the immense vineyards which, to the right and left extend like a green savannah as far as the eye can see. It can be said without fear of contradiction, this magnificent crop, shows vividly and eloquently the grape fever. That fever where nothing comes before the cultivation of the fruit so precious and so lucrative on the English market.



Loading barrels of grapes bound for England, at the port of Almería. From 'El Puerto de Almería' by A. García Lorca.

Shortly beyond Rioja, in the Terrera de las Palomas, the light of day fades and soon darkness falls. The lantern, which the coach has mounted on its roof, brightly illuminates fugitives on the road, drawing in the shadows, silhouettes of horsemen. The jingle of the bells induces drowsiness and the traveller cannot escape the dreaminess as the eyelids droop.

Occasionally the vehicle stops to change horses, then continues on its way, until it enters Vera in the early hours of the morning. From here, to go to the mountains, the traveller takes a trap, which travels for an hour along a road, on whose sides are large fields of maize, until reaching the left bank of the Almanzora. From here the landscape changes, passing into the gentle foothills of the Sierra.



A tartana, or trap, of the type which Santamaría would have travelled in.

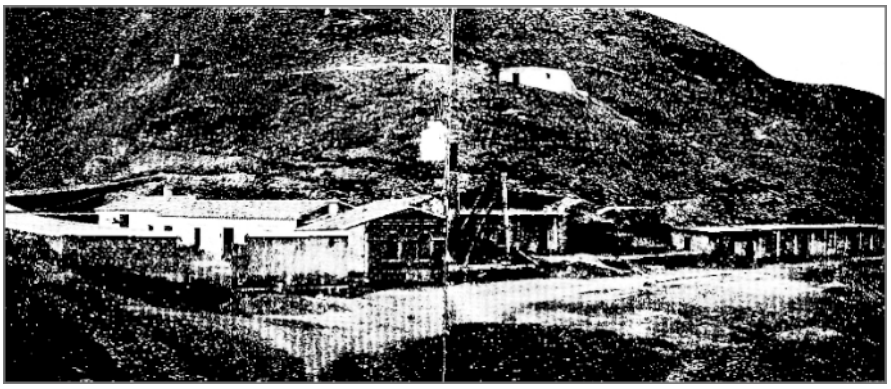
On arrival at the hamlet of Los Lobos, proffered to the travellers gaze, is the immense mound of the Sierra Almagrera. Crossing the Rambla de Muleria and, following the winding path, the tartana that is conveying us starts the ascent. The full force of the heat is felt and the dust raised by the mules contains so many mineral particles that it shines in the sun. In truth, it is worth noting the neglected state of the track, heavy going, uphill and full of potholes. It would be a lie to say that anyone had a mind to fixing it. If each of the mining companies that are served by it, allocated at the end of the month, two or three workers, and took advantage of the massive amounts of slate rock which is everywhere, it would be possible to totally repair the entire length of the track. From its start on the left bank of the Rambla de Muleria as far as the Plaza del Jaroso, a length of approximately half a league, finishing near the San Roque mine, it would be accessible by carriage. From the plaza, situated at a height of 100 meters, the climb to the top is via a wide steep path.

The approach to the Plaza del Jaroso, where in days past, a Saturday market was held.

The opposite approach to the Plaza with the ruins of the Virgen del Carmen's chapel on the right.

Author's photos.

From the Plaza de Jaroso, you can see, on the other side of a narrow ravine, the Almagrera pumping station buildings situated in the area closest to the Rambla de Muleria. Nearby are many washing floors which took advantage of the water raised by the pumping station. All that can be seen today, where once there was life and activity, are the ruins of two large buildings with no indication of movement or work. Continuing the ascent, we left behind, on either side of the Jaroso valley, the mines Ánimas, Esperanza, Constancia, Virgen del Mar, Unión Primera, Dulcinea, Montserrat and Niña until we arrived at the Collado de la Muerte. Here, situated at 300 metres above sea level we found the mines San Andrés, San Torcuato and Venus Amante.



Montserrat then and below, as it is today.

The ruins of San Andrés above Montserrat at the top of the path.
Author's photos.

From this last mine the landscape is beautiful. Rounding the small height on which Venus is situated one discovers the sea, stretching from the South to the East. From this point, Villaricos and Garrucha on the shoreline look like two white spots standing out against the foothills of the mountains.

Description of a mine: Venus Amante.

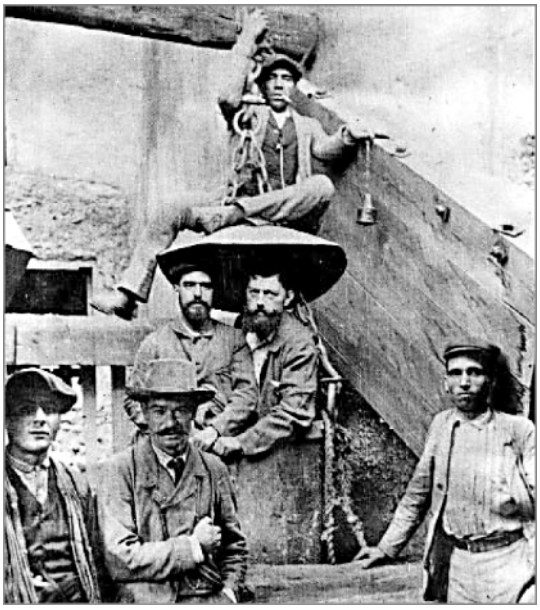
Two views of the mine Venus Amante.

Author's photos.

Let me tell you something about this mine, that is I will detail my impressions, which, to be frank, were very different from how I imagined it to be. I can't quite define them as I have nothing to compare them with. I can do no more than describe that which I saw and of the insight which it gave me.

Concerning Venus Amante, the mine which I visited. Next to the building housing the machinery, the main shaft yawns, its mouth surrounded by a masonry wall. From this wall rise four pillars, which in pairs support the pulley sheaves over which the cable runs. Attached to the end of it is the metal tub which we are to enter to make our descent.

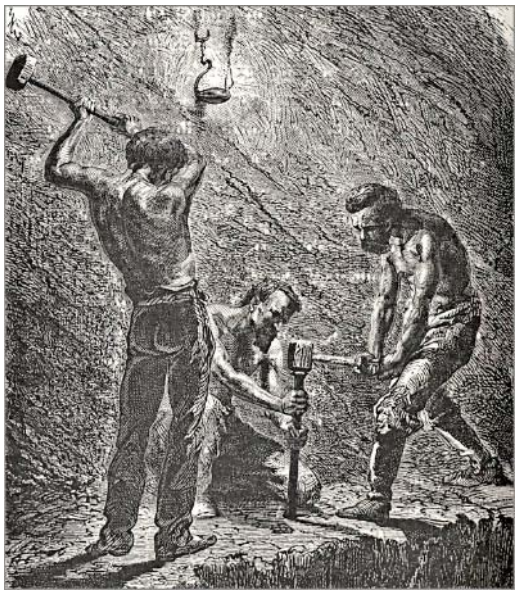
Such an operation could not be more impressive! Slowly the sheaves started to to rotate and the tub started to descend over the collar at the mouth of the shaft, which became little by little narrower. Below, the darkness of the very deep shaft was illuminated by the candles which we had been given. In the uncertain flickers of light the minerals reflected as flashes on the walls of the shaft, which became more noticeable as we progressed. Finally, at the end of 15 minutes, the tub touched the bottom of the shaft at a depth of 387 metres.



Making the descent. This photograph of the engineer Manuel Figueras de Vargas (bearded, on the right) making a descent at El Pinar, Bédar in 1895 is from 'Memoria Fotográfica de Garrucha 1838-1936' by J A Grima Cervantes.

A gallery opened on one of the sides, in which could be seen tools for work, done in the bowels of the earth, in artificial light, portraying the quest for enormous riches, the pursuit of great wealth. By a labyrinth of galleries more or less narrow, ventilated, feeling sometimes cold and other times suffocatingly hot, we arrive at the place where all the hopes and efforts were focused. The cross-cuts, North and South in which the vein is found embedded in slate and other rock.

Work seems impossible at such depths, however, here the worker spends the best part of 24 hours a day, struggling with the drill and the pick to break away the granite which surrounds the precious silvered vein. There, the worker feels the dynamite explode, the demonstration of human strength, breaching and breaking that formed by nature. His is the strength that extracts the riches, but it is others that profit from it. And it happens that, as in other things, they see the vein, they look on the product of their labour with indifference, without any kind of ambition. A strange maxim but true; sometimes, what arouses aspiration, causes indifference if, after close handling, one doesn't see any benefits!



The manual boring of a hole to take an explosive charge.
Simonin.

I was in the mine for a space of four hours, always witnessing different workings, old, new, and abandoned workings, where the vein once discovered, then exploited and now peters out in the sterile. New workings, where the vein offers future riches running ahead, flashes of it caught in the candle's flickering light. Workings, in short, where the hopes of the Venus shareholders are pinned, for good reason, to soon have the reward of the many sacrifices.

At the end, having seen all that there was to see, the signal was made and we got into the tub which had lowered us to the workings three at a time. The machinery started to tension the cable suspended over the void. Moments of anxiety, in which ones imagination considers the heights of audacity of man who, constantly defying death, on the wings of his ambition, spares no means to prise from the earth, the secrets and wealth hidden deep with it.

Finally, we arrive at the top, the daylight streaming over the shaft illuminates us. We feel as if our spirits have been lifted in the presence of such splendours as we were privy to in the last four hours.

My particular aim, but not the real reason for my trip to the Almagrera, my innermost desire was satisfied. I now knew about the land of lead and silver, and also of one of the richest mines in the Sierra. But, I must confess, what a disappointment I experienced! Before I saw it, I imagined it as something else. I thought that a mine would be bigger than the one that I had been down; I thought that the Almagrera was something like Peru or Potosí, where the precious metal, the obsession of the mine owners, was to be found everywhere, within easy reach, needing no great effort to find it. On the other hand, I thought of the Sierra as a land of ambitious undertakings, where the noise of gigantic machines, in harmony with the purpose for which they were invented, filled the air with their continuous, deafening movement. I figured I could hear the incessant vibrations of those iron contraptions roused by the fever of riches; the hubble bubble of an immense multitude. All this and more, that I cannot define, I was expecting to witness. But, when fact overcame fiction, when reality was presented instead of the fantasy picture that my mind had created, the disillusionment could not have been greater.

Yet, something remained of those flights of fantasy. The work season had finished, the worker resting from four months of hard labour. The chimneys no longer belched into the air the black clouds of smoke that signalled movement and mechanical life. The tubs, lying next to the main shafts, looking like immense, abandoned pots. The cables wound round the drums, waiting after the break, the opportune moment to carry to the bowels of the earth the valiant, devil-may-care worker. All, for the moment, calm and tranquil, however, the spirit of life, of labour and of work breathes over everything.

To the stillness of the recess from the season of work, comes the action which makes sense of all the efforts, the feverish activity of reaping the rewards of the many days of anxiety, of hopes, of calculating and of dreaming.

All along the winding track from the Rambla de Muleria to the top of the mountain, numerous mule trains go up and down, carrying on their backs small baskets containing the mineral wrested from the bowels of the earth. They say that this to and fro, this incalculable wealth, sings a hymn of triumph of man over nature, a hymn to work harnessed to ambition.

Immeasurable wealth, which represents heavy sweat, great danger and exhaustion; at the end of the day, riches, in tiny, bounded fragments, coming to the surface of the earth in whose depths they have long been entombed, to become part of a better, more profitable life, by the acumen and enterprise of men other than those who wrested them from the ground.

As is so often the case, there is a marked contrast between the mine itself and the miner who works there.

The Miner.
How does the miner, who, for 18 hours of the day's 24 is entombed several hundred metres underground, and, by the uncertain light of an oil lamp, follows, using his pick and drill, the coveted seam which snakes tightly and brightly between the surrounding rock, identify himself with all those riches? He looks at them with indifference, and continues his work, heedless of the fact that others will benefit, with hardly any effort, from the fruit of his labours. This worker, a titan, imitating an inhabitant of Pluto, naked, herculean, battling without rest the hard stone that holds fast the vein. Breaking it by the force of his hammer, he teases it out with the pick and the drill and finally manages to free the trapped silvered metal. Naked from the waist up and from the thighs down, the miner performs his laborious task in the midst of his baking surroundings, in a contaminated atmosphere, rarefied by the burning lamp oil, the dust and smoke of the explosives. That worker, glistening with sweat, blackened, singing happily as he works, and, when his strength fails, the gang-master and the foreman force him to swing his pick anew.

