THE CONTRIBUTION OF „RUDA 12 APOSTOLI" MINING ASSOCIATION IN BRAD TO THE DEVELOPMENT OF TRANSYLVANIAN GOLD MINING BETWEEN 1884 – 1921

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ABSTRACT: *One of the major gold mining regions in Romania is part of the gold rectangle in the Apuseni Mountains and lies around the town of Brad. It is here that the"Ruda 12 Apostoli" Mining Association of cuxas was established at the end of the XVIIIth century. This association was to become the most important unit for the mining of precious metals in the entire Austrian – Hungarian Empire after 1884, when it was taken over by the German company "Harkortschen Bergwerke und Chemische Fabriken zu Schwelm und Harkorten A.G. zu Gotha", preserving its status in the interwar Romanian as a component of the "Mica" Mining company. This mining complex had a production of 27,919.520 kg of gold between 1884 – July 1, 1911.*

KEY WORDS: *Romania; Brad; the last quarter of the XIXth century – the beginning of the XXth century; gold mining; the"Ruda 12 Apostoli" Mining Association.*

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The continuity of gold mining in the Brad area (Hunedoara county), since ancient Rome up to the modern age is mainly attested by mining operations, as "no matter how many slaves and war prisoners the Romans would have used, they still would not have been able to drive so many galleries in 150 years, given the means available at the time, but they are the result of the work of local people, throughout the Middle Ages"[1].

Ion Rusu Abrudeanu states that "reliable notes date the resuming of newer mining operations in Ruda area in mid – XVIIIth century". Around 1760, except the mines in Valea Arsului, which belonged to the locals gathered in a mining association[2],

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[1] Ilie Haiduc, *Industria aurului din România*, Editura „Adeverul", Bucureşti, 1940, p. 83

[2] Art. 138 of the Austrian Law of Mines in May 25, 1854, stipulated that "a mining association of *cuxas* is a union whose objective is to achieve a mining of resources in which each participant has a responsibility

the other mines, including the ones at Ruda, were the property of the Ribiczey Adam family, who exploited them most efficiently up to the locals uprising in 1784, when they were ravaged and their owner was killed in his mansion in Ribița village. It is considered that, in 1791, these mines become the property of count Toldalagy and baron Zeyk, who founded the mining associations ”Ruda 12 Apostoli” at Ruda and ”Sfântul Ioan Evanghelistul” at Zdraholț.

The German company ”Harkortschen Bergwerke und Chemische Fabriken zu Schwelm und Harkorten A.G. zu Gotha” was to take over the 128 *cuxas* of the ”Ruda 12 Apostoli” Mining Association, together with Ruda and Barza mines, for 600,000 florins in 1884 and 1887. In 1889, the same company took over the 128 cuxas of the ”Sfântul Ioan Evanghelistul” Mining Association at Zdraholț, together with the mines in Valea Morii and Valea Arsului[3]. It is worth mentioning that, on grounds of the decision of the General Assembly of the ”Sfântul Ioan Evanghelistul” Mining Association in October 18, 1908, the ownership right of the mining complexes bearing the name ”Sfântul Ioan Evanghelistul” is granted to the ”Ruda 12 Apostoli”[4].

In 1899, as a continuation of the extension process and for the establishing of a unique mining complex, under the name of ”Ruda 12 Apostoli”, the ”Harkortschen Bergwerke und Chemische Fabriken zu Schwelm und Harkorten A.G. zu Gotha” Company purchased the 124 *cuxas* of the ”Musariu Gold Mines”[5] Association, created in 1889 by”Industrie Gesellschaft Geislingen” Company in Würtemberg, as a result of purchasing Musariu and Dealu Fetii mines, as well as mines belonging to other surrounding companies[6]. On April 2, 1910, in separate general meetings, it was decided that the ”Musariu Gold Mines” Association should merge with the ”Ruda 12 Apostoli” Mining Association and that all the fixed assets should become property of the ”Ruda 12 Apostoli” Mining Association[7].

