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Copper in Russia

MOSCOW 1995

Internet: www.infomine.ru e-mail: info@infomine.ru

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1. TYPES OF COPPER DEPOSITS.

There are more than 240 estimated copper deposits, including more than 110 essentially copper deposits on the territory of the former USSR.

The main copper reserves occur at the deposits of copper-sandstone (30%), copper-porphyry (14%), sulphide copper-nickel (31%), and copper pyrite (21%) ores. Copper ores of quartz-sulphide (2%) and scarn (2%) types are also used in industry.

Ores of copper-sandstone deposits (Jezkazghanskoye, Udokanskoye etc.) are sedimentary rocks, for the most part sandstone, with disseminated copper mineralization. They comprise mainly non-metallic minerals (85-95%): quartz, feldspar, calcite, chlorite, sericite, etc. Ore minerals make up 3-15%, generally, they occur as chalcopyrite, bornite, chalcosine. Covellite, grey copper ore, betechtinite, pyrite occur in small quantities. Sulphides are in close and thin mutual intergrowths. In the sulphide copper ores the following mineral types are distinguished: chalcopyrite, bornite, chalcosine, etc. In the oxidation zone, ores are generally porous, argillaceous, impregnated with iron and manganese hydroxides. The following ore minerals occur here: malachite, asurite, brochantite, cuprite, chrysocolla, native copper.

According to the existing classifications, ores with an up to 10-30% relative content of oxidized copper are classified as sulphide ores, ores with a more than 50-70% content of oxidized copper are oxidized ores, ores with intermediate content of oxidized copper are complex ores.

The main part of sulphide ores at copper sandstone deposits are high and medium washability ores, oxidized ores are low washability ores.

Silver, rhenium and iron (Udokanskoye deposit) occur as accessory valuable components.

Ores of copper-porphyry deposits (Kalmakyrskoye, Kounradskoye, etc.) are porphyrous granitoid rocks, and also enclosing rocks, usually essentially altered. Ore minerals at these deposits are chalcopyrite, chalcocite, bornite, pyrite, molybdenite; non-metallic minerals are the following quartz, feldspar, sericite, etc. Generally overall sulphide content in the ores does not exceed 3-5%.

More rich chalcosine ores are developed in the zone of secondary sulphide enrichment. In addition to copper, molybdenum, gold and other valuable components are usually present in ores.

According to the relative content of oxidized copper, the ores are classified into sulphide (oxidized copper content up to 10-15%), complex (from 10-15% to 50-75%) and oxidized (more than 50-75%). Sulphide ores make up the main part of the reserves. Oxidised ores occur mainly as malachite, asurite, chrysocolla, brochantite,

atacamite, copper-bearing hydromica, etc. Low-washability (refractory) oxidized ores are fine-grained, rather ferruginated and kaolinized, with considerable quantities of copper silicates.

Ores of pyrite (copper pyrite and copper-zinc pyrite) deposits (Uchalinskoye, Sibaiskoye, Gayskoye, etc.) have a high pyrite content (up to 95%). Copper, zinc and sulphur are the main valuable components. The proportion of these components varies considerably: in massive ores it is 1:1:20-25, in impregnated ores it is 1:1:5-10. Chalcopyrite is the main copper-bearing mineral, sphalerite is the main zinc-bearing mineral. Pyrrhotite, marcasite, chalcosine, bornite, coveline, tennantite are of minor importance.

The most abundant non-metallic minerals are sericite, chlorite and quartz; barite, calcite and siderite occur in smaller quantities. The content of non-metallic minerals varies from 0 to 50%.

Gold, silver, cadmium, indium, thallium, gallium, germanium, selenium, tellurium occur as accessory valuable components.

Mineral separation is difficult in the pyrite ore beneficiation process as the ores are fine-grained with widespread close intergrowths of sulphide minerals. The most difficult for processing are massive copper-zinc ores of the South Urals deposits where collomorf texture is extensively developed.

Quartz-sulphide (Kafanskoye) copper deposit comprises a large number of quartz-sulphide veins and mineralization zones (stockworks). All the veins and stockworks occur in the plagioclase and quartz porphyrites developed into secondary quartzites.

The ores vary considerably in mineral composition from essentially copper to polymetallic. The main ore minerals are chalcopyrite, bornite, chalcosine, pyrite; quartz is the main non-metallic mineral.

Vein ores are easier to process because sulphides are coarse-grained and there are no floatable non-metallic minerals (sericite, etc.). Stockwork ores have a smaller grain size and are not so easy to process.

Ores of the skarn deposits (Gumishevskoye, etc.) are skarns comprising chalcopyrite, bornite, pyrrhotite, molybdenite, cobaltine, magnetite. Ore bodies are usually small in size, have a complicated form and a complex composition. Chalcopyrite occurs in ores as unevenly distributed disseminations of various size (from 0.5 to 5 mm). Molybdenite occurs in quartz-molybdenite veinlets or in fine disseminations, or in small bunchy accumulations. Molybdenium, gold, cobalt, bismuth, selenium, tellurium, silver, iron are the accessory components.

2. COPPER ORE RESERVES IN RUSSIA.

The reserves are unevenly distributed (Tabl 1).

Table 1

MAIN COPPER DEPOSITS IN RUSSIA.

			1	III KUSSIA		
Deposit	Type of deposit	-	Reserves	Type	Grade	Complex of
	!	of		of mining	Cu,%	accessory
		working				components
Zhdanovskoye	sulphide Cu-Ni	OP	v.large	QA	0.25	Ni,Co,Se,Te
Zapolyarnoye	sulphide Cu-Ni	OP	medium	UG	1.08	Ni,Co,Se,S,Te
Kaula	sulphide Cu-Ni	OP	v.small	UG	0.96	Ni,Co,Se,Te
Sputnik	sulphide Cu-Ni	RO	medium		0.77	Ni,Co,S,Se,Te
Urupskoye	copper pyrite	OP	medium	UG	2.71	Zn,Cd,S,Ga
Khudesskoye	copper pyrite	RO	medium		1.54	Zn,Co,Cd,S
Kisil-Dere	copper pyrite	RO	v.large		2.14	Zn,Co,Cd,S,In,Se
Sibayskoye	copper pyrite	OP	medium	QA	1.09	Zn,Co,Cd,S,Ga
Podolskoye	copper pyrite	RO	v.large		2.11	Zn,Pb,Hg,Bi,S
Yubileynoye	copper pyrite	RO	v.large		1.55	Zn,Cd,S,Se
Zapadnp-Ozernoye	copper pyrite	RO	medium		0.86	Zn,S
Severo-Podolskoye		UE	medium		3.60	Zn
Uchalinskoye	copper pyrite	OP	large	QA	1.13	Zn,Cd,Au,Ga,Ge
Ozernoye	copper pyrite	RO	medium	-	2.70	Zn,S,Se,Te
Novo-Uchalinskoye		UE	medium		1.03	Zn, Pb, S
Oktyabrskoye	copper pyrite	OP	medium	UG	3.81	Zn, Pb, Bi, Cd
Komsomolskoye	copper pyrite	RO	medium		1.57	Zn,Co,Cd,Bi
Gayskoye	copper pyrite	OP	e.large	СВ	1.33	Zn,Co,As,Cd,S,Ga
Jusinskoye	copper pyrite	RO	medium	CD	3.34	Zn, Pb, Cd, Ba, S, Ga
Vesenne-	copper pyrite	RO	medium		2.55	Zn,Cd,S,Se,Te
Arlachinskove	copper pyrice	NO	mearam		2.55	211,00,5,50,10
Letneye	copper pyrite	RO	medium		3.39	Zn,Cd,S,Se,Te
Osenneye	copper pyrite	RO	medium		3.86	Zn, Co, Cd, S
Barsuchy Log	copper pyrite	RO	medium		2.83	Zn, Pb, S, Cd
Volkovskove	Cu-Fe-V	OP	v.large	QA	0.65	Fe, V, Ga, Se, Te
Tarnyerskoye		RO	medium	QA	1.60	
	copper pyrite				1.22	Zn,Cd,S,Ga
Novo-Shemurskoye	copper pyrite	RO	medium	0.7		Zn, Co, Cd, Se, Te
Safyanavskoye	copper pyrite	OP	large	QA	3.03	Zn,Co,Cd,S,Se,Te
Levikhinskaya	copper pyrite	OP	medium	UG	3.84	Zn,Cd,S,Ga
group of deposits			1.		2 67	
Novo-Shaytanskoye		UD	medium		3.67	Zn,Cd,S,Ge,In
Gumishevskoye	skarn	OP	medium	UG	1.46	In, Se, Te
Molodezhnoye	copper pyrite	OP	medium	QA	2.47	Zn,Cd,S
Uzelginskoye	copper pyrite	OP	v.large	UG	1.37	Zn,Cd,S,In,Se,Te
Chebachye	copper pyrite	RO	medium		1.72	Zn,Pb,Cd,S
Talganskoye	copper pyrite	RO	medium		3.91	Zn, Pb, Hg, Cd
Alexandrinskoye	copper pyrite	UD	medium		4.40	Zn,Cd,S
Sultanovskoye	copper pyrite	RO	medium		2.37	Zn,S,Ga,Ge
Novo-Urskoye	copper pyrite	RO	medium		1.05	Zn,S,Se,Te
Kamenushinskoye	copper pyrite	RO	medium		1.71	Zn,S,Se,Te
Rubtsovskoye	polymetallic	UD	medium		4.63	Pb, Zn, Bi, Cd, S, Ga, S
	!					е
Karbalikhinskoye	polymetallic	RO	medium		1.46	Pb, Zn, Cd, S
Norilsk-1	sulphide Cu-Ni	OP	large	СВ	0.48	Ni,Co,Au,Pt,Se,Te
Talnakhskoye	sulphide Cu-Ni	OP	e.large	UG	1.51	Ni,Co,Au,Pt,Se,Te
Oktyabrskoye	sulphide Cu-Ni	OP	unique	UG	2.05	Ni,Co,Au,Pt,Se,Te
Sorskoye	Cu-Mo porphyry	OP	medium	QA	0.054	Mo,Re
Udokanskoye	copper	UD	unique		1.56	Fe, Au, Ag, S
- 4 -	sandstones		1			' ' ' ' ' ' ' ' ' ' ' ' ' ' ' ' ' ' '
Agylkynskoye	W-bearing	RO	medium		2.71	W
Festivalnoye	Sn-bearing	OP	medium	UG	1.88	Sn, Pb, Zn, W, Bi, Cd
- 2 -			l	<u> </u>		, , , , , ,