Working a seam.

He has a certain amount of time to excavate the stipulated number of metres of gallery, he has to burst in order to fulfil the contract. It's a pittance looking for a penny in these caverns, where for the fabulous wealth he extracts, the miner receives six or seven reales plus board.

From afar, that is to say, having no knowledge of what mines are like, the idea of full board for a worker holds a certain attraction, giving heartfelt comfort, knowing that while the wage is petty, at least the miner's food will be plentiful and nutritious.

Illusion! Delusion!

Apart from what we have already hinted at, in this the contrast between the owner and the miner is most palpable. In the morning, before starting their heavy work, the men are served with what in the Sierra is called a broth. This broth is made from hot water, a drizzle of oil and a little paprika and other spices; into this soup is crumbled a little bread, and … nothing else. At lunchtime they eat a stew of spiced rice with potatoes and beans and … nothing else. And, for the dinner, the same soup as they had for the morning. That is all the food for the men who, far below ground, exhaust their strength and their energy, all for chasing at great depths the rich veins which others capitalise on in order to spend, achieve and have a good life.

It often happens that the catering contractor for the miners gives them rotten bread, impossible to eat, and as the bread is the sole nutrient in the workers' food, so it is that on days when the bread arrives bad, the miner does not eat.., but he does work.

Such is the contrast. Those who work more or less non-stop, poorly paid and worse fed; they are everything, the hand that delivers the looked for and counted on wealth, the hand which pulls it from the depths where it is found and raises it up to the surface, where it becomes a thing of comfort, luxury and ease. Nevertheless, lacking everything, each one exposed to countless dangers, seeing death close by, waiting to feel their bodies torn apart by the blast of an explosive, living content, relatively happy within their limited aspirations they are bound by their work.

A sad end, where many are obliged to give of their abilities, moral and physical, to meet the needs of a life filled with pain and bitterness.

The illustrious story of the Sierra Almagrera also has its dark side. Man's blood has, many times, stained the argentiferous lode, which winds waywardly in the uneven veins. Each mine has its share of sadness and tears. Each mine holds bitter memories, reminiscences of painful events, which, in an instant, brought mourning and desolation to many homes. Amongst the mining people, the mine with the most reported deaths is viewed with suspicion. There are those who count them in hundreds. And all are similar. In one, the cable snaps, casting to the bottom of the shaft the tub in which three or four men are being raised. In an other, a distracted winch-man, by tightening the cable, causes the tub to reach the pulleys where it circles, throwing out the miners who are in it. In others, the driller who sets his charge and tears apart several of the work children. In yet another, a gallery collapses, burying and suffocating in its bounty the unlucky miner who only receives this miserable reward.

The ruins of the hospital in the Jaroso where injured miners were tended. *Author's photo.*

And those who live, those who every day leave the sunlight, the translucent sky, the joy of the play of light, and the delight of that which exists above ground; those who can't thank the Lord enough for keeping them from harm, those, who, when passing in the vicinity of a blood-stained mine grow pale and turn away, fearful. They shy away from the pull of the danger that they consider irrevocable, thinking of their homes, of their parents or wives or children, and unfailingly they say a fervent prayer for the souls of those who perished deep underground, torn apart, never to set eyes on their loved ones, and whose sorry remains rest, united again, beneath the white slab watered by the tears of those that mourn them.

The exploitation of the Sierra Almagrera.
The lust for money, which goes back to the early days of the Sierra, brought men to this special area to stake claims, more numerous each day. As soon as the mines were demarcated and brought into operation they struck rich seams, all, or mostly all, of the same type of metal. So, minute by minute, the fame of the Sierra Almagrera grew, a new Klondike, where those who had interests and those who had not, saw in it the realization of their dreams of gold.

The land responded to those first formed hopes, with fabulous returns it allowed the enterprise and investment to flourish and the Sierra Almagrera was the emporium of power and wealth. Mine shares within its folds were worth their weight in gold, and for a long time, before the inundation, it was the place for reckoning and recompense. The flooding of the Sierra back in ’84 and ’85 was the death blow to many of the mining and processing establishments there. The lowest and richest mining companies saw their workings flooded and for several years the area was just a shadow of its former self. What was dead now returns to life with new vigour, with greater energies, with more strength and power, offering again to men the immense riches of its hidden treasures.

It would be a long and arduous task to list all of the mines nestled in the mountain range. Their topographical positions cause them to qualify as first or second class. To the first belong: Medio Mundo, Venus Amante, Ramo de Flores, Dos Mundos, Asalto, Riojana: Eloisa, A Mesías, Guzmana, Elena, Fuensanta, Rosario, Santa Isabel, San Agustín, San Manuel, Convento, Ánimas, Constancia, San Luis Gonzaga, and others; and to the second: San Antonio, Carrascosa, San Ildefonso, Esperanza, Estrella, El Globo, Madrileño, Los Altos, Florenciana and many others of little importance today, but which initially were thought to be worthwhile. In June there were 276 mines registered in the Sierra, of which two thirds are in operation.

It often happens that when carrying out exploratory work in a mine adjacent to a rich mine they follow a lode which turns from them to run into the neighbouring mine, where all of their efforts are wasted. Or, by a ridicule of luck, the rich, coveted lode, which in one mine is exploited with magnificent results, is lost in the sterile when it reaches the boundary of the neighbouring workings. Because of this, after a few trials the workings are completely abandoned.

And, as I have had occasion to observe, this abandonment is so utter that the societies set up to explore these mines, when leaving them also flout one of the most stringent regulations of the Mining Inspectorate: the main shafts remain open, with no wall around them, inviting accidents. Of such mines, I counted 8 or 10 along the route taken from the Collado de la Muerte to El Arteal. Serious, imminent danger which should be avoided at all costs, and in the worst circumstances these abandoned workings can be found on the sides of the tracks and narrow paths which circle the Sierra.

One of the many open shafts on the way down to El Arteal.
Author’s photo.

Except in this last respect, following the thread of my impressions, I could not and can not do other than admire the fabulous richness of the region. I have seen how in principle mines are exploited, yielding the predominant mineral in the Almagrera, argentiferous lead, after these veins are exhausted, finding in other extensive, widespread workings estimable amounts of iron, in sufficient quantities to defray the costs of its exploitation, and yielding to those who work them sufficient wealth to compensate for the exhaustion of the initial lodes. Mines of this class are few and far between, but they do exist and are in production today and the recording of this fact, I believe, is enough to demonstrate in a palpable way how far the metallurgical wealth of the Sierra Almagrera goes.

Great ideas only have a place in the minds of the privileged, the big companies are only formed by great imaginations, which in this case were lofty, daring and magnificent. A cataclysm, an unexpected phenomenon, a geological revolution was the reason that in the year 1884 Sierra Almagrera lost its prominence in the industrial world.[(1)] The in-rush of water flooded the mines which were being exploited with growing success, and within a few days the most absolute silence reigned throughout the area. The machines no longer worked, mechanical motion was no longer visible, that hectic activity that demonstrated the power harnessed by the big companies. Everything was calm. The solitary buildings looked like abandoned tombs, the mine chimneys, the advance guards of the death, rigid, unshakeable, watching over the place where before reigned life, movement and animation.

That cataclysm was like a lesson given to man by Nature. A lesson that entailed the eloquent manifestation of an indisputable power before the audacity and daring of humankind. The reaction of an almost defeated enemy, who in a surge of energy, in a re-concentration of overwhelming force, returns for the ground lost in the fight and recovers, in a second, that which was snatched during fierce combat.

There is nothing like the work of man in all aspects of life. Gifted with intelligence which he wields as a battering ram against Nature, and by every means trying to subjugate it, defeat it, and bend it to his will, tearing her secrets, penetrating her domains, stealing the treasures that she keeps in the depths of the seas or in the bowels of the earth.

Well it is that sometimes the reaction of Nature so embattled is to show man that the colossus still has the power to win, good that Nature retaliates in a grandiloquent manifestation of her power. Greatness comparable only to the human talent which rises high, very high, in bold concepts and companies, developed in their minds and created in their image and likeness.

For a long time the veil of oblivion covered the region which before had been the emporium of riches, and Sierra Almagrera remained in the memory, as the remembrance of something that was big and powerful. But, as I have said, a daring idea was conceived to return it to its former glory, and since then the mind in which this thought was conceived did not stop it developing, aided by a firm will, by an irresistible desire, by a deep conviction of triumph, by unwavering faith, the founding of marvellous companies which command admiration and respect.

It was a shame to let the main destruction, starting in the workings in the Sierra Almagrera by the invasion of the waters to complete the task and annihilate for ever the concerted efforts and the hopes pinned there. The speed with which the phenomenon occurred and the circumstances in which it happened means that the many workings in the various exploitations in the Almagrera will remain suspended and abandoned for the moment, for many of the mines didn’t even have time to rescue their work tools.

[(1)] The closure of the Jaroso and Francés pumping stations led to flooded mine workings.

Giving up the exploitation of a region as immensely rich as the one which concerns us, leaving behind forever the heart warming prospects that the Sierra formed, in truth was painful to a high degree, and to relinquish the positive gains precisely when the importance of these was greater, and when the future was brighter, for all those who, in one way or another, had interests in the mines located in the Sierra Almagrera.

To record the events that happened concerning the pumping station, detailing the circumstances which coincided with this ambitious project, would be lengthy and tedious, and, in addition, would tell you nothing new, since the facts are already well known. For my part, it is sufficient to record the fact, that in doing so I pay homage, admiration for the actualization of a wonderful idea, which up to this point was practically unknown to me, appearing, like a dream before my eyes, as something inconceivably fabulous. The initiators of the pumping station succeeded, after a great deal of effort to complete the project, and, little by little, the powerful machinery started working, extracting from the flooded workings the water which was the cause of the paralysis of both man and machinery in the Sierra.

A visit to the pumping station.

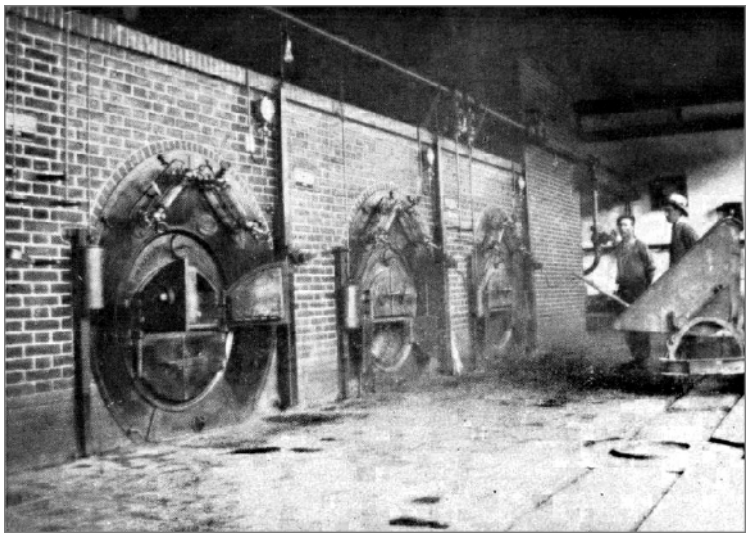
To spend two days at the Collado de la Muerte and not visit the current drainage establishment, seemed highly incongruous, even unforgivable. So, making the necessary preparations, on the 13th of this month, Doctor José Rubira, who accompanied me in the Sierra, and I, guided by a workman from the Venus Amante mine, at daybreak started along the path to El Arteal, scarcely a league from where we were staying. Rounding the hill which is in front of Venus Amante, and which like an immense curtain conceals most of the landscape, was revealed to our eyes the wonderful panorama that from those heights awaits us. In the foreground is the enormous expanse of the sea, to the left the foothills of the Sierra with the steep rough slopes reaching down to the shore, where a lovely lacy foam is traced and, to the right, Villaricos, first El Arteal and after, Herrerías, then Garrucha, as a white spot standing out against the darkish blue of the sea which dies at its feet, and on either side the brownish background of the mountains on whose slopes it lies; and lastly, the foothills of the mountains which disappear in the distant horizon under the morning mists.

The view from Venus Amante.