The ”Harkortschen Bergwerke und Chemische Fabriken zu Schwelm und Harkorten A.G. zu Gotha” Company was to become part of the ”Ruda 12 Apostoli” mining complex, the most important precious metals mining unit in the entire Austrian – Hungarian Empire and, actually, in Central and South – eastern Europe[8]. The first mine purchased by the Company had an outer surface of 0.5 km^2, the owned area being

proportional to its participation to the common assets, both regarding the contribution to the business, and all the obligations assumed in the name of the association in front of third parts” (*Legea generală minieră din mai 1854*, în „Legea Minelor austriacă. Din 25 mai 1854”, Tipografia „Lupta” Nicolae Stroilă, Bucureşti, 1923, p. 39). The assets of a mining association could be divided into a maximum number of 128 *cuxas* (equal rights), and one cuxa into a maximum number of 100 parts

[3] Ion Rusu Abrudeanu, *Aurul românesc. Istoria lui din vechime şi până* azi, „Cartea Românească”, Bucureşti, 1933, p. 255

[4] Direcția județeană Hunedoara a Arhivelor Naționale (hereafter DJANH), *Fond Societatea „Mica”*, dos. 22/1927, f. 60

[5] Nicolae Maghiar, Ştefan Olteanu, *Din istoria mineritului în România*, Editura Ştiinţifică, Bucureşti, 1970, p. 215

[6] DJANH, *Fond Societatea „Mica”*, dos. 27/1927, f. 72, 89. Despre Asociația minieră „Minele de aur Musariu”, vezi: xxx, *Brad és vidékének aranybányászata. Erdély, Magyarság,* 1899. év végével, p. 36-49

[7] DJANH, *Fond Societatea „Mica”*, dos. 10/1920, f. 256-258

[8] F. Schumacher, *Die Golderzlagerstätten und Goldbergbau der Rudaer Zwölf - Apostel - Gewerkschaft zu Brád in Siebenbürgen*, Max Krahmann, Bureau für praktische Geologie, Berlin, 1912, p. 3

expanded systematically to 16 km^2 in 1903[9], and to 1761.3769 ha around World War I. This surface covers the 254 mining concessions "purchased by *Harkort'sche Bergwerke und Chemische Fabriken A.G in Gotha* Company"…These concessions refer to the exploitation of the gold mines in Brad area, situated on the territory of the following villages: Brad, Ruda, Criştior, Țerețel, Luncoiul de Sus and Ormindea", as points out a document of "Mica" Company, dated July 2, 1926, addressed to the President of the Regional Court Deva[10].

This complex yielded between 1884 – July 1, 1911, a production of 27,919.520 kg of gold[11]; 1912 was the year of the highest annual production, 2,002.350 kg of gold, of which 936.324 kg of native gold, and the rest was obtained from stamped ore; unfortunately, under the circumstances determined by World War I, production was to drop to 610. 934 kg of gold in1918, the mines tending to become inefficient[12].

Table 1. The Gold Production of "Ruda 12 Apostoli" Mining Association between 1884-1921[13]