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Degree of working:

Type of mining:

OP - under exploitation;

UG - underground;

UD - preparated for exploitation;

QA - open cut;

RO - reserves explorated;

CB - combination.

UE - under exploration;

NP - exploitation is not planned.

Demonstrated reserves of metal:

> 10 mln. tonnes - unique

5 - 10 mln. tonnes - extra large (e.large)

1 - 5 mln. tonnes - very large (v.large)

0.5 - 1 mln. tonnes - large

0.1 - 0.5 mln. tonnes – medium

The Russian Federation accounts for 53% of the prospected reserves and about 59% of copper production. There are 122 prospected copper deposits in Russia, including 67 deposits of essentially copper deposits. Sulphide copper-nickel, copper pyrite and cupreous sandstone are the predominant commercial ore types.

Such unique deposits located in Russia are the followund: Udokanskoye deposit of cupreous sandstone (Chita region), Talnakhskoye and Oktyabrskoye deposits of sulphide copper-nickel ores (Krasnoyarsk territory), Gayskoye deposit of copper pyrite ores (Orenburg region) and a number of other large deposits.

3. COPPER ORE MINING.

49 deposits are worked for copper in Russia. The Norilsky region, the Urals and Bashkortostan are the main mining regions in Russia. Zhdanovskoye (Kola peninsula), Gayskoye, Volkovskoye (the Urals), Talnakhskoye, Oktyabrskoye (Krasnoyarsky territory) are the largest mined copper deposits. Kyzyl-Dere (North Caucasus region), Podolskoye, Safyanovskoye, (the Urals), Udokanskoye (Chita region) are the largest developed and reserve fields.

Copper ore is mined and processed at 16 Russian combines:

- in the North Caucasus it is the Urupsky mining and beneficiation combine;
 - in the Kola Peninsula it is the "Pechenganickel" combine;
- in the Urals region these are the Degtyarskoye and Buribayevskoye mining departments, Gaysky and Uchalinsky mining and beneficiation combines, Karabashsky, Kirovgradsky and Krasnouralsky copper smelteries, Sredneuralsky copper smeltery (SUMZ), Bashkirsky copper-sulphur combine;
- in the Altay Territory it is the Altaysky mining and beneficiation combine;
- in the Krasnoyarsk region these are the Norilsky mining and metallurgical combine, Sorsky copper-molybdenum combine;
- in the Far East these are the Primorsky and Solnechny mining and beneficiation combines.

The deposits worked by the Russian enterprises, copper content in the mined ore and production volumes in 1994 are shown at the table 2.

Table 2 **COPPER-BEARING ORES MINING IN CIS IN 1994.**

Mine, quarry	Deposit mined	Grade of	Tonnage of ore		Destination concentrators	
		ore Cu, %	kt	1994/1993,		
				%		
	C	ombine "Peche	enganickel"			
Central quarry	Zhdanovskoye	0.24	4019.4	-2.5	Concentrators No 1 and 2 of	
Western quarry	Zhdanovskoye	0.3	1394.4	-2.0	"Pechenganickel" combine,	
Kaula-Kotselvaara	Kaula, Kotselvaara-	0.46	996.4	+17	copper smeltery	
quarry	Kammikivi, Semiletka				of "Severonickel" combine	
Severny quarry	Zapolyarnoye	0.72	511.2	+18		
Urupsky mining and processing combine						
Urupsky and	Urupskoye	1.51	365.677	+31	Urupskaya concentrator	

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Bykovsky quarries	Bykovskoye							
	Bashk	irsky copper-s	sulphur comb	ine				
Sibaysky quarry	Sibayskoye	0.91	1483.58	-17	Sibayskaya and			
Bakr-Tay quarry	Bakr-Tau	1.81	114.03	-35	Uchalinskaya concentrators			
Tash-Tau quarry	Tash-Tau	8.63	111.7	+1300				
Uchalinsky mining and beneficiation combine								
Uchalinsky quarry	Uchalinskoye	1.05	1505.3	+7	Uchalinskaya concentrator			
Uchalinsky mine	Uchalinskoye	1.00	438.0	+21				
Molodezhny quarry	Molodezhnoye	1.65	982.8	-7				
Uzelginskaya mine	Uzelginskoye	1.27	133.0	+48				
	Burib	aevskoye min	ing departme	nt				
Oktyabrsky mine	Oktyabrskoye	3.32	96.232	-26	Buribaevskaya and			
					Sibayskaya concenrators			
	Mednog	gorsky copper	-sulphur com	bine	T			
Blyavinsky mine	Blyavinskoye Yaman-	2.5	139.3	-7	Sibayskaya and			
	Kasy				Uchalinskaya concenrators,			
					Mednogorsky copper			
					smeltery			
	Gaysky n	nining and ber	neficiation co	mbine				
Mines	Gayskoye Jusinskoye	1.7	3060.0	+21	Gayskaya Kirovgradskaya,			
	Vesenne-				Sibayskaya and			
	Arapchinskoye				Uchalinskaya concenrators			
Quarries	Letneye Osenneye	2.89	272.0	+32				
	Priorskoye							
	Krasnou	ralsky copper-	-smeltery con	nbine				
Turyinsky mine	Vadimo-	1.2	151.3	NO	Turyinskaya concentrator			
	Alexandrovskoye							
	Krasnogvardeyskoye,							
	3d International by							
	name							
Lavrovo-Nikolaevsky	Volkovskoye	0.8	813.5	-20	Turyinskaya concentrator			
quarry								
	Kirovgra	dsky copper-	smeltery com	bine				
Levikhinsky mine	Levikhinskaya group of	4.3	200.0	-3	Kirovgradskaya concentrator			
	deposits							