We went down a narrow path, leaving on either side a whole host of mines, some abandoned and some being exploited, until we reached the Rambla de Muleria, at the end of which we caught sight of the pumping station buildings. Then we lost the desperate uniformity featured in the Sierra due to its lack of

vegetation. To the right of the rambla, in a flower garden was the house of the society's director, Mr. Charles Brand, and a little way off the machine gallery. I was in front of, and in the presence of, the audacious construction that I knew by reputation; work of a fertile imagination helped by mighty labour, put to the service of another more momentous task, of greater importance; a company which represented the salvation and redemption of the Sierra, opening the door to a bright future.

We sent a message to Mr. Brand and shortly the gentleman appeared before us and gallantly offered to accompany us on our visit, showing us all the buildings on the site which today holds and encompasses the hopes of all the miners. As I said, near to Mr. Brand's house is situated the boiler room, housing four boilers, each 75 horsepower, which operate at a normal pressure of 10 atmospheres. From these boilers run pipes which carry the steam to the machines, which at a depth of some metres act to extract the water. To the side of this building is the cage shaft, 118 meters deep, which goes down to the gallery housing the water lifting machines.



The boiler room in 1901and below, all that remains of it today.

Author's photo.

On entering this gallery situated on the right of the cage shaft, we see two mighty, 300 horse power machines, which work constantly to extract the water. From these machines run pipes which connect with the latest artesian wells, recently built at a depth of 45 and 60 metres lower than the receiving gallery, and, through which flows water at a rate of 350 cubic metres per hour and at a temperature of 45 degrees. In light detail, this is what is comprises the first level of the pumping station.

The second, somewhat distanced from the first, is located to the left of the Rambla del Arteal, and is reached via a 225 metre long tunnel running into the mountain, at the end of which are found the huge boilers which activate two great air compressors, which run the pumps emplaced in the first level.

Above, the entrance to the tunnel housing the compressors.

Right, the chimney above the boilers.

Author's photos.

Mr. Brand showed great satisfaction with the progress of the dewatering and held out great hopes for it.

You'd need to be a mechanic, an engineer to understand all of the importance of the place that we had just visited. Despite my lack of technical knowledge in this matter, something occurred to me that I admired; I can't define it exactly, but all the same I am convinced, and that I had tangible evidence of, that the marvellous, the implausible has been almost achieved and become a reality thanks to the talents of men.

That water, which at high temperatures comes out of the depths of the ground; that powerful vibration of the machines, panting tirelessly; those clouds of black smoke billowing from the chimneys forming capricious clouds which the wind breaks into wisps, and carries away; that synthesised movement of mechanical life, developed in a splendid and daring way thanks to the efforts constancy and talent, represent a triumphal hymn of man over Nature, here defeated, enslaved, obedient to commands, to calculations made in advance.

The dewatering plant is the saviour of the Sierra Almagrera. The thought process has had many phases, it has had many ups and downs, has been the cause of many struggles, of much jealousy, of much rancour. Today it stands powerful, showing with conviction the truth and the reality to those who initially were pessimistic. Perseverance and faith were the powerful helpers of the original and daring idea; faith rolled

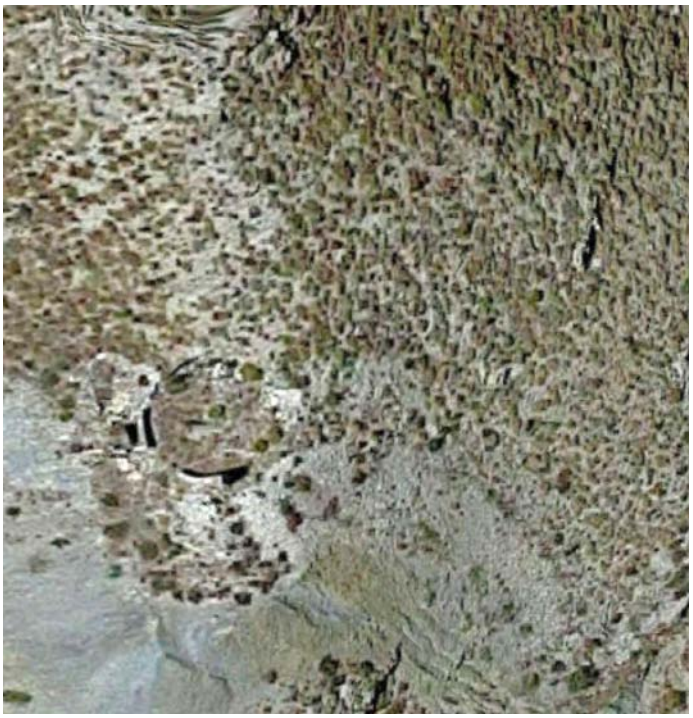
away the obstacles and smoothed over the objections, overcame the hurdles; faith and perseverance united to shield the thought that today seems to be accomplished and to win, to cry a triumphal eureka, gaining an attestation of admiration and respect for the intelligent men who set up the great company in order to drain the Almagrera.

The de-watering plant today. *Author's photos.*

The waters subside, slowly yes, but descend in the workings of the mines in the Sierra. Life returns with renewed vigour, in its bowels are rich seams which offer great returns, giving men from all walks of life a means of development. Returned is animation, heard again is the vibration of the machinery, seen again is the working bustle that it produces. Almagrera resurfaces with its infinite riches, with its incontestable power the dead are awakened. The body is not galvanized with wholly fictitious energy, as one aroused from a long slumber, but one that wakens with twice the strength that it had before, in order to make up for lost time. The future for the Almagrera is shining, man won the contest, and soon will bring out into the daylight, like the spoils of war, the fabulous riches that the Sierra Almagrera keeps fast in her depths.

The Better Baritel

I had read Rob Vernon's Researchgate paper 'Research Notes on Mule Power in the Sierra Gádor', and he knew of my research into mining development in the Sierra Almagrera so, whilst not surprised to receive a copy of an aerial photograph of the Sierra Almagrera, I was delighted with what it showed.



Rob Vernon's aerial photograph.

There was no mistaking the characteristic circle alongside a shaft as horse whim, or malacate, so I forwarded the photograph to Antonio Jódar, who put a drone over the site. The drone's pictures generated quite a lot of excitement in the mining geek community, as it is very rare to find traces of whims in the area. Horse whims, or in this region mule whims, were simple wooden structures, and the only likely evidence of one would be the whim base. This would usually be a central stone with some kind of recess in to allow the mechanism to turn. Quite often, this was no more than a stone with a hole in it. In some other areas, the animals' circular pathway can still be seen as a depression of compacted earth, but in the Sierra Almagrera they left no such footprint.

Whims were simple wooden structures which have left no trace.

You might, if you are lucky, find a stone with a hole in it.

What the drone's pictures showed was that this was no simple malacate, or horse whim, but one where the machinery had been supported and housed in a purpose-constructed, possibly roofed, structure. This type of whim is known in Spain as a baritel, and the only other one that I know of in the Sierra Almagrera is the one at the Virgen de Carmen mine in the Barranco de Jaroso.

A drone's eye view. *A G Jódar*

Baritel de Carmen.

Accessing the site was the next problem as it was obviously in a remote, little explored corner of the mountains. Since it never had a steam engine, a track to it in order to transport a boiler had never been constructed. So, it was over the rough, edging across spoil heaps, and generally keeping one's fingers crossed. Not something that I would have done alone, but it was well worth the effort! Here's what was found.

From below it looks like just any old mine.

As you climb up to it you see that its not.

The whim platform was carved out of the rock.

More than 50% of the walling was county rock.

This 12 metre diameter baritel used the minimum amount of masonry by means of the clever use of the topography of the site. The county rock tapers down to the masonry of the shaft on one side and down to the masonry beam support on the other, even serving as a slight buttress to it outside the circle.

The masonry of the extraction shaft is centre left …… ... and centre right.

The deep seatings for the main support beam, which kept the capstan and vertical shaft centred, are situated in the rock and the masonry wall, and are at right angles to the shaft. Their height, and that of the shaft wall, give an indication of the height of the capstan, while the diameter of the whole structure would indicate its diameter.

The beam seating in the masonry.

The beam seating in the rock (circled)

Look what I have found!

And, just where you would hope to find it, the central stone. Not just a simple stone with a hole in it either! It is a rather sophisticated affair, which would have had a metal plate in it similar to the one below right.

Central stone.

Whim base.

It is not clear whether the structure was roofed. There are various small holes in the rock surround which could have been roof supports but equally, they could have simply been supports for an esparto covered partial canopy.

The extraction shaft itself is quite small, measuring not much more than 2 metres by one metre, but its housing has much larger dimensions and was once a very elegant affair. It had arched extraction openings on three sides, and the remains of the arches can be seen in the rubble where the walls have fallen outwards.

Above left, the shaft.
Above, shaft housing.
Left, the remains of one of the arches.

Below the actual baritel is the remains of a forge, with bits of charcoal lying around the remains of the hearth. Metal artefacts, possibly made in the same forge, were found, one of which was identifiable as part of a mule's bridle.

Metal objects found around the site. In the centre, part of a mule's tack.

Below the forge is a latrine, a proper stone built toilet. O.K., so it doesn't have a nice wooden seat, but that's not to say that it never had one, however it never had a flush. While there may have been other pit head toilets in the Sierra, this is probably the only one that can be positively identified as such. (Workers' sanitation was not a priority for mine owners.)

Two 'loo' views!

So, what do we know about this site? For the moment its name and location is classified information. Its an old site that wasn't worked for very long. This is evident from the amount and particle size of the spoil surrounding the shaft. When the well known concessions plan was drawn up, the site, which was probably abandoned even then, fell in the small area between the borders of three adjacent large concessions and is not shown. Apart from scavenging any metal, and of course the timbers, the site was of no use to any of its neighbours. That is not to say that it wasn't encroached on underground, where no one could see, but that is by the bye. So here in the 21st Century, we have still have the remains of this wonderful structure which I hope that you too will be able to visit in the near future.

"*Occasionally the whistle of some machine, the characteristic tic-tac of some whim, or the singing of some miners, remind the traveller of other scenes, of a very different nature, within the bowels of the earth you are walking on.*"

J. Pie y Allué, Mining Engineer, Sierra Almagrera, 1883

El Arteal.
Its Bricks and Mortar.

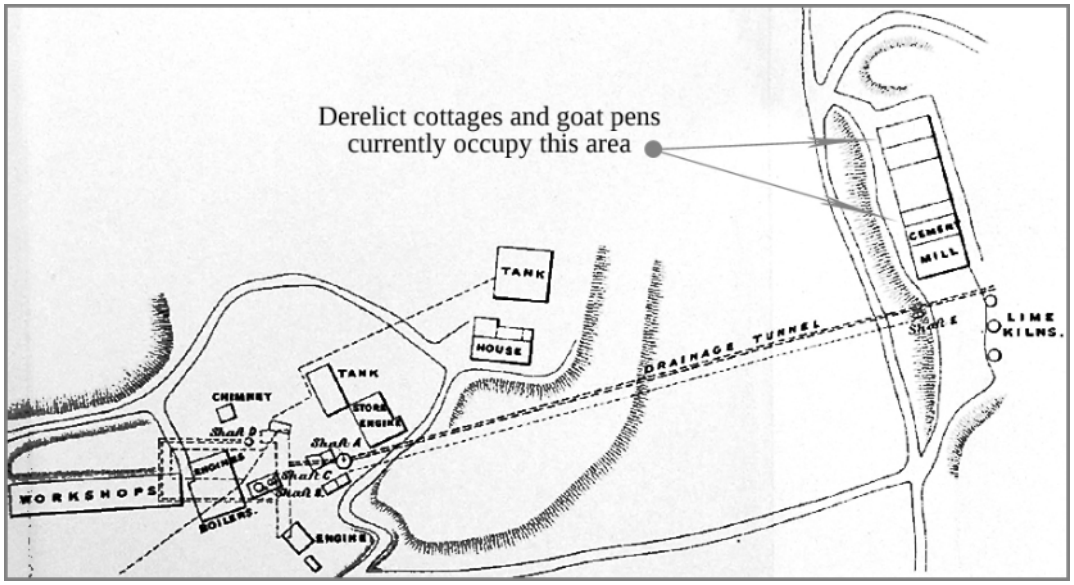
In 1894, when work began on the el Arteal pumping station, brick and lime kilns were constructed in order to make the necessary bricks and mortar. Making bricks on site had great advantages, as the exact size and shape could be specially made for what ever they were required for. This was particularly useful when lining tunnels and shafts, and when building chimneys. Clay, similar to London clay, is found in abundance along the foot of the Sierra Almagrera, where it is layered with conglomerate and sandstone. The bricks used in the Jaroso buildings and underground workings were made at el Tomillar, using the plentiful clay found there. The clay used for the el Arteal project was probably dug from the area beyond where the bath houses now stand, the base of the incline plane, or near to the quarry on the top road to the bath houses.