Year	*Stamped Ores (to)*	*Gold production*			*Total extracted gold kg*	*Production gr/to*
		Stamping Ores /kg	*Ores containing free gold/kg*	*Metallic waste /kg*		
1884/85	5.855	54,340	5,824	-	*60,164*	34,45
1885/86	6.362	50,430	8,499	-	*58,929*	49,56
1886/87	13.360	84,115	30,269	-	*114,384*	23,30
1887/88	17.898	120,874	30,145	8,000	*209,019*	17,64
1888/89	28.659	205,728	254,509	6,798	*467,035*	19,94
1889/90	44.403	326,817	345,854	14,959	*687,630*	17,90
1890/91	57.751	420,352	331,004	19,134	*770,490*	18,21
1891/92	54.343	335,949	282,137	36,240	*654,326*	18,71
1892/93	53.686	352,679	251,462	15,584	*619,725*	18,14
1893/94	56.719	310,574	205,241	14,943	*530,758*	17,12
1894/95	53.236	341,911	190,595	17,065	*549,571*	17,64
1895/96	57.824	384,034	264,663	11,870	*660,567*	16,44
1896/97	71.807	477,585	326,898	28,860	*833,343*	14,77
1897/98	68.183	408,274	341,388	36,920	*786,582*	15,17
1898/99	136.170	776,187	414,190	94,735	*1285,344*	12,24
1899/1900	163.854	910,670	419,117	159,670	*1489,225*	11,64
1900/01	178.399	903,791	476,208	163,728	*1543,727*	11,76
1901/02	181.094	930,503	410,076	185,103	*1525,982*	12,16
1902/03	181.900	988,278	349,226	90,313	*1427,817*	10,96
1903/04	188.144	1123,896	436,806	93,993	*1654,695*	10,41
1904/05	183.290	1086,174	518,103	117,453	*1721,731*	10,80
1905/06	187.501	1172,865	582,974	124,467	*1880,306*	10,56
1906/07	168.994	1051,120	538,765	123,785	*1713,670*	11,94
1907/08	175.857	1139,646	574,607	110,333	*1824,586*	11,91
1908/09	173.146	1089,968	429,198	60,750	*1579,916*	12,33
1909/10	181.783	986,776	552,224	36,204	*1575,204*	11,87
1910/11	169.238	944,232	713,478	37,184	*1694,894*	12,10

[9] *Ibidem,* p. 105
[10] DJANH, *Fond Societatea „Mica"*, dos. 10/1920, f. 212
[11] F. Schumacher, *op. cit.*, p. 106
[12] Nicolae Maghiar, Ştefan Olteanu, *op. cit.*, p. 216
[13] F. Schumacher, *op. cit.*, p. 106; Societatea „Mica", *Darea de seamă a Consiliului de Administrație şi Raportul cenzorilor către Adunarea generală ordinară a acționarilor din 19 februarie 1922. Exercițiul 1921*, Tipografia Curții Regale, F. Göbl Fii, Bucureşti, 1922, p. 16

1911/12	175.087	1040,607	936,324	25,419	*2002,350*	11,43
1912/13	165.102	818,835	1029,953	28,103	*1876,891*	11,37
1913/14	186.835	1032,855	880,230	35,017	*1948,105*	10,43
1914/15	148.516	886,170	654,525	10,000	*1550,695*	10,44
1915/16	72.051	485,236	747,471	12,000	*1244,707*	17,27
1916/17	48.398	349,331	526,769	66,692	*942,792*	19,48
1917/18	63.049	397,326	586,184	43,144	*1025,654*	16,27
1918/19	45.701	257,454	413,530	-	*670,934*	14,68
1919/20	62.928	312,173	346,316	-	*658,489*	10,46
1920/21	53.414	305,752	380,299	-	*686,051*	12,84

There are three main periods[14] in the development of the ”Ruda 12 Apostoli” Mining Association:

1. 1884-1890, when less than 30,000 to of ore are processed annually by stamping, yielding a low gold content and involving high mining costs;

2. 1890-1898, when 45-70.000 to of ore are processed annually by stamping, at fairly high costs – 15 – 18 crowns/to – but with a production of up to 833 kg of gold in1896/1897 and an average of 12 gr of gold/to;

3. after 1898 when the Processing Plant at Gurabarza started operations, processing 170 – 190,000 to of ore annually. Gold concentration decreases with 2 – 3 gr/to in comparison with the previous periods, as the plant processes more stamping ore than ore containing visible gold. However, a massive processing of ore, even if with a lower content of precious metal, is more profitable on the long run than the exclusive exploitation of areas where ores contain visible gold, because the latter method leads, in time, to the exhaustion of resources and a low efficiency of mining. In this period there is a ratio of 0.46:1 between the production of free gold and the production of gold obtained by stamping; there were also moments when the production of free gold was equal to or exceeded that of stamping gold, but these could not change the ratio. This, among other things, explains both the longevity of the ”Ruda 12 Apostoli” mining complex, and its production.