	Degt	yarskoye mini	ing departmer	nt	
Degtyarsky mine	Degtyarskoye	1.48	224.0	-45	Sredneuralskaya,
Gumishevsky mine	Gumishevskoye	1.02	48.5	NO	Kirovgradskaya
					concentrators
	Karabas	shsky copper-	smeltery com	bine	
Yuzhny mine	Yuzhnoye	2.91	16.296	-66	Uchalinsky concentrator
	Altaysky	mining and p	rocessing con	nbine	
Zolotushinsky,	Zolotushinskoye Novo-	0.79	148.5	-46	Zolotushinskaya
Zmeinogorsky,	Zolotushinskoye,				concentrator
Rubtsovsky mines	Zarechenskoye,				
	Sredneye,				
	Rubtsovskoye				
Stepnoy mine, pilot	Stepnoye	1.99	8.9	+41	
industrial section					
	Norilsky r	mining and me	etallurgical co	mbine	
Zapolyarny mine	Norilsk-1	0.62	912.7	-10	Norilskaya and
Medvezhy Ruchey	Norilsk-1	0.394	354.7	-28	Talnakhskaya concentrators,
quarry					copper smelteries of
Mayak mine	Talnakhskoye	2.05	456.7	-0.2	"Severonickel" combine and
Komsomolsky mine	Talnakhskoye	2.85	1351.8	-18	"Pechenganickel" combine
Skalisty mine	Talnakhskoye	1.13	10.7	NO	
Taymyrsky mine	Oktyabrskoye	3.49	1682.4	-1	
Oktyabrsky mine	Oktyabrskoye	7.74	3231.1	-4	
	Sorsky	copper-molyl	odenum comb	pine	
Sorsky quarry	Sorskoye	0.046	9432.6	+40	Sorskaya concentrator
	Solnechn	y mining ang p	processing co	mbine	
Solnechny mine	Solnechnoye	1.17	1918.899	+67	Tsentralnaya concentrator
	Festivalnoye				
	Perevalnoye				
	Oktyabrskoye				
	Primorsky	mining and be	eneficiation co	ombine	
"Vostok" mine	Vostok-2	0.88	115.2	-20	Primorskaya concentrator
	Arsenyevskoye				

Note: NO - in 1993 not operational

4. COPPER CONCENTRATE PRODUCTION.

At the territory of Russia copper concentrates are produced by 14 enterprices. Besides, one combine ("Pechenganikel"") produces only collective copper-nickel concentrate. In 1994 total copper amount in concentrate, produced in Russia, accounted for 385.4 thous. tonnes, that is greater, than in 1993, by 1.3%. About 237 thous. tonnes of copper in concentrate were produced in Krasnoyarsky region (Noril'sky district), about 113.7 thous. tonnes in Urals, 14 thous. tonnes in Kol'sky peninsula, the rest of the copper (20.7 thous. tonnes) was produced in Siberia and Far East.

Substantial portion of copper produced in concentrate is accounted for by Noril'sky mining and metallurgical combine (61.5%); in Urals most of the copper was produced by Gaysky GOK (Mining and processing combine) - 11.9%, Uchalinsky GOK - 7.3%, and Bashkirsky GOK - 5.8%. Notice that the Noril'sky mining and beneficiarion combine (GMK), did not practically decrease output volume of copper in concentrate as compared with the level of 1993, and the main producers of Ural increased that one (copper in concentrate output): the Bashkirsky copper-sulphur combine (MSK) by 44.9%, the Gaysky GOK by 7.4%, the Uchalinsky GOK by 11.1%.

All the other russian copper producers (with the exception of Solnechny GOK) decreased volumes of output of copper in concentrate, and the greatest drop in production of copper in concentrate in 1994 took place at Buribaevsky ore-department - almost 50%, and at Krasnoural'sky combine - 42.6%.

The volumes of copper concentrate produced in 1993-1994 and copper content in it are presented in table 3. Besides, in this table the main currents of copper concentrate transportation to copper smelting enterprises for blister copper production are shown.

Table 3

PARAMETERS AND SUPPLIERS OF PRODUCTION
IN COPPER CONCENTRATORS IN RUSSIA.

Enterprise	Mines providing feed	Cu, %	Conte		1994/1993,	Destination of Cu
			copper,	tonnes	%	concentrate
			1994	1993		
Urupsky mining and	Urupsky and Bykovsky	15.36	4577	5493	-16.7	Kirovgradsky
processing combine	quarries					copper smeltery
						Sredneuralsky
						copper smeltery
Sibayskaya plant of	Sibaysky quarry,	17.24	22325	15410	+44.9	Krasnouralsky
Bashkirsky copper-	Bakr-Tau quarry					copper smeltery
sulphur combine	Oktyabrsky mine					Kirovgradsky
	Blyavinsky mine					copper smeltery
						Sredneuralsky
						copper smeltery
Uchalinsky mining and	Uchalinsky,	16.01	28091	25266	+11.1	Krasnouralsky
processing combine	Molodezhny, Sibaysky,					Sredneuralsky
	Bakr-Tau,					copper smelteries
	Letny, Osenny Priorsky					
	quarry; Alexandrovsky,					
	Blyavinsky, Jusinsky,					
	Yuzhny mines					
Buribaevskaya	Oktyabrsky mine	15.95	2797	5591	-49.97	Krasnouralsky,
concentrator						Kirovgragsky
						copper
						smelteries,
Gaysky mining and	Gaysky, Jusinsky,	15.90	45806	42644	+7.4	Krasnouralsky,
processing combine	Vesenne-Arapchinsky					Sredneuralsky
	mines; Letny,Osenny,					copper smelteries
	Priorsky quarry					
Krasnouralskaya and	Lavrovo- Nikolaevsky	16.01	6492	11319	-42.6	Krasnouralsky
Turyinskaya	quarry Turyinsky mine					copper smeltery
concentrators of						
Krasnouralsky copper-						
smeltery combine						

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Kirovgradsky copper-	Levikhinsky,	17.11	5483	5967	-8.1	Kirovgradsky
smeltery combine	Lomovsky,					copper smeltery
	Degtyarsky,					
	Gumishevsky,					
	Jusinsky mines					
Sredneuralsky copper-	Degtyarsky,	13.87	2663	3346	-20.4	Sredneuralsky
smeltery combine	Gumishevsky mines					copper smeltery
Zolotushinskaya	Zolotyshinsky,	18.83	575	826	-30.3	Kirovgradsky,
concentrator plant of	Zmeinogorsky,					Mednogorsky
Altaysky mining and						copper smelteries
processing combine						
Sorsky copper-	Sorsky quarry	19.77	1806	2502	-27.8	Kirovgragsky
molybdenum combine						copper smeltery
Solnechny mining and	Solnechny mine	27.59	12868	9333	+37.9	To export
processing combine						
Primorsky mining and	Vostok mine	18.64	633	736	-14.0	Sredneuralsky
beneficiation combine						copper smeltery
Zherekensky moly-		19.85	201	185	+8.6	Kirovgragsky
copper combine						copper smeltery
Sum without "Norilsky	Nickel" concern		134322	12861	+4.6	
		T		8		
Norilsky mining and	Zapolyarny,	20.89	237054	23720	-0.06	Nadezhdinsky
metallurgical combine	Komsomolsky,			3		and copper plants
	Taymyrsky,					
	Oktyabrsky, Mayak					
	mines; Medvezhy					
	Ruchey quarry					
"Pechenganickel"	Central,Western	2.89	14012	14734	-4.9	"Pechenganickel"
combine	quarries, Kaula-					smeltery
	Kotselvaara Severny					
	mines					
Russia total			385388	38055	+1.3	
				5		

5. PRODUCTION OF BLISTER AND REFINED COPPER.

At the territory of Russia rough and refined copper are produced by russian enterprises:

- in Ural: Krasnoural'sky, Sredneural'sky (SUMZ), Kirovgradsky, Mednogorsky copper smelting combines; Kystymsky copper electrolytic plant, and combine "Uralelektromed" (Pyshma);
 - in Kol'sky peninsula: combine "Severonokel'";
- in Krasnoyarsky region: Noril'sky mining and metallurgical combine, including copper plant and Nadezhdinsky plant.

Besides, the combine "Pechenganikel" produces copper-nickel converter matte, which is delivered to the combine "Severonikel" for further processing.

In table 4 the sources of raw materials (for producing blister and refined copper) for these enterprises are presented.

Table 4

RAW MATERIAL SOURCES OF COPPER SMELTERIES IN THE RUSSIA.

Metallurgical plant	Raw material
Krasnouralsky copper	Cu concentrate from: Krasnouralskaya, Turyinskaya,
smeltery	Sibayskaya, Gayskaya, Buribarvskaya, Uchalinskaya
	plants. Cu concentrate by "tolling".
Kirovgradsky copper	Cu concentrate from: Kirovgragskaya, Urupskaya,
smeltery	Buribaevskaya, Zolotushinskaya, Sorskaya plants. Cu
	concentrate by "tolling". Cu scrap
Sredneuralsky copper	Cu concenterate from: Sredneuralskaya, Gayskaya,
cmeltery	Uchalinskaya, Sibayskaya, Urupskaya, Zhirekenskaya,
	Primorskaya plants.
Mednogorsky copper	Cu concentrate by "tolling".
smeltery	
Norilsky combine (NGMK):	
Nadezhdinsky smeltery	Cu concentrate from Norilskaya and Talnakhsky plants.
	ROM Cu-Ni ores from Oktyabrskoye deposits
Copper smeltery:	Cu concentrate from Norilskaya and Talnakhsky plants.
	ROM Cu-Ni ores from Oktyabrskoye deposits, Blister
	copper from Nadezhdinsky copper smeltery, Copper
	product from nickel plant

E-mail: info@infomine.ru, Tel/fax: +7 (095) 237-8033, Address: InfoMine Research Group, P.O.Box 55, Moscow, 117049, Russia

Smeltery of "Severonickel"	ROM Cu-Ni ores from Taymyrskoye deposit. Converter
combine	matte from Nadezhdinsky smeltery, Roasted pellets and
	feinshtein from "Pechenganickel" combine.
"Uralelectromed" combine	Cu blister from: Krasnouralsky, Kirovgradsky and
(Pyshma)	Sredneuralsky copper smelteries. Cu scrap, Cu blister
	by "tolling".
Kyshtymsky copper	Cu blister from: Krasnouralsky, Kirovgradsky and
electrolytic plant	Sredneuralsky copper smelteries. Cu blister by
	"tolling".