Possible sources of the clay and brick kilns.

The position of the brick kilns is marked on the 1908 plan of the area. They were somewhere near to the pictured, circular structure above the Rambla del Arteal. There is no trace left of them.

Circular structure on the possible site of the brick kilns.

The engineer, Gustave Charles Reinhold, worked on the early part of the construction of el Arteal. In 1898, he presented a paper about the project to the Institution of Civil Engineers in London. In it was a diagram showing the position of the lime kilns and that of the adjacent cement mill.

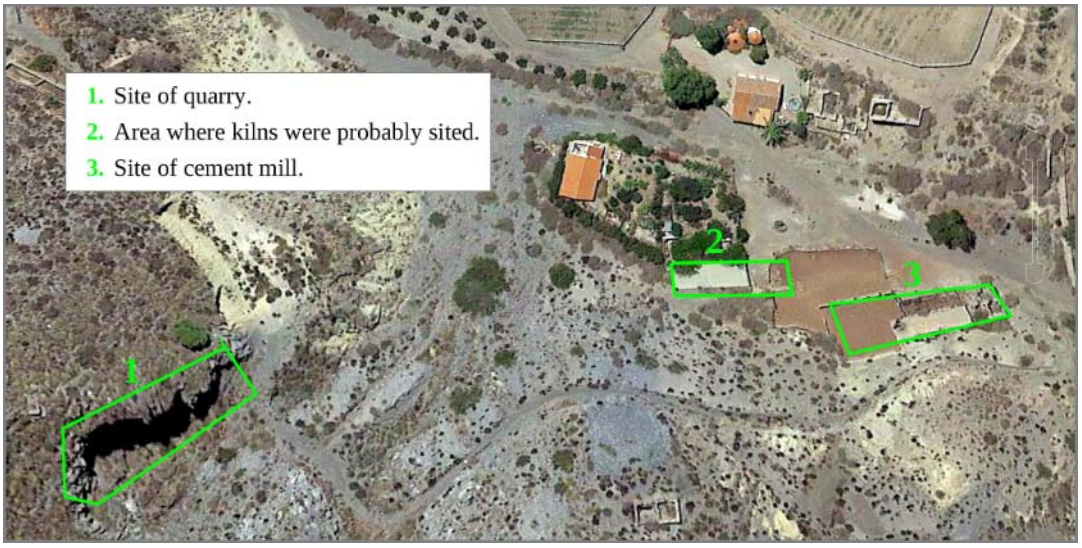


Reinhold's diagram showing the position of the lime kilns and cement mill.

Of the three lime kilns, all that is visible today is the remains of either a buttress or the wind shield of one of them, incorporated into the wall of the house next to the entrance to the Casualidad tunnel.

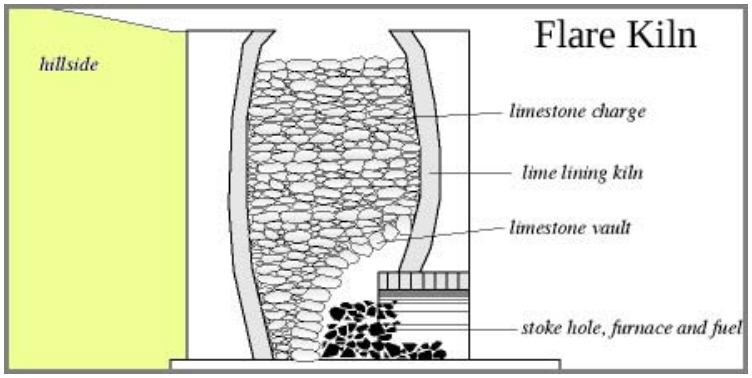
The sloping wall on the right of the entrance to Casualidad's tunnel is now all that remains of the lime kilns.

Classically, lime kilns were built into hillsides, close to a quarry, and near to where the lime was to be used. Those at el Arteal certainly used the lie of the land to great advantage. They could be charged from above and emptied onto the broad flat area at their base. They were also close to where the lime was to be used, which was at the adjacent cement mill. There was a quarry 150 metres along the track above the kilns, but I think that it was the stone used in the rough reconstruction of the buildings that was quarried there. The limestone possibly came from the area to the west of Los Lobos.

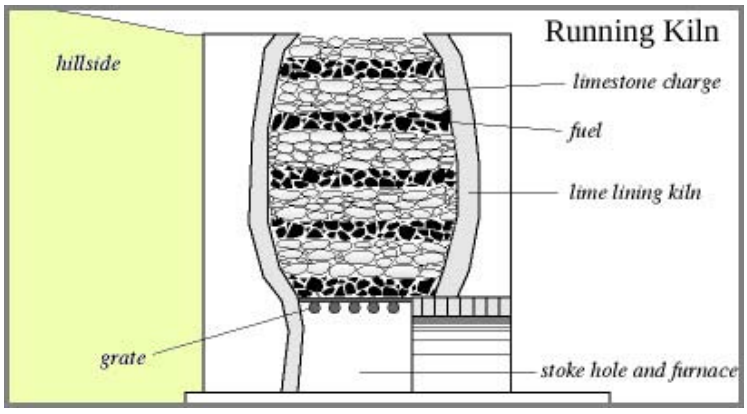


Google screen shot of the position of the cement mill, the lime kilns and the quarry.

The kilns at el Arteal could have been either flare or running kilns. Flare, or intermittent, kilns were loaded, fired, cooled and emptied. Then, the whole process started again. Running, or continuous kilns were, as the name suggests, continuously charged and fired.



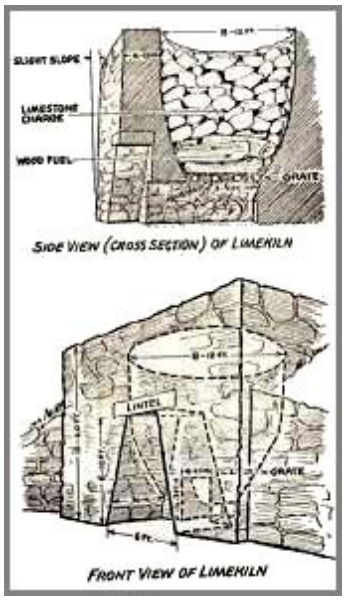
Flare or intermittent kiln.
ucl.ac.uk



Running or continuous kiln.
ucl.ac.uk

The fact that there were three kilns calcining two differing types of limestone, makes me suspect that they were flare kilns, possibly working in series when the demand for lime was high. Three running kilns would suggest production on an industrial scale, producing far more lime than was required for the el Arteal project. Both types of kiln look similar, the boxy shape being given by an outer, stone built casing that contains the tapering, cylindrical oven. The oven, or pot, is lined with refractory bricks, capable of withstanding the great heat. The gap between the oven and casing is filled with ash and rubble.

The casing provides support and insulation, and has an archway beneath the pot where the hearth and draw hole are situated. Both types of kilns are charged from the top and the quicklime removed from the bottom.

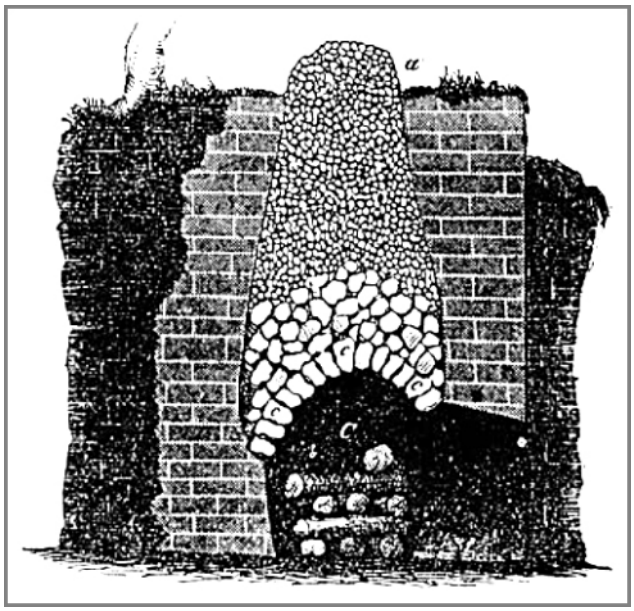


Drawing of a flare kiln
monroehistorical.org

Remains of a running kiln.
newcumnockhistory.com

In a flare kiln, a vault made of large stone blocks is created above the hearth, and a single charge of limestone is placed above it. A fire is then lit, and kept stoked for several days, until the limestone has been calcined. At this point, the top of the kiln is sealed and the everything is allowed to slowly cool down over several days. The contents, which now are 45% lighter, are then removed.

Diagram of a flare kiln showing the stone vault.
vtarchaeology.org



A running kiln has a permanent grate on which the fuel and limestone are piled in layers. The heat from one layer of fuel, dries and pre heats the next layer of stone before it reaches the hottest part of the kiln. As the limestone is calcined the resulting powdery quicklime drops through the grate and is removed, thus giving room for more fuel and limestone to be added to the top.

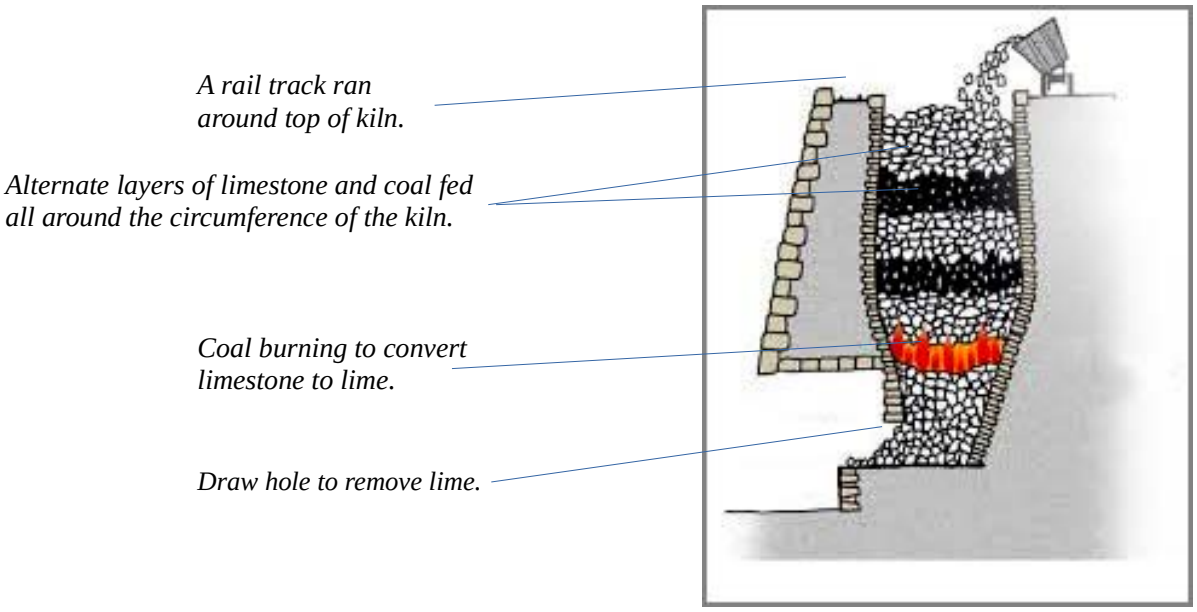


Diagram of a running kiln.
geolancashire.org.uk

The main difference between the two types of kiln is that in the former the limestone charge does not come into direct contact with the fuel. This is the same difference as that between a reverberatory and an ore hearth furnace used for smelting lead.

When limestone, calcium carbonate ($CaCO_3$), is burned at temperatures in excess of 900°C, it gives off carbon dioxide, (CO2) and is converted into calcium oxide, or quicklime (CaO). When slaked with water, the highly corrosive quicklime becomes calcium hydroxide, or hydrated lime $Ca(OH)_2$.

Hydrated lime, more commonly called lime, is thoroughly mixed with either enough water to form lime putty, or with less water to produce a lime powder. As slaking is an exothermic reaction, a dry powder can be produced because excess moisture is driven off as steam. Hydrated lime, naturally turns back into calcium carbonate as it reacts with carbon dioxide in the air. For this reason it needs to be stored either under a film of water, in the case of the putty, or in air tight containers, in the case of the powdered product.