This evolution was determined by a series of natural factors, mainly by the orographic and petrographic configuration of the deposit, and also by the capacity of the personnel to account the deposit at ”Ruda 12 Apostoli”.

The mines of the ”Ruda 12 Apostoli” mining complex were grouped around the Barza mountain as it follows: mines Ruda - Barza in the Barza massif; mines Musariu - Dealu Fetii, to the west, between Dealu Fetii hill and the Barza mountain; mines Valea Arsului - Valea Morii, to the east, between the Barza and the Măgura mountains.

[14] F. Schumacher, *op. cit.,* p. 87-114, describes the evolution of the ”Ruda 12 Apostoli” mining complex, seen as a technical, economic and social entity, since it was taken over by ”Harkortschen Bergwerke…zu Gotha” and up to World War I. A synthesis of Fr. Schumacher’s work belongs to dr. Tr. Suciu, *Băile de aur de la Brad*, în, *Anuarul XXXVIII al Gimnaziului român greco-oriental din Brad şi al Şcoalei primare anexate acestuia pe al 45-lea an şcolar 1913-1914*, Tiparul Tipografiei arhidiecezene, Nagyszeben (Sibiu), 1914, p. 1-19.

Dr. eng. Fr. Schumacher was an engineer at ”Ruda 12 Apostoli” Mining Association between 1910-1913, and then a Professor of Geology and deposits at the Mining Academy of Freiberg (Analele Minelor din România, XV, 1932, nr. 10, p. 382).

Mining operations were started at the surface, by adits that were connected with cross – cuts. The main galleries were connected in the underground, the extracted ore being taken to the surface by Victor gallery (346 m altitude), and the main gallery of the Barza group, begun in the Barza Valley after 1840. The Ruda – Barza group also included the following galleries: Anna (426 m altitude) – where the Roman Steps are to be found; Drei Königs (Three Kings, 466 m altitude) and Zwölf – Apostel (12 Apostles, 496 m altitude); in Valea Morii mine, the Ferdinand gallery (304 m altitude); in Valea Arsului mine, the Franziska gallery; in Musariu mine, the Ludwig (Ludovic) and Maria galleries. The sides of the galleries were reinforced with oak beams and pillars, but the rock was generally hard enough not to call for any additional support for the roof.