Notice that, besides copper in copper concentrate of the NGMK, particular portion of copper (about 60 thous. tonnes) enters nickel concentrates, sending to nickel and Nadezhdinsky plants, so the copper plant of the NGMK is supplied, in addition to copper concentrate, with copper product of converter matte dividing at the nickel plant and with anode copper of Nadezhdinskycopper smeltery (NMZ).

In 1994 about 193 thous, tonnes of blister copper was produced in Russia (excluding crude copper output of the concern "Noril'sky nikel", in which blister copper is not treated as commercial product, because it processed to refined copper immediately), that is less than in 1993 by 18.8%. It is caused by increasing copper concentrate export volumes (see chapter 8) and by decreasing deliveries of copper-bearing secondary resources, as well as by decreasing total portion of operations by "tolling". The main crude copper producer among the Ural plants is the SUMZ, but its portion in the total output volume slightly decreased: from 40% in 1993 to 37% in 1994.

From the four Ural enterprises only the Krasnoural'sky and Mednogorsky combines increased crude copper output volumes, as compared with 1993 (by 10.7% and 29.5%, respectively). The greatest drop in crude copper output in 1994 took place at the Kirovgradsky combine (-48.5%), that was mainly caused by sharp decreasing delivery of secondary resources, portion of which in the combine feeding accounted for about 75-76%.

The amount of crude copper, produced on "tolling" basis, accounted for about 58 thous. tonnes in 1994 (71 thous. tonnes in 1993), and only the Mednogorsky combine increased output of crude copper from tolling resources (Sweden, Turkey).

In 1994 about 551 thous, tonnes of refined copper were produced in Russia, that accounts for 98.4% of the level of 1993. Main refined copper producers are the Noril'sky GMK (45% of the total output in Russia) and the combine "Uralelektromed"

(33.5%). In 1994 the copper output of the NGMK remained at the level of 1993, and the "Uralelektromed" decreased the refined copper output by 15.7% as compared with previous year (1993).

Portion of refined copper, produced on tolling basis (taking into account processing resources from the CIS countries), accounted for about 22.72% in 1994 (12% in 1993).

Table 5 **PRODUCTION OF RUSSIAN COPPER METALLURGICAL ENTERPRISES** .

(including tolling)

Metallurgical plant	Product	Grade	Output		1994/1993,
		Cu, %	productio	n, tonnes	%
			1994	1993	
Krasnoyralsky copper smeltery	Cu blister	99.13	57549	51970	+10.7
Kirovgradsky copper smeltery	Cu blister	99.45	34846	67112	-48.1
Sredneuralsky copper smeltery	Cu blister	99.44	71091	95960	-25.9
Mednogorsky copper smeltery	Cu blister	99.45	29610	22869	+29.5
Total blister copper			193096	237911	-18.8
Norilsky copper smeltery	Cu	99.97	248550	247730	+0.33
	electrolytic				
Smeltery of "Severonickel"	Cu	99.97	65290	58080	+12.4
Combine	electrolytic				
"Uralelectromed" Combine	Cu refined	99.99	184696	219100	-15.7
(Pyshminsky copper electrolitic					
plant)					
Kyshtymskyelectrolytic plant	Cu refined	99.99	53290	35680	+49.4
Total copper refined			551830	560590	-1.6

Table 6 **TOLLING IN RUSSIAN COPPER METALLURGICAL ENTERPRISES**(TONNES)

Enterprise	Product	1994	1993	1994/1993,
				%
Sredneuralsky copper-smeltery combine	Cu blister	15031	27158	-55.3
Kirovgradsky copper-smeltery combine	Cu blister	2476	2186	+13.3
Krasnouralsky copper-smeltery combine	Cu blister	10999	19034	-57.8
Mednogorsky copper-smeltery combine	Cu blister	29610	22869	+29.5
Sum copper blister		58116	71247	-18.4
Kyshtymsky plant	Cu refined	5290	9776	-54.1
"Uralelectromed"	Cu refined	49916	41193	+21.1
"Severonickel"	Cu electrolitic	16833	1245	+13500
Sum copper refined		72039	52214	+38

6. REVIEW OF WORK OF ENTERPRISES, PRODUCING COPPER IN RUSSIA.

1. Kirovogradsky copper smelting plant.

Presently portion of crude copper, smelted from secondary resources at the Kirovogradsky combnat, accounts for about 57%, and in 1994 sharp decrease of secondary resource deliveries occured, with simultaneous impairing quality of this raw material (elevated portion of slimes and slags).

The combine is characterized by bad state of metallurgical (smelting) shop: accidents and failures with resource supply often happened in the shop, for a long time the refractory furnace did not work here (capital repairs was conducted), and the losses of copper with slags are great.

In the expert's opinion, in 1994 the situation at the combine became rather critical, and, as the result, sharp lowering crude copper production occured.

In connection with severe financial situation the combine began to seek investors, and at the shareholder meeting in August, 1994, the firm "M-Invest-Holding" (including 6 companies, headed by "Menatep") was accepted to the structure of the Joint-Stock Company (JSC) "Kirovogradsky copper smelting plant".

The tasks on extension of the combine resource base will be solved as Novo-Shaytansky mine (which is built since July, 1993) will be commissioned. However, the first stage of the mine will be put into operation not earlier, than within three years.

2. Krasnoural'sky copper smelting plant.

Until recently the combine used as the resources for crude copper production the copper ore of own mining from Tur'insky mine, and complex Cu-Fe-V ores (Volkovsky mine), which are processed at Krasnoural'sky concentrator.

The state of the plant is characterized by low level of processing technology, problems with equipment, outdated reagent section and drying section, high dust content in air. The net cost of copper concentrate derivation is high, so it is more profitable for the metallurgical shop to buy somebody else's concentrate (in particular, the concentrate of Uchalinsky GOK).

The scheduled reconstruction of benefication conversion includes promoting 10-12 columnar flotation machines, that result in decreasing electric energy consumption and increasing concentrate output; also using ceramic filters of capillar action, produced by the firm "Outokumpu" is planned instead of construction of new drying section.

Presently reconstruction of the metallurgical shop, having outdated equipment and technology, is actively conducted.

The building of oxygen plant is also conducted, that later on will allow to change over the smelting in refractory furnace to more modern and economical smelting in liquid tank (PZhV). Project on the PZhV construction at the combine is scheduled on 1994-2005.

3. Sredneural'sky copper smelting plant (SUMZ).

As the SUMZ presently has not own resource base, it uses for crude copper production delivered copper concentrates (mainly from Bashkirsky and Gaysky combines). Until recently the concentrator of the SUMZ processed ores from Degtyarsky mine, but in connection with closing this mine the question is being solved about conversion of the Sredneural'sky concentrator to slag processing.

The SUMZ, as well as other Ural combines, experiences sharp resource deficiency, in addition, the concentrates delivered often have low quality.

Presently owing to the lack of resources only one refractory furnace instead of two ones operates in the metallurgical shop. The crude copper output at the SUMZ is significantly dropped.

In 1994 the amount of crude copper, smelted using "tolling" raw materials, accounted for 21% (1993 - 28%).

The main achievement of the SUMZ is the production re-equipment: promoting of the Vaniukov smelting (PZhV) in metallurgical unit.

4. Mednogorsky copper-sulfur combine (MMSK).

As for resources for crude copper production, recently (1992-1994) the combine differs from other Ural copper-smelting enterprises in that it works, using mainly (unless only) "tolling" resources.

The combine work is complicated by the absence of concentrator in its structure. The MMSK structure includes carrier Yaman-Kasi, mining copper-zinc ores, but processing these ores in metallurgical cycle without benefication is inprofitable. So presently these ores are delivered to the Bashkirsky MSK and the Uchalinsky GOK for processing.