The Lime Cycle. *Mind42*

Whichever type of kiln was used at el Arteal, the fuel was probably imported coal or coke as this would have already been on site to fuel the boilers.. The kindling was most probably dried jara, what we call yellow rock rose, it was the traditional kindling in this area. The Barranco Jaroso owes its name to the jara that grew abundantly there and which, with the healing passage of time, is again flourishing.

Halimium atriplicifolium. Jara or yellow rock rose. ©José Quiles

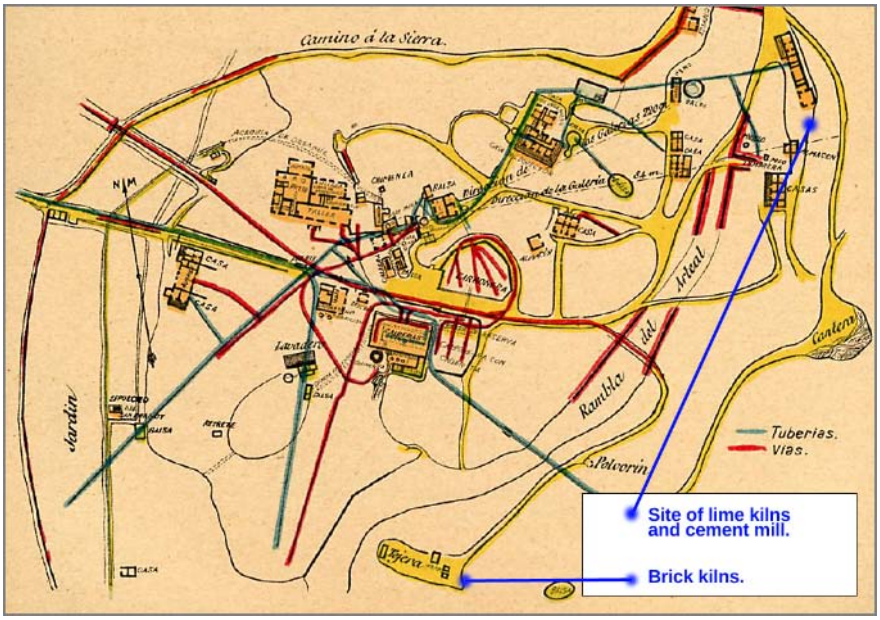
Reinhold had this to say, *"Excellent limestone of two kinds was found in the neighbourhood and was burnt in kilns erected for the purpose. One kind of limestone when ground yielded a hydraulic cement of excellent quality, very quick setting, and attaining in time to great hardness. This was invariably used whenever masonry or brickwork had to be carried out and where the work was interfered with by water, or likely to become submerged soon after completion"*

The availability of this limestone was a boon to Brandt, Brandau and Siret. It was argillaceous, or clayey, limestone which, when burnt, reacts differently from more usual limestone. Clayey limestones contain 15-40% silica, alumina and iron oxide. When burnt in a kiln, lime combines with them to form silicates aluminates and ferrites of lime. This modified stone doesn't crumble and isn't slaked when water is poured on it. Known as Natural Hydraulic Lime, it sets partly by reaction with water, (hydraulic set), and partly by reaction with air, (carbonation). Cement made by grinding this lime would set, even in areas that were wet, and unlike Portland cement needed no further additives.

Reinhold tells us that no special machinery was used to grind the burnt stone. It was simply spread onto a stone floor (probably circular), where it was ground by the action of roller, made of either stone or cast iron, pulled by a mule. After sieving, the ground cement was spread on to a floor and left to dry for about a week, and then stored in bags. Neat cement was used to render the surfaces of anywhere that was intended to be watertight, for example the balsas. Ordinary lime, presumably produced from the other type of limestone mentioned by Reinhold, was added when the setting time of the mortar needed to be extended.

The cement mill was situated where this ruin and house stand today.

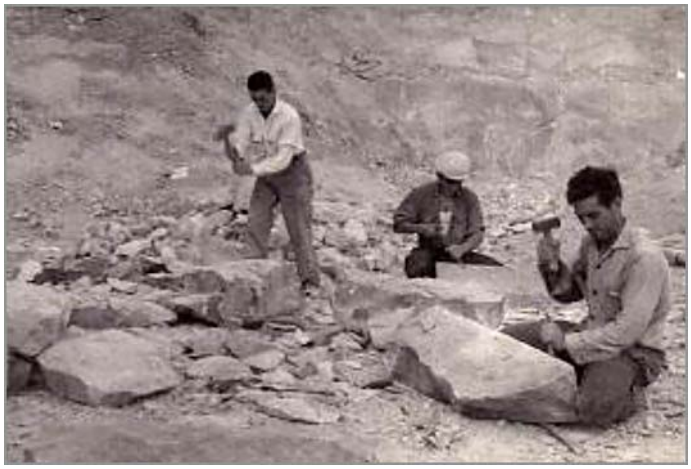
While the brick kilns are shown on the 1908 plan of el Arteal, the lime kilns are not. It is even possible that they no longer existed by the time that Reinhold actually presented his paper. He left the project, probably in 1897, before the tunnel to Casualidad was driven, the entrance to which is on the possible site of the kilns.



1908 plan. *Hastial 2012*

Because of the experience and skill required to calcine limestone, traditionally it was a family business where boys learnt the art as they grew up, working alongside their uncles, cousins, fathers and grandfathers. This poses a question about the operatives of the kilns at el Arteal. Were they perhaps a peripatetic group, who both built and operated kilns for relatively short term projects, such as the construction of the pumping station, rather than the more traditional, long-standing, family affair?

For details about some of the skill that was required to load and operate a lime kiln I recommend buriton.org.uk. Buriton Lime Works and Mr Chitty's Story. If however, you understand Spanish, or have the patience to Google Translate it, the PDF, Estudio y análisi de la utilización de la cal para el patrimonio arquitectónico. R.M.Usedo Vallés, takes you through every stage. From the quarrying and dressing of the stone, through the careful selection of pieces for the arch, and the meticulous placing of the charge inside the kiln. To the laying, lighting and maintaining of the fire, which had to be nursed night and day, until it was time to cap the kiln and allow it to cool. Vallés's paper would serve as a handbook for anyone wanting to revive this lost art.



Dressing Limestone.
R.M. Usedo Vallés.

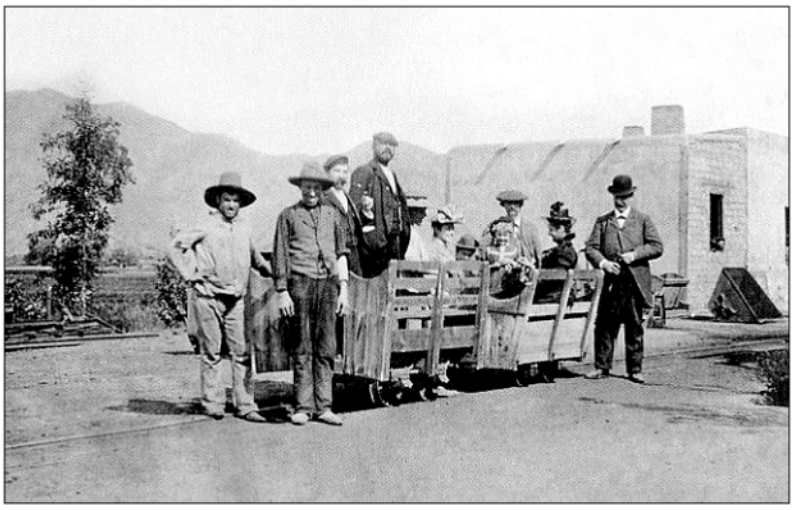
The precision placing of limestone in a kiln.
R.M. Usedo Vallés.

Some of the more technical details can be found at:
Rosendale Cement.
Kiln Architecture and Technology. ucl.ac.uk
Original Issue of 200 years of Soot and Sweat. vtarchaeology.org.

Córcholis Takes to the Tracks

In 1902, a young man by the name of Córcholis visited the Sierra Almagrera. He first went to the power station just along the coast from Villaricos and then, on his return to the village, went to el Arteal by rail. His boyish excitement about the journey makes me think that it was the first time that he had ever travelled on rails. This is a translation of his published account.

These good friends (Siret and Flores) had put at our disposal a specially adapted wagon[1] to transport us to el Arteal. It is difficult for me to give an idea of my delight at the novelty of the rail journey. Imagine a toy, a child's idea of a railway, two parallel rails, so tiny and narrow that they seemed to snuggle right into the mountain's side. On them a wagon, with just a platform and two wooden benches with backs, having just enough room for six people. So, six of us settled on them; Flores, Polo, Bellod, Bachiller, Vigil and myself.



Passenger carrying wagons. *Taken from Sierra Almagrera y Herrerías. Bolea*

A strapping lad pushed the small wagon and we began to glide smoothly on the rails. Delighted by the originality of the vehicle, we start clapping like children with a new toy. We had only gone a few metres when our driver warned us to keep our arms tucked in. We entered a small, narrow tunnel. Really more of a borehole made by ants than a tunnel for transporting mineral, with only the marks made by pickaxes to show that it was indeed man-made.

Tunnel exit in the grounds of the necropolis.

At speed we skirted the Almanzora and then the Rambla de Muleria with its reed beds and drifts of rock rose, at intervals almost touching the trailing tendrils of the melons and the golden ears of millet. Occasionally, a

long line of wagons, laden with ore and pulled by a mule, brought our express to a stop. We were forced to step down and move our wagon to the side in order to give way for it. Once the cross over was made, we put our wagon back on the rails, and were again pushed by the strapping youth.

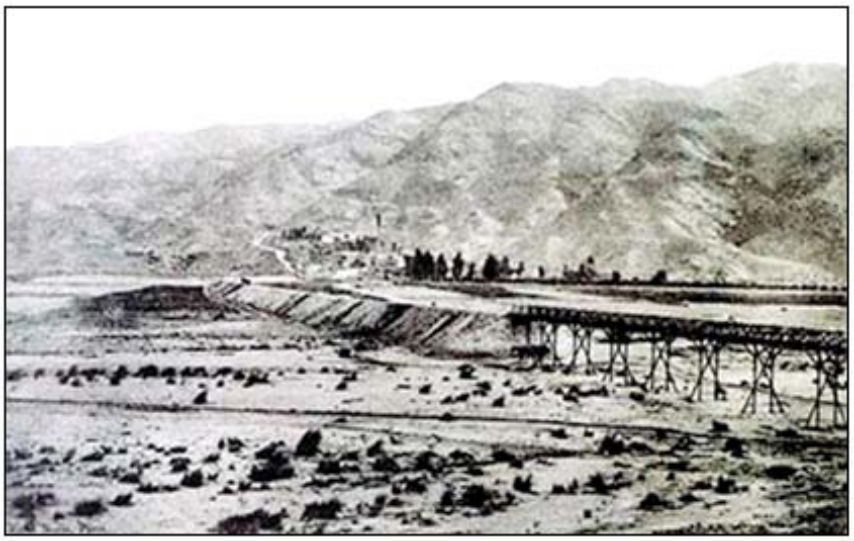
We stopped just below Siret's house, of which we had a quick tour, leaving convinced that nothing could be as simple and as exquisite as that little chalet. Surrounded by tropical plants, covered in morning glory and bellflowers, its overhanging vines seemed to be guarding over an extravagant grotto.

Siret's house today.

Close by, Carlos Brandt was waiting for us with another friend. Their wagon was coupled to ours and we continued the journey through tunnels. Gazing from our ambulant observatory at the las Herrerías installations, their chimneys wreathed in black smoke, the workshops and warehouses darkened by iron, a hue which dominates the entire landscape, and finally, the great mounds of the mine workings, which seem to have been thrown there by the earth itself in order to show the riches that lie beneath.

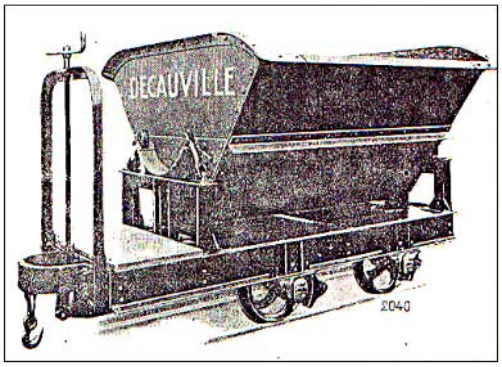
We escaped from the narrow darkness of the final tunnel and crossed over the bridge which straddles the rambla and there caught sight of el Arteal nestling in the foothills of the slatey mountains. About a hundred metres further on we came to a halt, went down a ramp, and were then within easy walking distance of our destination.