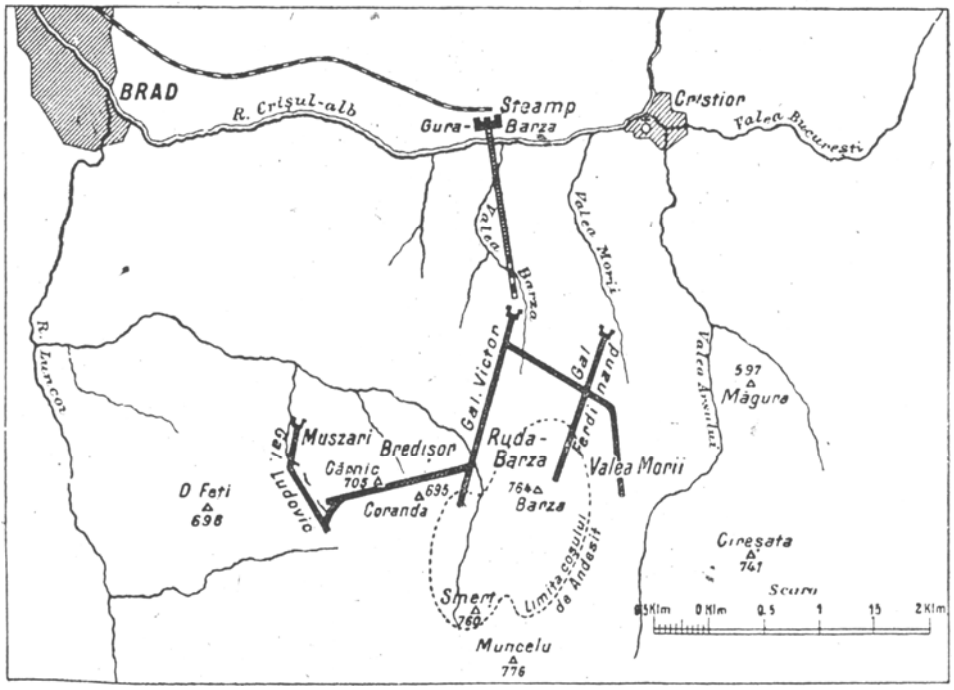

Figure 1. The Brad mines of the "Ruda 12 Apostoli" Mining Association[15]

For the mining of the levels below the main galleries there were shafts along which cages were circulating, driven by electric hoisting engines; the levels were open at their upper and lower ends, at heights and depths of 30 m each.

The ore was generally displaced from the vein by blasting with dynamite. The material resulting from the blast was crushed with a hammer, and the crushed boulders were loaded in horse – driven cars and taken to the electric locomotives; the waste that contained no gold was disposed of or used in the underground for stowing operations.

[15] V. Puşcaşiu, C.I. Motaş, *Minele de aur din Brad şi Săcărâmb*, A.M.R., II, 1919, nr. 4, p. 276.

There were also attempts at mechanizing certain underground operations and thus, at the beginning of the XXth century the electric – pneumatic drills were introduced mainly for driving galleries.

The ore extracted from the vein was transported, in cars, to the haulage ways. In the *Victor* gallery, with a length of 5.7 km, transport was ensured by two electric locomotives; the gallery had branchings to Valea Morii and Musariu mines; a double railway led to the branching to Valea Morii mine, ensuring the transport of cca. 600-660 to of ore in 24 hours.

At the exit of the Victor gallery, the ore was discharged into the grinders of the pre – crushing area and, after the grinding, it is transported to the stamps of Gurabarza by cableway, built in 1898, with a length of 1.2 km and a capacity of 500 to of ore within eight hours.

The "Ruda 12 Apostoli" Mining Association also had an operating cableway in its own coal mine at Țebea and Brad station, which transported the coal, mainly for the Electric Power Plant at Gurabarza, and between Brad station and Gurabarza there was an industrial railway with a length of 6.4 km and a track width of 760 mm, which was used both for the transport of materials necessary for mines, and for the transport of personnel.

The Processing pant at Gurabarza was built by the end of the XIXth century.

The "Harkortschen Bergwerke und Chemische Fabriken zu Schwelm und Harkorten A.G. zu Gotha" Company initially built two stamping installations: the installation at Șteampurile Vechi (Old Stamps) in Brad (Tărățel), equipped with 128 arms, which processed the ore extracted from different small mines in the area, as well as the one extracted by the Company through other galleries than Victor; the rustic installation at Crișcior, equipped with 66 arms, which processed the ore extracted through Victor gallery[16].

During the mid – '90s of the XIXth century, the problem of building a new processing plant was raised, having in view that the old stamps were no longer efficient, the attempts at amalgamation by using potassium cyanide failed, and the gold production was increasing continuously. The stamps at Brad and Crișcior were to be closed down, and the ones of the " Musariu Gold Mines" Association at Racova were abandoned in 1903.

The processing plant for the gold and silver ores at Gurabarza, considered the largest and most up – to – date plant of its kind not only in the Austrian – Hungarian Empire, by in all Europe, had a processing capacity of 150-190,000 to annually[17], covering the ores extracted from the whole "Ruda 12 Apostoli" mining complex. Placed on the right bank of the Crișul Alb river, the plant was begun by the German Company "Friedrich Krupp Grusonwerk Magdeburg - Buckau" on August 7, 1897, being ready for full operation only on May 27, 1899.

The 120 m long stamps installations consisted of 18 Californian iron stamps, namely:

a. 14 large stamps, each with two sets of 5 arms, each arm weighing 360 kg;

[16] Kheil Ottmar, *Metale nobile: Tehnologii de preparare - Uzina Gurabarza*, Deva, 2003, p. 23-25.