The MMSK leaders decided the combine to take part in constructing mining and processing combine at the territory of Chelyabinsk region, that will allow to have benefication conversion and to close technological chain. The MMSK leaders also

plans to start exploitation of Komsomol'skoe deposit, having reserves, that will provide the work of the combine during above 60 years.

The MMSK actively reconstructs copper smelting shop.

The decision is made to build new briquetting plant, that will use west-German technology and equipment. The plant commissioning will allow to obtain charge of higher grade for metallurgical conversion.

Since 1992 the replacing of outdated equipment in the metallurgical shop is conducted; in 1993 the MMSK bought new converter equipment and assembled it during 1993-1994.

Since 1994 the MMSK has being conducted dismantling of old building of pyrosection of the lead shop; in the metallurgical shop the erection of anode conversion with installation of machines for permanent copper casting is scheduled to be completed by 1996. The fulfillment of these works is the first stage for future constructing electrolysis shop at the MMSK. Presently in the metallurgical shop of the MMSK two ore furnace and one concentration one, and two converter operate.

In 1994 the combine had no problem with resources.

5. Combine "Uralelektromed" (Pyshma).

The combine uses crude copper, being delivered by the Kirovogradsky, Krasnoural'sky and Sredneural'sky (SUMZ) combines, as well as secondary resources (copper scrap and waste) as raw material for producing commercial product, and in 1993-1994 a portion of secondary resources sharply increased in comparison with the previous years..

Recently significant volume of refined copper (in 1994 about 56%) is produced on "tolling" basis, including processing cathodes of Dzhezkazgansky and Balkhashsky combines (Kazakhstan).

The refined copper production volume steadily decreases: in 1994 copper production decreased by 37% as compared with 1990.

Lowering copper production at the combine is also connected with sharp decreasing domestic copper market (owing to consumer insolvency, for example, concern "Kamkabel" (Perm' city).

Nevertheless, the combine actively modernizes technologies and equipment. It bought the unit on cathode packing (of the firm "Wenmec"; the unit erection was completed in April, 1994, the unit was commissioned); also the unit "Wenmec" on weight dosing for providing the shop of copper electrolysis with cathodes with uniform weight. In 1994 the line on processing utilized cables by technology of

German firm "Hetzer-Alpine" (with capacity of 15 thous. tonnes of raw material a year) was put into operation.

The main project of the combine is construction of shop on copper rolled wire production (see chapter 7).

In 1993 and the beginning of 1994 the combine experienced significant difficulties with the sale of produced copper powders, the store of ready production had an excess of the powders, but after it sale conditions was improved.

In 1994 the decision was made on stopping shop on foil production. The main copper foil consumer in the CIS: the plant "Moldavizolit" (Moldavya) -presently has no capital to buy the foil of the "Uralelektromed".

As for the quality of commercial production, all the cathode copper, produced in 1994, complied with the requirements for mark MOOk. The combine considers that actual prerequisites exist for obtaining high-purity copper, which meets the requirements of copper mark A at the London metal exchange (presently the work is conducted on registration of the combine copper at the LME.

In 1994 the combine worked with stoppages, resulted from the lack of resources. The difficulties with crude copper deliveries are caused, on our data, by bad terms with suppliers; especially crude copper deliveries from the SUMZ failed.

6. Kystymsky copper-electrolytic plant (KMEZ).

Last time, the KMEZ capacity was increased and accounted about 70'000 tonnes of refined copper, the raw material is delivered mainly by the Kirovogradsky combine and the SUMZ, and partially by the Krasnoural'sky combine. The refined copper production volume in plant was sharply increased in 1994 (on 49.4%).

In 1993 the KMEZ commissioned the copper electrolysis shop by Finnish technology, and german line on cable waste processing, in 1994 new slime section for processing own copper-electrolytic slimes was put into operation.

Besides, in accordance with contract with Finnish firm "Outokumpy Kastform", the production of copper rolled wire of various diameter, as well as trolley wire, is scheduled to be organized at the KMEZ in 1994-1995. Presently, in connection with lowering demand on copper foil, the KMEZ organized production of radiator strip.

Refined copper of the KMEZ complies with the requirements for mark MOOk, and presently the documents for the copper registration at the LBM are ready. The KMEZ actively works using "tolling", in particular, with the firm "Urkopp".

7. Noril'sky mining-metallurgical combine (NGMK).

The copper plant of the NGMK uses copper concentrate of Noril'sky and Talnakhsky concentrators, copper product of converter matte dividing (nickel plant), and crude copper of Nadezhdinsky plant as the resources for refined copper production. The NGMK produces copper using only own resources (without tolling).

In 1994 the plan on refined copper output of the NGMK accounted for about 310 thous. tonnes, however, the combine worked irregularly (for example, the month plan realization varied from 60% in June to 103% in March), and finally realized the year plan by 80% (248.6 thous. tonnes). The work of the NGMK during 1994 experienced a number of factors, among which the following ones should be noticed:

- unfafourable weather conditions (freezing weather), redoubled by the lack of various materials, equipment; heat and water deficiency, partial limitation of gas and electric energy supply;
- often emergencies (the most great in November, 3, 1994), resulted in standing idles at mines, the copper and Nadezhdinsky plants; bad state of the equipment (mainly at the Noril'sky plant);
- severe financial state of the NGMK during the whole year, connected with indebtednesses of consumers and Government of Russia, and the NGMK debt to hydroelectric power stations, that was redoubled by temporary attachment of the combine currency account by the Administration of Krasnoyarsky region.

General feeling of workers (total instability sensation), which did not receive salary during 2-3 months, local mini-strikes, and "secret sabotage" (the worker dissatisfaction was also caused by failure of schedule of delivering goods to Noril'sky district) also had played a part in the combine problems.

Nevertheless, the copper production volume in 1994 proved to be no more than the level of 1993. To some extent this fact is owed by abolition of copper export limitations, that was rather profitable for the NGMK; as the result, most of the NGMK production was exported in 1994 under favourable price business conditions.

8. Combine "Pechenganickel".

Until recently the combine mainly processed copper nickel ores from Noril'sk, but every year the amount of delivered ores decreased owing to sharp increasing transportation expense (in 1994 the Noril'sky ore volume decreased in 1.6 time). Simultaneously the combine develops own resource base, the main prospects are connected with mines "Northern" and "Central". The combine studies variants of work

without the ore from Noril'sk, the leaders of the "Pechenganikel" consider that the combine will be able to survive in this case.

After reconstructing concentrator N 1, where import equipment of the latest design was assembled, the concentrator capacities were enough for processing all the ore, being mined by the combine (taking into account, that the mining volumes decreased, and a portion of rich ores was directly sent to smelting). In this connection the need in work of the concentrator N 2 fell away, so in the middle of 1994 this plant was closed.

Until recently the combine delivered own converter matte and one third of own pellets to the combine "Severonikel" for processing; now all the pellets are processed to produce converter matte at the "Pechenganikel", then all the converter matte is delivered to the "Severonikel" for processing. In accordance with tolling contract the "Pechenganikel" pays for the converter matte processing, and independently deals with copper and nickel, obtained from this converter matte.

9. Combine "Severonikel".

Since early 1970s the combine has transferred to the work on delivered resources, namely, ores and converter matte of the NGMK,, ores and converter matte of the "Pechenganikel". In 1994 the supplies from Noril'sk decreased, as Murmansk Steamship Company rised prices on cargo transportation (by atomic ships) by 25 times, as the result 1 tonne of converter cost at the combine was \$32-33. The converter matte processing, the more so as processing copper-nickel ore of the NGMK, became unprofitable.

To compensate the lack of domestic resources the "Severonikel" imports resources (in 1995 the combine processed, in particular, concentrates from Chili, Finland).

Besides, the combine is going to exploit local copper-nickel deposits (at Monchegorsky plateau) with high contents of copper and metals of platinum group; presently the ore reserves are specified.

In the beginning of 1994 the "Severonikel" conducted active export operations, that allowed to improve financial state; but in the end of 1994 financial problems arised again in connection with the combine debt to the NGMK (the "Severonikel" had to conduct prepayment for providing with resources in the first half of 1994, but the "Severonikel" had no capital to do it).

7. THE PROJECTS, COMPETITIONS, INVESTMENT.

The quantity of the projects, connected with investments to copper branch of Russia in 1994 slightly increased, as compared with the previous year. However reasonably symptomatic is the fact, that a sharp increase of investment volumes of foreign firms does not occur. The projects of 1993, connected with reconstruction of combine "Pechenganikel" and extension of combine "Severonikel" capacities were insignificantly advanced ahead, though, at the same time, there is some revival of actions around Udokansky project. It should be noted, however, that the Russian businessmen have begun to invest capital to the projects, connected with non-ferrous metallurgy, including with copper raw material, more actively, than before.