View of the bridge over the rambla and el Arteal.



Note [1]. The wagon that Córcholis travelled on was a converted brake wagon. The tipper part was removed and replaced with a wooden platform on which the high-backed seats were mounted. What Córcholis called the driver was the brakeman. Ordinary wagons were also converted and could be coupled behind the brake wagon as can be seen in the photograph on page 1 taken on the day that the line opened.

Brake wagon.



El Arteal Under Siege.

El Arteal under siege.

My stay at El Arteal in January 2020 was tinged with sadness. The imposing Central de Transformación building, built in the 1920's by Luis Siret's Société Minière d'Almagrera to house the 535Hp German diesel generator which powered two of the subterranean pumps, was open to the sky. Daylight was streaming in where, once, the roof had been. The roof girders hanging drunkenly, the walls blackened and not a single pane of glass remaining. There had obviously been a fire, but why and how? Who would want to torch this historic, iconic building? The friends with whom I stay with at El Arteal told me the sorry tale. Sometime during the night of December 3rd a fire had broken out in the building and the tons of discarded irrigation tubing, which was stored within it, had burned for the best part of 24 hours.

The fire in the Central de Transformación. *S Farminer*

Neither the local police, who surveyed the scene from the other side of the Rambla de Muleria, nor the owner of the tubing, seemed in the least bit bothered by the event. The weather was wet and the Rambla was crossable only by 4x4, so no attempt was made to douse the fire nor to examine its cause.

There is the possibility that the building was hit by a lightning strike and the tubing, or something else which was stored in there, caught alight. Whatever the cause, the walls contained the fire, the roof girders buckled, the terracotta tiles fell, the remaining windowpanes shattered and tons of unwanted plastic was reduced to a sticky mess. How long will the walls, which had so valiantly resisted the inferno, remain standing now that the roof has gone, and will anyone care?

Then

Now

Open to the sky.

Not a window remaining.

Worse was to come. Between the 6th and 17th of January, truck loads of earth and rubble trundled along the track to el Arteal and returned empty. I thought that perhaps the old water deposit up by the bath houses, or the one by the transformer building, was being filled and prepared for agricultural use. I was horrified when I saw what in fact was being filled.

The 1908 coke storage bays, which themselves had been repurposed as ore sedimentation tanks, probably by MASA, were now almost completely full and the site levelled. The pump house where the slurry was pumped into the tanks is still, for now, just about standing. It is in the centre left of the before photograph.

The tanks before their destruction.

What tanks?

I can understand that the area could be put to agricultural use, as the tanks would retain water, thus minimizing irrigation, but what I saw next was totally incomprehensible. The only remaining wall of the massive, 30 metre long, double galleried boiler house, built in 1908 to house eight condensing boilers had been demolished. Now all that remains of the magnificent power plant, built to power the pumps situated 220 metres underground, is the water tower and the base of the 45 metre chimney.

The boiler-house wall before demolition.

What wall?

For what end had this wall been demolished? Now there is nothing to indicate the presence of a once magnificent piece of turn of the century industrial architecture. Will the water tower be next?

The extent of the boiler-house wall.

The rubble is buried.

I am also becoming increasingly concerned about the future of the married miners' quarters. They have been quietly decaying since they were 'comprehensively decommissioned' when MASA pulled out in the 1950's. Every year, more of the roofs cave in, and the courtyards become more and more overgrown. However, now they are under siege from another quarter, from below. This time it is water, and not just the rain that falls on them but unnecessary flooding of their shallow foundations which will soon take its toll. The occasional flooding when the Rambla de Muleria overflows its banks is one thing, but flooding every time there is a day of rain is quite a different, and more frequent, matter.

For whatever reason, in 2018, one, but only one, of the old acequias, or irrigation ditches, was re-excavated.

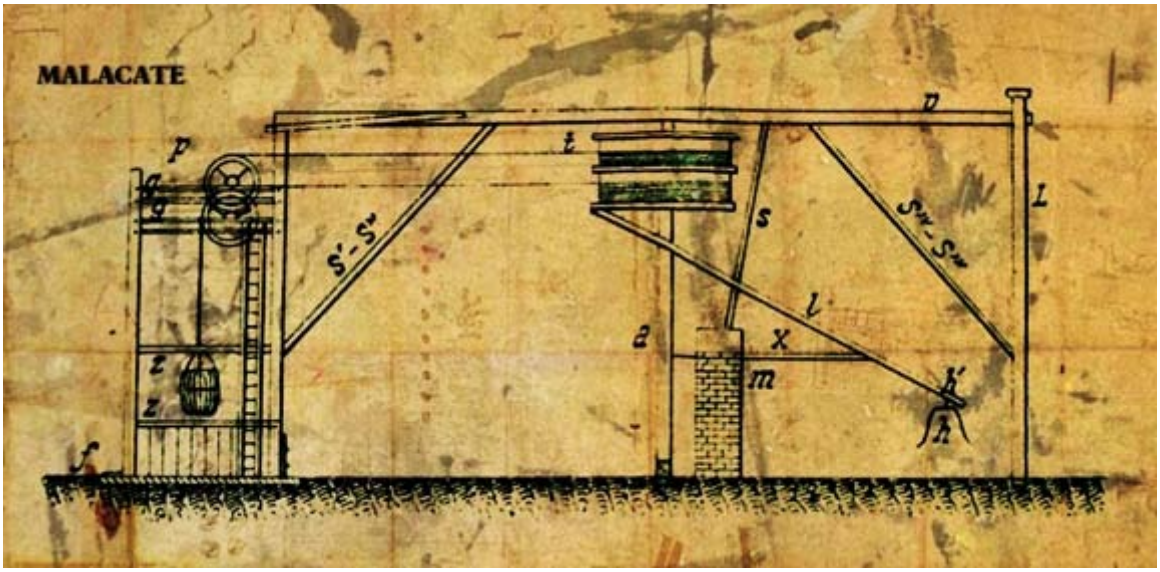
Because the rest of the network of ditches were left overgrown, silted up and incomplete, the result was, that every time it rained, water flooded into the field on the northern side of the main track into el Arteal. Now, a drain has been run under the track, and the water flows at an alarming rate into the field at the side of the miners' quarters, creating an almost perfect wetland habitat for the ducks and drakes.

In this diagram of the acequias the red line denotes the ditch that was re-excavated. The new drain was built under the causeway, presumably to relieve excessive flooding in the northern fields at the end of the new ditch.

Flooding in the northern field and in front of the miners' quarters.

Whether this has been done to enrich the soil as the water brings important nutrients, or not I don't know. What I do know is that clay soil, alternating very dry and very wet conditions, and shallow foundations, equals subsidence and further disintegration. There is a small measure of embankment in front of the miners' quarters, but this is inadequate and barely contains the surface water. The rapid increase in the amount of cane growing in the courtyards since the opening of the acequia tells its own story.

On a Whim.



There is documentary evidence that horse powered winches were used in the Sierra Almagrera to raise ore to the surface, but little trace of them on the ground. One photograph of a whim in use exists, but where it was situated has yet to be pin-pointed, and there are some who doubt that the picture was actually taken in the Sierra at all.

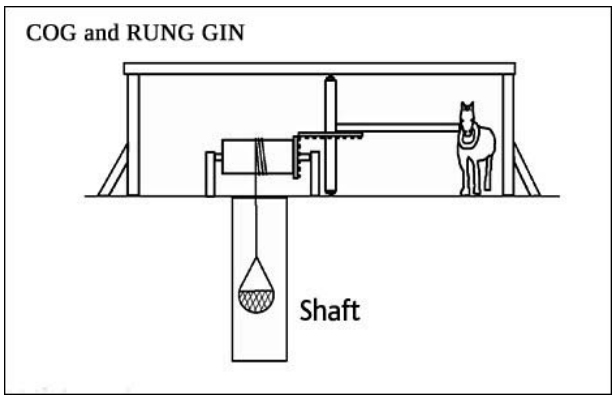
A malacate, possibly in the Sierra Almagrera. *Anon.*

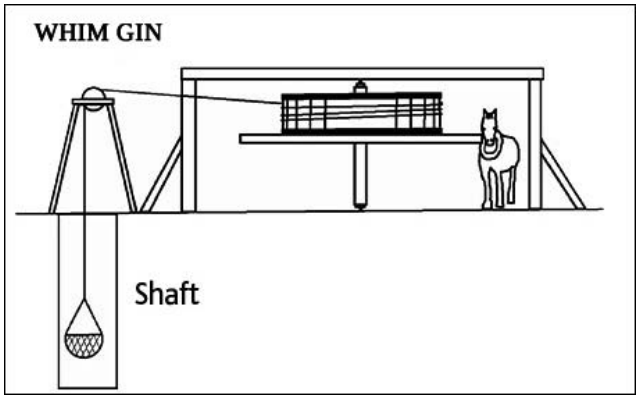
It was thought that the only baritel (whim housing) was that at the mine Virgen del Carmen but, following the recent discovery of a second baritel, I revisited the topic of animal powered hoists and carried out further research, first in the English context, and then in the more difficult Spanish context.

The remains of the second baritel.

The English Context.

Animal powered hoists had been in use in Britain from at least the 15th century and were known as 'gins, an abbreviation of the word engines. The earlier form of gin was the cog and rung gin, nowadays more often referred to simply as a gin. This type was in common use in mines during the 18th century, but also survived into the 19th century, where it was superseded by the whim gin. The whim gin was also variously known simply as a whim, or whimsy, or more often as a horse whim and working examples could still be found in the early 20th century.

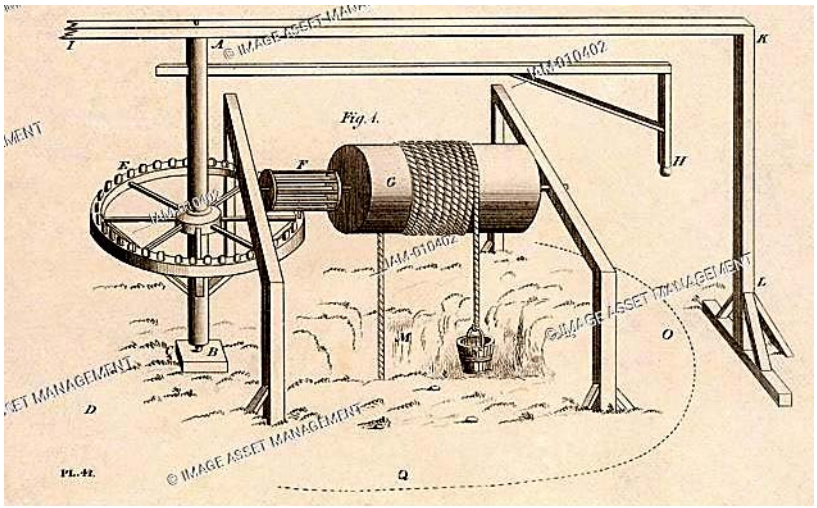




Diagrams, goytvalley.org.uk

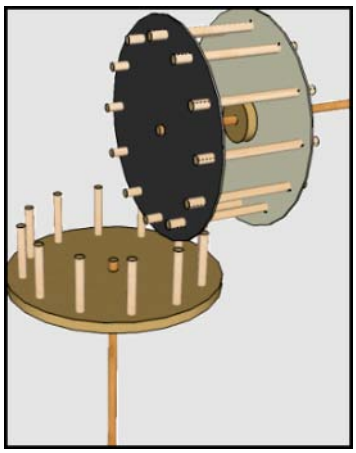
Gins.

First, a look at the earlier type, the gin.