[17] Further details about the technological flow and the installations at the Gurabarza Processing Plant see, Kheil Ottmar, *op. cit.*, p. 28-51.

b. 4 small stamps, each with three sets of five arms, each arm weighing 180 kg.

The stamps functioned like many other primitive stamps lying on river banks, where water drove the big wheel, which, in its turn, would raise and lower the wooden arms, whose rock or metal coated points were meant to crush the gold rich rocks. The arms of the Gurabarza stamps, which were iron coated, reached a frequency of 90 hits/min, and the height from which they dropped was adjusted in accordance with the type and hardness of the ore, the average being 20 cm; the average capacity per stamp was of 40 to/24 hours for the large stamps and of 20 to/24 hours for the small stamps, the whole installation being able to stamp 600 to of ore/day or 180,000 to/year between 1909-1910.

The stamping ore, crushed and ground, was discharged into the mill where clean water was flowing continuously; there, the material was turned into "pulp", from which the mercury would capture a significant amount of gold, on two silvered copper plates or electrolytically, the rest flowing over amalgamation platforms fitted with silvered copper plates, placed under the form of steps, at an inclination of 5^0, meant to amalgamate the ore; about 60% of the amalgam was extracted from the mill - possibly even more, if the water was warmer – the rest being removed from the plates. Twice a month, the gold was removed both from the arms and the copper plates; the amalgam, which contained cca. 30% gold, was poured into airtight retorts and placed in furnaces. Here, the mercury was turned into vapors and passed into a tank filled with cold water, where it was turned into metal again. In a matter of hours, the raw gold was obtained and sent to Zlatna or Körmöcbànya, where it was melted, its fineness was established and between 2,189-2,332 crowns/kg were paid, according to the source mine, as the whole process was developed separately for each of the five main mines: Barza, Ruda, Valea Morii, Valea Arsului, and Musariu. The finest gold came from Valea Morii mine, its fineness decreasing westward, the farther was its source from the main eruptions.

If the ore had a minimum gold content of 1 gr /kg of material, it was considered free gold and processed differently. Free gold was placed in bags right on the mining site, sealed and sent to a special section of the Processing plant. Up to a certain moment, this gold was processed at Gurabarza into 22 iron mortars in which mercury was poured; this was a tiresome and expensive operation being also exposed to the danger of theft. For these reasons, the Company built a new installation consisting of eight ratler steel cylinders, with a diameter of 75 cm, equipped with lids. Cca. 15 kg of crushed ore, together with 3.5 kg of mercury and warm water, were introduced in these cylinders which were rotated slowly -32 spins/min – by using a motor, so that the steel balls inside them should grind the ore and prepare the amalgam. After 9-10 hours, the amalgam was extracted, cleaned, washed, dried in pieces of cloth, gathered in balls and taken to the furnaces; from this stage on, the free gold shared the trajectory of the stamping gold. The free gold amalgam contained 40-45% gold, or even as much as 60% in the case of the rich ore from Musariu mine, and the kilogram of raw gold extracted from it was worth 2,232-2,470 crowns.

Beginning with 1903, the gravity concentration equipment of the stamps was transferred from Racova to Gurabarza in order to process the sulphurous ores from

Musariu and Dealu Fetii; on this occasion, experiments for the use of cyaniding were resumed, but with no satisfactory results.

The power necessary for driving the stamps – 74 H.P. – was provided by two condensation - based steam engines of Compound type, with a power of 390 HP, later upgraded to 650 HP.

To ensure the power necessary for the operation of the cableway, lighting, the operation of mine locomotives and different engines, the Electric Power Plant at Gurabarza was built, consisting of three separate installations: *a.* an A.E.G. alternating current generator, with an installed power of 520 kW; *b.* The backup plant containing: an alternating current generator with a power of 250 kW; two dynamos, one of 550/575 V for the driving of electric trains in Barza mine, and the other of 120 V for lighting; an alternating current generator, with a power of 180 HP; *c.* four large boilers, with a heating surface of 268 m^2, which produced steam at 300^0 C, and 12 atm.