All this occurs on the background of general instability of an economic and political situation in Russia (especially in the end of 1994) and uncompleted standard-legislative base. From the moment of accepting in 1991 by the Supreme Council of Russia the Law " About the foreign investments in Russia" and till now, favorable investment climate was not created in Russia.

Most of the projects, as before, are connected with development of new copper deposits.

The tender for the right of developing Lovnozerskoe copper-nickel deposit (Kola peninsula) is announced by the Joint decree of the government of Russia and administration of Murmansky region. The tender is held since December 1, 1994 to March 15, 1995. At the end of 1994 Joint-stock company (JSC) "Kola Mining" is established, aimed to creation of mining and processing combine on base of the Lovozerskoe deposit. Among the main founders are the Finnish firm "Outokumpu" (83% of the authorized capital), fund of the property of Murmansky region. (15%).

The reserves of the Lovnozerskoe deposit are evaluated to be about 50 thousands tonnes of copper, with the average copper contents of 0.43 %.

The administration of Sverdlovsky region has declared JSC "Tarn'er" to be the conqueror of competition announced in January 1994 on the right of development Tarn'erskoe copper-pyrites deposit, located in 98 km to the north-west of Ivdel' city. The deposit contains about 146 thousands tonnes of Cu, as well as zinc, silver, gold, cadmium, selenium, tellurium. On conditions of competition the winner is obliged to invest 150 billion rubles to development of the deposit. The Joint-Stock Company (JSC) "Tarn'er" is supported by a consortium "The Credit of Ural", including six leading banks of Russia and Uralpromstroybank, planning to finance the project.

Development of Aleksandrinskoe copper-pyrites deposit (Chelyabinsk region) is conducted by Russian-Swedish enterprise "Aleksandrinskaya mining company",

created in 1994. Copper reserves of the deposit are evaluated to be 159.8 thousands tonnes, with the average copper content of 4.4 % and zinc content of 5.48 %. The volume of the production is determined to be 300 thousands tonnes of ore a year, and the exploitation is planned to be started until the end of 1995. The ore mined, until commissioning Aleksandrinsky GOK, (rough date is 1996), will most likely be processed at Bashkirsky copper-sulfur combine.

On the Infomine data, at present Mednogorsky copper-sulfur combine is excluded from a structure of the founders of Joint venture on development the Alaksandrinskoe deposit; among remaining ones are: Kyshtymsky copper-electrolytic plant, Chelyabinsky electrolytic-zinc plant, and Swedish firm "Euromin".

The first thousands tonnes of ore are mined in the end of 1994 at Safyanovskoe copper-pyrites deposit, located near the Rezh city (Sverdlovsk region). This deposit is characterized by significant reserves of metals, containing about 610 thousands tonnes of Cu in the ores, with the average copper contents of 3.03 %. Notice, that more than half of the ore at the deposit can be mined by carrier, at some sites the ore occurs only at a depth of 11 m from a surface.

Development of the Saf'yanovskoe deposit is conducted by JSC "Safmed", found in 1994, including Rezhsky nickel plant (RNZ), Krasnoural'sky copper smelting combine and a number of other enterprises, and the RNZ incurs the main charges on mining works. At present the ore mined is departed to Krasnoural'sk by trucks. The RNZ completed construction of railway to Saf'yanovsky mine. Full capacity of the mine is 1200 thousands tonnes of ore a year. In 1995 the JSC "Safmed" is scheduled to deliver up to 350 thousands tonnes of copper-zinc ore to the Krasnoyral'sky combine.

In the middle 1994 competition on the right of development of two large deposits of copper-pyrites ores: Shemurskoe and Novo-Shemurskoe, located at 35 km from Ivdel' city (Sverdlovsk region) is announced. The total copper reserves in the ores of these deposits are evaluated to be 450 thousands tonnes.

As before, of special interest is forthcoming development of unique Udokanskoe deposit of copper sandstones (Chita region). Ore lode of the deposit represents upset dish, located in the basis of large mountain. Now the copper reserves of the Udokanskoe deposit are evaluated to be 14-16 mln. tonnes, with the average copper contents of 1.56 %; by this parameter the ores are rather lean. In addition, the ores, besides copper, contains only small amount of gold, silver and PGMs, and by evaluations of the experts, the price of components, recovered from 1 tonne of the ore, is 10 times less, than that of Noril'sky ores.

Besides, a number of the experts considers, that the geological data on the ore reserves can appear to be by 30 % less than it was calculated formerly, owing to bad quality of drilling. It is known, that in January 1993 the international tender for the right of drawing up of the feasibility study report for development of the the Udokanskoe deposit was won by Udokanskaya mining company (UGK). The UGK originally included: the association "Chitageologia" - 15 % of the authorized capital, Closed JSC "Arter Group" (stated as Joint russian-american-german enterprise) - 35 %, administration of Chita region - 5%, " Chita Minerals " (is owned by british subject of Chinese origin Mr. E.Wong) - 45 %. In June 1993 the board of directors of the UGK has accepted the decision to expel the company "Chita Minerals " from the structure of the founders, and to exclude Mr. Wong from the structure of the board in connection with the fact, that he is in inquiry of Interpol. The "Chita Minerals" has refused to pay bonus to Chita region Administration, as well as costs of consulting firm Fluor Daniel, which in accordance with preliminary plans should prepare the feasibility study report (FSR).

It was previuosly assumed, that the UGK will present the FSR for state examination till June 1, 1994, but Russian Committee of Entrails (Roscomnedra) and the Administration of Chitinsky region have given a consent on changing date of the FSR elaboration to a later date. Then it was informed about an opportunity of presenting the FRS by the end of 1994, however, the whys and wherefores of the Udokan deposit development, preparation of which is conducted now by the firm "Minproc Corporation", is so far not submitted for examination. In accordance with the license agreement the UGK is obliged to elaborate the FSR and to elaborate all the variants of mining and development of the deposit, technology of processing and sales of the production. In case if the FSR will not be confirmed at the first time, it will be sent on completion with new conditions, in the second time - the license will be cancelled and transferred to firm, that will be able to satisfy with all presented requirements.

Notice that there is some contradiction in this situation: the license was granted to the UGK by the Roskomnedra and the administration of Chita region in accordance with the Law of Russia "About womb", on the right of development of the deposit, however it is spoken in the government order on conducting the tender on Udokan, that the winner receives the right only on FSR elaboration.

By now the UGK has changed initial plans in number of details, in particular, refusing to construct a Udokan city and to extend a settlement New Chara at the BAM,

located at short distance from the deposit. Instead of this, works on the object is supposed to be conducted by watch way.

The main change is that the UGK has offered the new plan of sale of 200 thousands tonnes of copper concentrate a year, according to which its part, which was earlier offered to be processed in China (construction of copper smelting combine in province Shen'yan), will be delivered to Ural copper smelting plants. However, the number of the experts considers, that the properties of the Udokan concentrate are rather specific, and the processing these concentrates at the Ural plants will require partial alteration of metallurgical process.

It is not improbable that above-mentioned facts, as well as large volumes of stripping, severe climatic conditions, rising prices of material resources, the existing system of the taxation can make the project unprofitable.

The main manufacturers of a copper concentrate at Ural: Bashkirsky coppersulfur combine, Gaysky and Uchalinsky GOKs try to conduct reconstruction by own forces, partially waiting for state financing.

The hopes for an increase of capacities of Bashkirsky copper-sulfur combine on manufacture of a copper concentrate are connected with the plans on development of Yubileynoe and Podol'skoe deposits, as well as with constructing Sibaysky underground mine (with the capacity of 250 thousands tonnes of ore), which is scheduled to exploit deep horizons of the Sibaysky copper-pyrites deposit. This project is included to the Federal program of modernization of nonferrous metallurgy of Russia. Previously the underground mine is planned to be put into operation in 1998, however, the lack of finance (government is allocated for the project only 30 % of capital, scheduled previously) dictates low rates of mining work conducting, and the most realistic date of the work completing is by 2002.

As to the Yubileynoe deposit, which is transferred on the balance of the Baskirsky combine, the decision is made to start developing it by watch way. The deposit is characterized by copper reserves of 1618.1 thousands tonnes (with copper content of 1.79 %), availability of the high contents of a gold (up to 3.25 ppm), development of the deposit is possible to conduct by carrier. Presently the Bashkirsky MSK has not possibility to construct a road to Sibaysky factory (100 km), so the ore of the deposit will be transported by trucks. The ore mining is scheduled to account for 500 thousands tonnes.