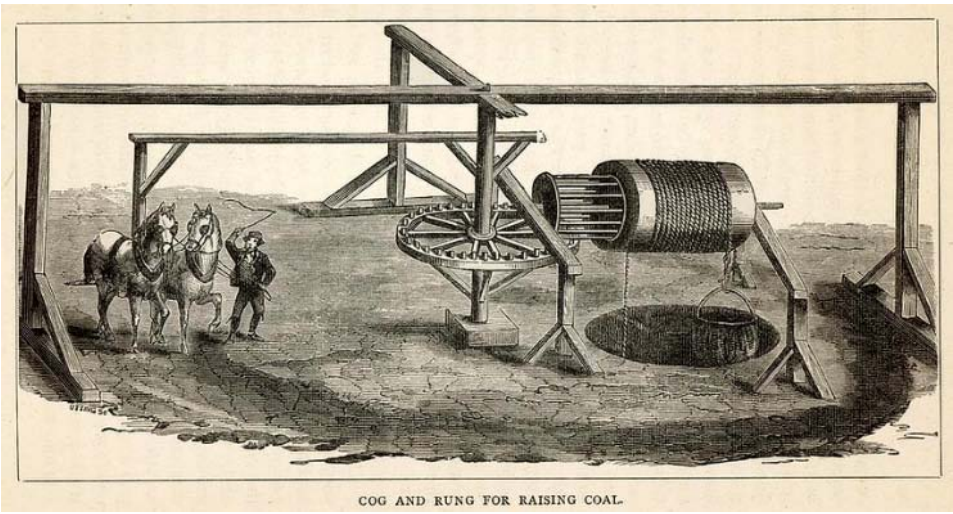
An early design of gin. *©IAM*

It had a crown wheel known as a rung gear because of the wooden pegs, called rundles or rungs, set in it. This rung gear meshed with a cog, known as a cage or lantern gear, causing it to rotate so actioning a winding drum.



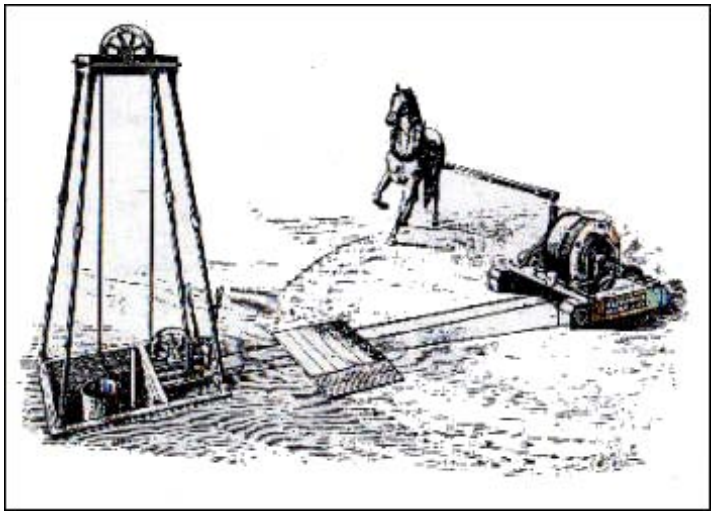
A rung gear meshing with a cage gear.
Modeling Gears. D T on line.

A sweep arm, to which the horse was harnessed, was attached to the axle of the rung wheel, causing it to rotate as the animal circled round. In an effort to save wear on the pegs, an extra peg was sometimes added to the rung gear so that the same two ‘teeth’ didn’t always come into contact with each other. The extra peg was known as the hunting cog. There were variations on the height and orientation of the gear mechanism, but the basic principle remained the same. The rung and cage combination was also often found in windmills and in clocks.



A gin for raising coal up a shaft. *coquet and coast.co.uk*

It is generally accepted that, when used for raising loads from a mine, the animal circled the mine shaft. This, however, wasn't always the case, as can be seen from the following illustration where the mine shaft is outside the path taken by the sweep arm, and the animal walks on wooden planks over the drive shaft.



Here the horse is not walking around the shaft.

Scott Brady's Mining Artifacts.

Some of the later gins had the drive shaft buried below the surface, presumably in some kind of trunking. The remains of this later one with metal gears, held in the Manchester Science & Industry Museum as part of the Richard Hills Collection, seems to be of this type.

A later example of a gin with a low level drive shaft.

Richard Hills Collection.

One disadvantage of the gin was the effect of wear on the wooden pegs or teeth. Worn or missing pegs caused the action to be jerky rather than smooth, which was most disconcerting for men riding in the kibbles.

The use of gins to drive agricultural machinery and mill stones seems to have lasted longer than their use for raising loads in mines. Even with metal cogs, their lifting power could not equal that of the horse whim.

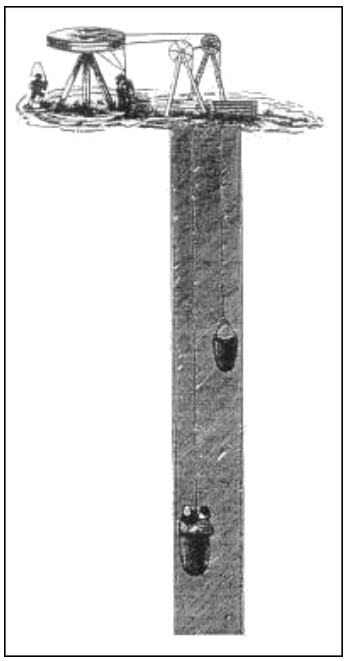
Whims.

A common whim design. *Beamish, The Living Museum of the North*

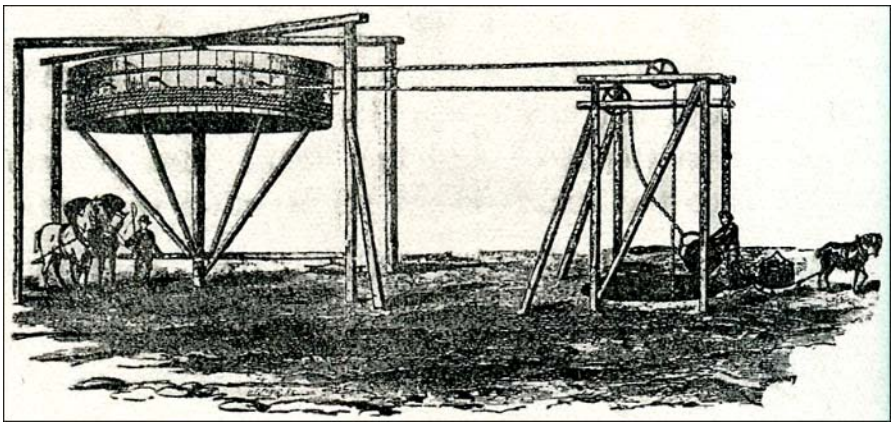
The whim is generally considered to be more efficient than the gin, and appears to have been developed from the type of gin which had a horizontal span beam and a vertical axle. A whim is also known as a horse capstan, a reference to the capstan, or drum, on the vertical axle which is the main feature of the device. The axle through the drum was held vertical by a bearing in the span beam and another, set in a central stone, at ground level. As with a gin, the motive power was provided by a horse, or horses, walking round in a circle.

The span beam was supported by inclined legs or posts, which were frequently set in masonry, and further strengthened by struts or props. A tremendous amount of torque was generated by these simple machines, particularly the larger ones, necessitating this solid framework. A rope, which was wound round the drum, was passed over pulleys and down the mine shaft, alternately raising and lowering the kibbles. This arrangement meant that the shaft could be situated outside the horse circle, allowing more room for the handling of the material raised.

I did find a variant of the usual structure of a whim, which may have been a stage in its development. Known as a scotch whim and found in the Scottish Lothians in the 18th and 19th century, the axle seems to pivot on a supporting tripod arrangement. Whether the artist omitted to show any other support and that it had an arrangement like that in the drawing on the next page, I don’t know.



A scotch whim.
www.hoodfamily.info



Possibly a scotch whim, but showing supports. *coquet & coast.co.uk*

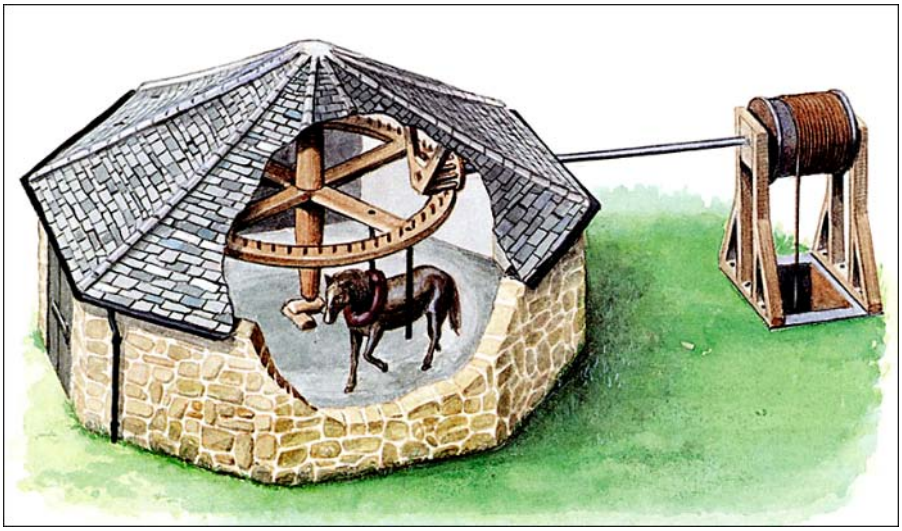
In both cases, I assume that this arrangement was only possible because of the reduced size of the drum. What is known is that the scotch whim was not very cost effective, possibly because of the small drum, and that mine owners often preferred to use the notorious 'bearer' system for raising coal. The 'bearers', who were usually women and children, carried coal up the ladders to the surface on their backs.
(Harrowing, first hand accounts of their lives can be found at Hood Family and Coal Mining : www.hoodfamily.info)

Women bearing, or carrying, coal up to the surface.
www.hoodfamily.info

In Britain, both gins and whims were often housed in purpose built structures variously known as gin gangs, wheelhouses, roundhouses and horse-engine houses, together with a multitude of other local names. These buildings were circular, polygonal, or sometimes square and served to protect the wooden engine, rather than the horse, from the inclement weather.

A gin gang or horse-engine house.
Wikipedia

In addition, the recesses in the walls provided support for the all important span beam and any other radial beams. Openings in the structure were provided for the drive shaft, in the case of a gin, and the rope for the kibbles in the case of a whim. The word gang will be familiar to older people from the north of England, where it was used to mean go. In the context of a gin or whim, it referred to the horse going, or ganging, round.



The gin gang had an opening for the drive shaft. Seen here raising a kibble.
locallocalhistory.co.uk

Both the whim and the gin could have a double-action system, where loads could be raised and lowered simultaneously, with one compensating the other to some extent. In both cases however, to return the kibble to the bottom of the shaft once it had been raised the animal had to be unhitched and turned so as walk in the opposite direction.

The Spanish Context. (With reference to the Sierra Almagrera.)

Gins.
In 1883, J. Pie y Allué, mining engineer and director of the Vera School of Mining wrote of the Sierra Almagrera,
"De vez en cuando el silbato de alguna máquina, el característico tac-tac de algún torno económico o el canto de algún minero recuerdan al viajero otros espectáculos, de bien distinta índole, dentro de las entrañas del suelo que está pisando."
By torno económico Pie y Allué is referring to malacates, which translates as a horse- whims, used for raising ore to the surface. So I translated it as,
"Occasionally the whistle of some machine, the characteristic tac-tac of some whim, or the singing of some miner remind the traveller of other scenes, of very different nature, within the bowels of the earth you are walking on."

There was something about the phrase 'characteristic tac-tac' that bothered me. The noise of a whim is more of a squeak and a groan as the rope is wound round the drum, so had I miss-translated torno económico? Could he have been talking about the noise made by a gin as the rungs engaged with the cog? Was there a Spanish word for a gin as opposed to a whim? Were gins used in the Sierra Almagrera?

Modern English- Spanish dictionaries translate gin as ginebra (the drink) or, desmotadora de algodón (cotton mill), and whim as capricho (caprice) or torno (winch). It was obvious that I needed to widen the search, and by chance, I came across a 1908 dictionary by Edward Halse 'A Dictionary of Spanish and Spanish American Mining, Metallurgical and Allied Terms'. Although not a Spanish-English, English-Spanish dictionary it was a wonderful find. Where regional terms are used Halse names the region and cross-

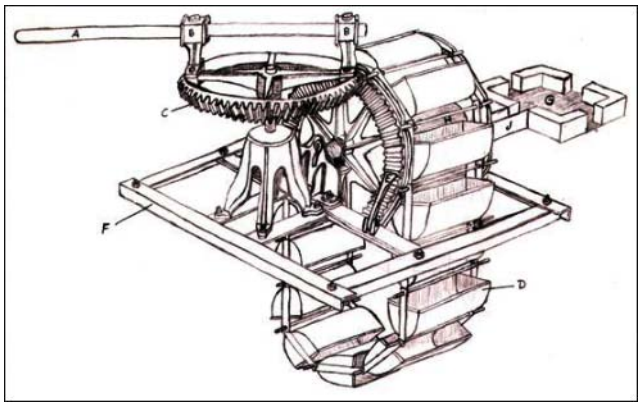
references the entry to standard terms. Many of his entries are attributed to Ezquerra del Bayo and to Manuel Malo de Molina, both of whom were well acquainted with the Sierra Almagrera.