In the stamps yard there were also in operation:

- the woodwork and ironwork shops, which ensure the maintenance of stamps and in the underground, and the sawmill;

- the laboratory for chemical analyses and the laboratory for the establishing of metal content after the processing of ore; the furnaces for the burning of gold, the storage areas, etc..

In order to cover the industrial and domestic wood necessities - cca. 12.000 m^3 annually – forests were bought in Luncoi, Ruda and Crişcior, with a total surface of 1,223.5 ha; the exploitation right for the state forest in Buceş and the forest in Mihăileni, which was property of the Romanian Gymnasium in Brad; wood was also bought from different suppliers.

All the activity carried on within the ”Ruda 12 Apostoli” mining complex is obviously focused on the extraction, at certain costs, of precious metals and coal. Owing mainly to the major amount of precious metal yielded by the mines, and to the way in which resources were managed, the activity was efficient. For instance, in 1909/1910 2,158.125 crowns were spent for the extraction of 1,575.204 kg of raw gold, which was sold for 3,618.074 crowns, at a profit of 1,459.949 cor. = 927 cor./kg of gold.

Table 2. The personnel of the”Ruda 12 Apostoli” mining complex - 1910

Employees	*Sector*								*Total*	*General total*
	Gold mine					*Stamps*	*Ţebea coal mine*	*Forests*		
	Barza	*Ruda*	*Valea Morii*	*Valea Arsului*	*Musariu*					
Clerks	-	-	-	-	-	-	-	-	23	*2.195*
Supervisors	25	10	20	7	11	21	1	2	97	
Workers	569	249	411	176	250	316	95	9	2.076	

Most of the work force was mainly ensured by the locals in the Brad area. As the local workers, almost entirely Romanians were at the same time engaged in agricultural activities, to the detriment of efficiency, the Company brought workers and administrative personnel from other areas of Transylvania and of the Austrian –

Hungarian Empire: not only Romanians, but also Hungarians, Germans, Jews, Italians, etc., the latter in less significant number.

In the underground the work was organized in one 10 – hour shift, from 6 a.m. to 4 p.m., whereas at the stamps work was divided into two 12 – hour shifts.

The Company also had in view the insurance of work and living conditions for its personnel.

Thus, lower workers and clerks, with a monthly salary below 200 cor., were members of the *Support Association* (Bruderlade), whose aim was to pay medical assistance and treatment; to refund burial expenses; to support widows, orphans and the physically impaired. For the clerks there was also a Pension Association/ Fund (Beamten - Pensionsverein), meant to ensure an adequate pension for its members ad to support the widows and the orphans of former clerks.

In Brad, the Company had a hospital with 16 beds.

The Company financed two elementary schools at Gurabarza and Musariu, where five teachers taught the lessons in Hungarian.

The Company also created *Consumption*, with shops at Gurabarza and Musariu, where the employees could buy food and other necessary products.

The Company also provided free living spaces, mainly for its clerks, both in Brad and through its *colonies* at Gurabarza and Musariu. The workers mostly lived in the neighboring villages, often having to leave very early in the morning and walk to work; the workers at the stamps were transported from Brad to Gurabarza and back by the company train.

This was the "Ruda 12 Apostoli" Mining Association whose shares "were in the hands of a German financial group, and even Kaiser Wilhelm II was among the owners and *the whole Europe perceived this gold mining area as the gold fields in California"* („Arádi Közlöny", December 23, 1933)[18].

And these are the circumstances under which, after World War I, this important economic and technical complex around Brad became attractive both for the newly founded Romanian state, and for the Romanian and foreign finances belonging to the victorious Alliance. "Mica" Company was to buy this complex after May 1920, maintaining the position of the region as the most important gold producer in Romania in the interwar period[19].

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[18] DJANH, *Fond Societatea „Mica"*, dos. 12/1933, f. 52

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