The significant reconstruction for increasing resource capacities is conducted at the Gaysky GOK. As a result in 1993 the capacities of underground mine were increased by 300 thousands tonnes, and in 1994 almost by 500 thousands tonnes, with

a prospect to achieve in nearest 1-2 year the volume of ore processing at beneficiation plant up to 5 mln. tonnes a year.

The Federal program of modernization of nonferrous metallurgy of Russia schedules a number of the projects on extension of raw material base of the Uchalinsky GOK, including: construction of: Uzel'ginsky mine (with project capacity of 2.5 mln. tonnes of ore a year) and of Uchalinsky underground mine (capacity 1.5 mln. tonnes of ore). The first stage of the Uzel'ginsky complex with capacity of 70 thousands tonnes is commissioned in 1992, presently the construction of the second starting complex with the capacity of 630 thousands tonnes is conducted, the commissioning of which is planned to be in the beginning of 1995.

To find investors is presently problem of Primorsky GOK (Primorsky region) which plans to increase ore mining to 350 thousands tonnes a year with corresponding output of 6 thous. tonnes of copper concentrate (estimated cost of the project is \$2 mln).

At Oktyabr'sky deposit of the Noril'sky GMK it is planned to commission the first stage of mine "Skalisty" until the end of 1996. The initial works have started there in 1984, however the acceleration of activity has started only since February 1993. Comparing with other mines of the NGMK, this mine is characterized by much more complicated mining-geological and mining-technical conditions. The total ore reserves are evaluated to be 3446.2 thousands tonnes of copper, the rich ore by valuations should be enough minimum for 50 years, the disseminated one for even greater duration.

In 1993 the combine "Severonikel" has finished the contract with the American firm 'Minproc" on \$25 mln. on purchase of technology and equipment for a new shop on manufacturing electrolytic copper. Rough date of start-up of this shop with capacity of 15 thousands tonnes of copper is 1996. On the data of Infomine, in spite of the fact that the equipment has already arrived to the combine, the construction of the shop is draged out, owing to financial difficulties of the "Severonikel".

As known, in modernization of combine "Pechenganikel" Norwegian firms "Elkem Technology" and "Kvarner Engineering", as well as Swedish company "Boliden Contech" must participate. As a result of modernization it is supposed to reduce SO2 emission more than 6 times in comparison with the level of the last years: to 40 thousands tonnes a year against 250 thousands tonnes in 1992. The reconstruction will allow to organize processing sulfur gases, as well as to lower power consumption of manufacture as a whole. Total cost of the reconstruction will account for \$256 mln. The bulk of capital, needed for the project implementation, will be

received at the expense of a foreign exchange earnings of export of 90 thousands tonnes of nickel without taxation by the customs duties during four years. Norway, granting free of charge credit of \$42 mln. for fulfillment of the project, is interested in starting the works on modernization of the "Pechenganikel" in 1995.

The administration of Chelyabinsk region has given at the end of 1994 - beginning the 1995 preferential credits for fulfillment of a number of the investment projects, among which organization of crude copper manufacturing at combine "Ufaleynikel". On the data of Infomine, one of variants is processing copper concentrates of the Gaysky GOK.

A number of the projects at the territory of Russia is connected to development of manufacturing copper rolled wire from copper, as the majority of the consumers (enterprises of a cable industry) experienced the lack of the rolled wire until recently.

One of the most great projects is construction of the shop on manufacturing copper rolled wire with productivity of 235 thousands tonnes a year at combine "Uralelektromed". The equipment of system "Kontirod" for this shop (the price is \$23 mln.) was purchased at the firm "Mannesmann Demac Sack". In accordance with the project the shop is to consist of two sections: metallurgical and rolling ones;, the shop is scheduled to produce copper rods of 8 mm in diameter as commodity production. Planned the payback time accounts for 3 years. In accordance with the agreement on construction of the shop of rolled wire, signed in 1992 (initial cost is 87 bln roubles), the partner of the combine "Uralelektromed", namely, a JSC "Kamkabel" must meet 40% of all capital costs, however, in December 1993 the "Kamkabel" refused financing the project, deciding organize own manufacture of copper rolled wire.

The administration of the "Uralelectromed" tried to find the investors among the foreign companies, as well as among domestic businessmen, however it could not. Manufacturers of crude copper: the SUMZ, the Krasnoural'sky and Kirovogradsky combines, to which the "Uralelektromed" also offered to participate in the project, have not needed financial funds. In spite of the fact, that the "Uralelectromed" asked for the government about financial support, the government refused to invest 40 bln. roubles to completing construction of copper rolled wire shop. On the data of Infomine, by the present time the shop has been constructed more than by half, however in the middle of December 1994 the combine administration still made a decision on suspension of the shop construction.

JSC "Roskat", found by the plant "Volgokabel" in Neftegorsk (Samarsky region), since summer of 1992 has also being conducted construction of a plant on manufacturing copper rolled wire with capacity of 55-68 thousand tonnes a year. The

line of continuous casting (on the basis of a machine "Sautvayer") and rolling copper wire (to a diameter of 8-14 mm) is planned to commission in 1995. Until recently the "Roskat" planned to use copper cathodes of the concern "Noril'sky Nickel" as raw material, however situation with copper deliveries to home market in 1994 (see the chapter 9) makes these plans more than problematic.

The extension of own manufacture of copper rolled wire, conducting by the "Kamkabel", also is carried out, calculating on using raw materials of the "Noril'sky Nickel". It is planned to install at the "Kamkabel" equipment for continuous casting copper wire "Propertsi" of Italian firm "Koktinuus" (at present the equipment has already arrived from Italy, the assembling is conducted). The capacity of the equipment is 60 thousand tonnes of rolled wire (with a diameter from 8 to 16 mm) a year.

The main of the above-listed projects were studied by the experts of the Infomine from the point of view of prospects and possibility of actual implementation of the projects. The conclusions of the experts are submitted in the table 7.

Table 7
EXPERT ESTIMATES OF MAIN PROJECTS
IN RUSSIAN COPPER BRANCH INDUSTRY

Project	Participants	The	Degree of	Opportunit
_	_	importance	study of the	y of
		of the	project,	realization
		project for	availability	of project in
		copper	equipment,	time
		branch	means	
Operational of	Kyshtymsky	4.0	4.0	4.0
Alexandrovsky	copper plant,			
deposit	Chelyabinsky			
	electro-zinc			
	plant, Euromin			
	AB			
Operational of	Udokan mining	5.0	1.5	2.0
Udokan deposit	company			
Electrolytic copper	"Severonickel"	4.0	3.5	3.0
refinery unit	combine,			
building on	Minproc			
"Severonickel"	_			
combine				
Reconstruction	Pechenganickel"	4.5	4.0	3.5
of "Pechenganickel"	combine,			
combine	Elcem, Kvarner,			
	Boliden			
Copper rod unit	"Uralelectromed	4.5	2.5	3.0
building on	combine"			
"Uralelectromed"				
combine				
Copper rod unit	"Kamcabel"	3.5	3.0	3.5
building on	combine			
"Kamcabel"				
combine				

8. COPPER CONSUMPTION IN RUSSIA, DOMESTIC PRICES ON COPPER, EXPORT-IMPORT OPERATIONS WITH COPPER-BEARING PRODUCTION.

The structure of copper consumption in various branches of industry in Russia is reasonably simular to that one in former USSR, as far as the significant majority of the enterprises consuming copper were found in Russia after disintegration of Soviet Union.

Structure of copper consumption in Russia in 1994 are shown in the table8

Table 8

STRUCTURE OF COPPER CONSUMPTION IN RUSSIA IN 1994.

Area of use	%
Cable production	45.2
Copper rolled stock	19.5
Brass rolled stock	19.8
Bronze rolled stock	2.2
Copper foil production	0.6
Copper powder production	3.6
Alloying of steel and alloys	4.5
Bronze casting	1.4
Other (state stock)	3.2
Total	100.0

As one can see, the main part (totally about 87 %) of produced copper is used in cable industry and for producing copper, brass and bronze rolled metal.

The main consumers of copper for a cable industry of Russia are the Joint stock company "Kamkabel" (Perm'), Joint stock company "Moskabel" (former plant "Moskabel", Moscow), Joint stock company "Sibkabel" (Tomsk), the plant "Volgokabel" (Samara), Joint stock company "Elektrokabel" (Kol'chugino), Joint stock company "Sevkabel" (Sankt-Peterburg).