The first word that I looked up was Mequinez, because Bayo documented it as the name given to an inclined extraction shaft, by the miners in the Sierra Almagrera, but said that he had no idea why. Mequinez wasn't in Halse's dictionary, but Mequines was. Here is the entry:
MEQUINES, (1) Almeria, Sp. inclined gallery, the floor of which is not in steps, but covered with boards for the espuertas (Molina), comp. trancada (2); (2) Sierra Almagrera, Sp. winch worked by horse, by means of toothed wheels and levers, see torna (2), comp. Malacate (1).

There we have it, there was a specific name in the Sierra Almagrera for a horse winch which had cogs rather than a drum, in other words, a gin. It is safe to assume that Mequinez and Mequines are simply different spelling of the same word, and interesting to note that it was applied to two different things. Or was it? Did the series of inclined shafts use gins to raise the load and so, were they simply known as the gin shaft? Interestingly, the word mequines translates from Catalan to English as machines. Could this be a parallel to the use of 'gin as an abbreviation of engine?

All this would seem to indicate that gins were used in the Sierra Almagrera. The similarities between a gin and the Andalusian noria are striking, which makes it all the more likely that gins were used, particularly in the early years of the mining boom. Halse has this under the entry:
MALACATE: (2); m. de rosario, Sierra de Gador, Sp., one working endless rope to which esportones are tied.

This malacate, here meaning a gin, worked in exactly the same way as a noria, with the noria's buckets being replaced by esportónes, or esparto baskets.



Noria diagram. The endless rope gin acted in the same way as the endless noria.
Catimenu.com

Rosario refers to the likeness of the lifting arrangement to a string of rosary, or prayer, beads. Known to have been used in the Sierra de Gádor, it is possible that the miners from there brought the technical know-how with them when they came to the Almagrera. Rob Vernon, in his paper 'Research Notes on mule power in the Sierra Gádor, Almeria, Spain: A significant mining landscape', writes,
'Several patents for malacate de rosarios exist in the Spanish National Patent Office, Madrid, and are presumed to be complex variations to the simpler form employed on the Sierra Gádor. Patent PR 4088 (dated 1865) and PR 4149 (dated 1866) were filed from Berja and show a method of taking an endless rope ore-raising system through a series of offset underground shafts.'
While this adds weight to my theory about the use of the word Mequinez for the series of offset inclined shafts of the mine Esperanza, as well as for the gin which may have been used in conjunction with them, for now, that will have to remain a theory.

Whims

What isn't supposition is the fact that that whims known, locally for some obscure reason, as as maragatos, were used in the Sierra Almagrera, where, given the shortage of water, they were probably almost as economic as a powered winch. With a large whim capable of working to a depth of 300metres it isn't surprising that some of even the larger mines were reluctant to convert to steam power. The mine, Virgen de Carmen, one of the most profitable in the whole of the Sierra Almagrera, was one of those who operated using horse, or rather, mule power long after so many others had changed to steam power. Carmen's whim was housed in a gin gang and was probably a very powerful machine. The housing was known as a baritel, the French word for a gin gang, or horse engine house. Its circular, brick wall, with a series of insets, provided support, not just for the span beams, but also for additional radial beams. Unfortunately, the walls were not strong enough to withstand an earthquake.

Carmen's baritel with the insets to support the beams of the whim.

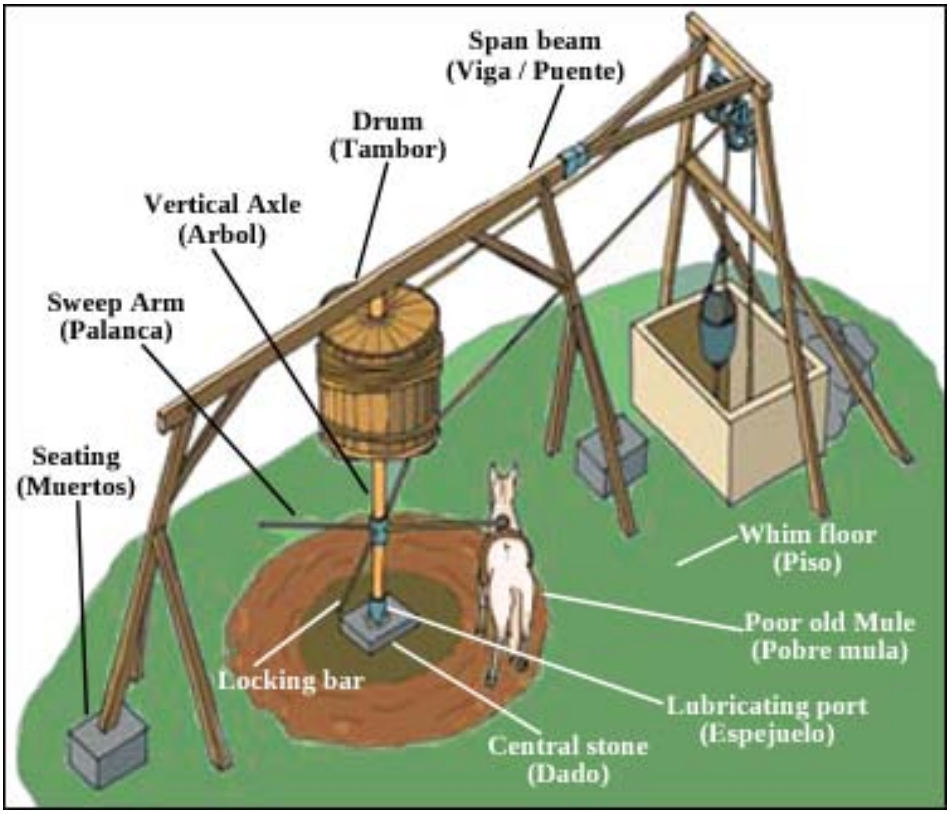
The mechanism inside Carmen's baritel may have been similar to this. *Baritel de San Carlos. Mayasa.es*

The newly discovered baritel in the Sierra Almagrera, actually has its central stone still in situ. which is very rare but, needless to say, the metal pivot plate is missing.

The newly discovered baritel. *Anon.*

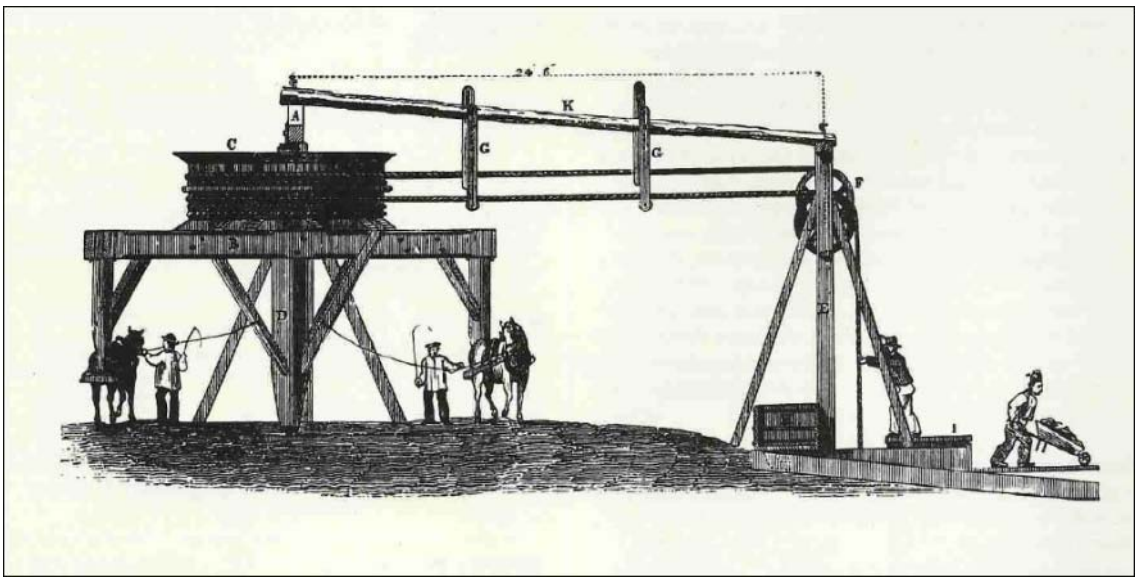
The central stone.

This particular central stone looks as if it had a sort of locking device set into it. The layout of the machine might well have looked something like the one shown in the diagram on the next page, where there is a locking bar between the base of the capstan drum and the central pivot stone. The stone also has two grooves in it which may have been lubrication ports for the pivot bearing. I have seen diagrams of malacates indicating something called an espejuelo, or spyglass in relation to the central stone, which may be a reference to these grooves.



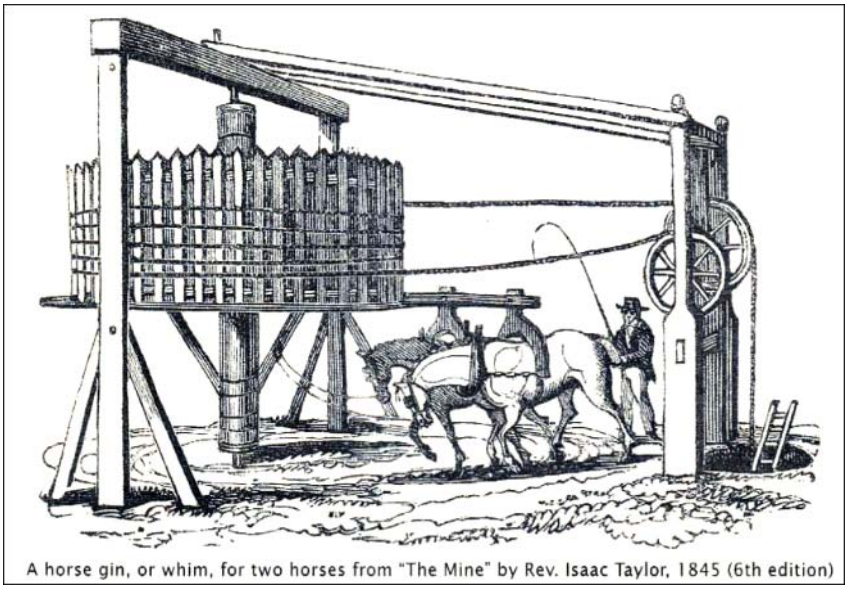
A malacate. *Centro de Interpretatíon, Linares*

This drawing shows a single mule working the malacate. The palanca, or sweep arm, has a horquilla, or yoke to harness the animal at the cabeza, or head of the arm. The free end of the arm was called the cola, or tail. When two mules were hitched to one extremity, using a whipple tree, (Spanish term unknown), the outer mule was called the capitana, or captain and the inner one was known as the rueda. While rueda generally translates as wheel, one of its synonyms is potro, meaning foal, which makes more sense in this context.



Above & overleaf, two different types of '2 horse' whims

Ken Bloank. BIAS Journal.


A horse gin, or whim, for two horses from "The Mine" by Rev. Isaac Taylor, 1845 (6th edition)

Rev. Isaac Taylor

One of the beauties of the whim was the fact that its power could easily be increased depending on the work load. Two animals could be harnessed to both ends of the sweep arm if necessary generating four horse-power. This was, however, a costly exercise. Mules and horses were not cheap to run and they had better working conditions, in terms of hours, than the rest of the workforce.

There are various accounts of the hours worked by teams of whim mules, varying from 2 to 2½ hours in every twenty four hour period, to six hours in the same period. The arreadores, sometimes also know as malacateros, or drivers worked either 12 hour shifts, or the dawn till dusk, dusk till dawn pattern common in the Sierra Almagrera. Such wide variation in the animal's work time could only be associated with the weight of the load that they were hauling and the considerable strain which they were under. A poor old mule generally only survived four years working a whim to a depth of 300 metres.

For further information about the second baritel see the article, The Better Baritel, in the New Discoveries section of the website.