The sharp increase of copper export from Russia in 1994 extremely negatively influenced on work of the enterprises of electrotechnical industry of Russia, resulting in sharp deficiency of raw materials.

Until recently refined copper, produced in Russia, were departed to the "Kamkabel" and to Joint venture "Elkat" (separated from the Moskabel") to produce copper rolled wire for the enterprises of cable industry of Russia; the "Kamkabel" mainly used copper from the Joint stock company "Uralelektromed', and the Joint venture "Elkat" mainly utilized copper from the Noril'sky GMK. In 1993 the Joint

stock company "Kamkabel" processed about 70 thousand tonnes of refined copper, and the Joint venture "Elkat" processed 120 thousand tonnes of refined copper (partially the copper was delivered by the Joint-Stock company "Dzhezkazganzvetmet" (Kazakhstan), in 1994 these amounts have sharply decreased to 28-30 and 45-50 thousand tonnes, respectively.

Because of the lack of raw material a number of the enterprises worked by the orders, using tolling resources from foreign countries (for example, the Joint stock company "Kamkabel" cooperated with the countries of the Persian Gulf), as well as copper from the CIS (countries of ex-USSR) (the "Elkat", the "Moskabel", the "Sibkabel").

In opinion of the experts of the Infomine, on a background of raw material deficiency, a part of the cable enterprises of Russia was in a quite safe financial situation. It results from, in particular, improving sales of oil-cables (for submerged pumps), that are presently in elevated demand of oilers.

Until recently, also large portion of copper was delivered for manufacture of nonferrous rolled metal. The main manufacturers of copper rolled wire in Russia are Kol'chuginsky plant on processing nonferrous metals (Kol'chugino), concern "Krasny Viborzhets" (Sankt-Peterburg), Kamensk-Ural'sky plant on processing nonferrous metals (Kamensk-Ural'sk), being a members of association "Tsvetmetobrabotka". These enterprises manufacture very diverse range of copper rolled metal: copper rolled wire, tapes, bands, pipes, sections and rods (the Kol'chuginsky plant); sections, plates, rods, radiator tapes, sheets (the "Krasny Viborzhets"); wire, tapes and bars, collector bands, rods, copper rolled wire, trolley wire (the Kamensk-Ural'sky plant).

These enterprises, as well as Kirovsky plant on processing nonferrous metals (Vyatka) and Revdinsky plant on processing nonferrous metals (Revda) produces most of brass and bronze rolled metal in Russia.

Russian enterprises, processing nonferrous metals as well as enterprises of a cable industry in 1994 experienced problems with contracting bargains on copper delivery by russian manufacturers. This problem resulted in reduction of rolled metal output volumes, with a simultaneous increase of a part of production from tolling raw materials (in particular, the portion of tolling resources, being used by the Kol'chuginsky plant at present accounts for 40% of the total).

The small part of refined copper is consumed by manufacturers of copper powders and foil. In the former USSR copper powder was manufactured only by the Joint stock company "Uralelektromed"; at this plant, when projecting, the shop of copper powders was designed for producing powder of the mark PMS-1 with bulk

density of 1.74 g/cub.sm, at present the shop manufactured 15 grades of the powder in a range of bulk density 1.4-2.63 g/cub.sm. In 1993 at the combine "Uralelektromed" a line on manufacturing modified powders of 6 grades (meeting to european standard requirements) of Italian firm "Pometon was commissioned. At present the capacities on the powder production are kept running by half. The Italian line stands idle. In opinion of the experts, today the Russian industry experiences need in light (< 1 g/cub.sm) and small-sized (fine) powders, which are necessary for manufacturing diamond tools, and for pigment production. Presently the combine "Uralelektromed" has mastered modes of light powder electrolysis, however, the powder drying remains unsolved problem.

Joint stock company "Vita", organized at the "Uralelektromed", produces, on the base of copper powders, articles from dispersed-strengthened compound materials (DUKM), its capacities account for up to 3 thous. tonnes a year, however, at present the manufacture is uncompleted and the DUKM are produced in cooperation with other manufacturers. The consumers of this production are motor plants (in particular, AvtoVAZ and GAZ), tractor and combine enterprises of the CIS.

In the former USSR maximum volume of demand on copper foil in late 1980s accounted for about 8 thousand tonnes a year, therefore that time shops on manufacture of the foil were organized at the Kistimsky copper electrolytic plant, plant "Moselektrofol'ga" and the combine "Uralelektromed". Presently the demand on a copper foil in Russia is low, owing to conversion of defense industry enterprises, as well as the fact, that a number of large consumers of the foil: plant "Moldavizolit" (Tiraspol', Moldova), Petropavlovsky plant of electro-insulating materials (Petropavlovsk, Kazakhstan) have remained in the countries of the CIS after disintegration of the USSR, and the economic contacts with them are practically broken off. Owing to the lack of copper foil sale, the shop on the foil production at the combine "Uralelektromed" is presently closed, and the same shop at the Kistimsky copper-electrolytic plant is conversed for producing another production.

In 1994 domestic prices on refined copper in Russia have increased from 1500 thousand roubles per tonne (January 1994) up to 6500 thousand roubles per tonne (beginning of January 1995). Nevertheless, if to compare domestic prices on the copper with world ones (in recalculation on average rate of dollar), following picture will come to light: this ratio (in %) by 01.01.1994 was 70 %, by 01.07.1994 was 50 %, by 01.01.1995 was 62 %. Thus, difference in copper price between the world and domestic prices slightly decreased in 1994, but still remains at the profitable for exporters level.

In this connection, and after cancellation of the restrictions on export (quotas) since July 1994, when the Russian enterprises have received large freedom in foreign trade operations, copper export in 1994 increased in comparison with the previous year 2.5 times and accounted for 407.5 thousand tonnes (on the Goskomstat data (Federal Committee on Statistics), that made up 73.8% of total refined copper output in Russia.

Notice that if during first half-year of 1993 Russia exported 110.9 thousand tonnes of the copper, in second half-year volumes of the copper export has grown more than 2.5 times, and, on the data of the Infomine, the main growth felt within July-August and December of 1994.

The distribution of the refined copper export from Russia over countries of the world is shown in table 9; in 1994, as well as in 1993 the main copper importers were the Netherlands and Great Britain.

The average export price of 1 tonne of refined copper from Russia in 1994 made up slightly above \$2000, that by 8.5% above the average export price in 1993.

Data on export and import of copper concentrate, copper unwrought is shown in table 9.

In connection with extreme increasing nonferrous metal export (including copper), the leaders of the Roskommetallurgii (Russian Committee on Metallurgy) plans to undertake some measures on protection of the home market and reduction of volumes of export, in particular, they declared about increase in 1995 of loading of rolling capacities at the enterprises of nonferrous metallurgy almost twice. The experts of the Infomine consider this forecast to be too optimistic and believe that in 1995 the domestic copper consumption in Russia will slightly increase up to 180-190 thousand tonnes, with simultaneous reducing volumes of copper export to 370-390 thousand tonnes.

Table 9
COPPER ORES, CONCENTRATES AND METAL
EXPORT AND IMPORT IN RUSSIA IN 1994

Code	Product	Country	Quantity,	Cost, '000
			tonnes	USD
		<i>IMPORT</i>		
2603	Cu ores and concentrates	Total	76778	8631
		Mongolia	32678	7202
		Switzerland	44100	1429
7402	Cu unrefined	Total	-	-
7403	Cu refined and alloys	Total	4	6
		Finland	4	6
		EXPORT		
2603	Cu ores and	Total	93484	29692
	concentrates			
		China	21847	6905
		France	10000	2362
		Japan	36100	12795
		South Korea	9728	2556
		Switzerland	15809	5074
7402	Cu unrefined	Total	240	323
		USA	240	323
7403	Cu refined and alloys	Total	407551	839151
		Austria	7310	15780
		Bahamas	240	565
		Belgium	6082	11140
		Virginia islands	125	353
		(GB)	07.0	1.1061
		Bulgaria	8762	14021
		Caiman islands (GB)	496	1284
		China	1782	4527
		Taiwan	66	156

Copper in Russia. Research Group INFOMINE Report (Moscow, 1995)

Cyprus	10719	21923
Czechia	3996	5400
Finland	7997	18237
Germany	51463	95454
Hungary	1776	2841
Ireland	1925	2087
Italy	1802	2642
Japan	36	45
South Korea	269	323
Latvia	3000	5304
Lithuania	108	188
Netherlands	140664	291024
Poland	1092	1410
Slovakia	6989	8101
Sweden	1080	2633
Switzerland	30040	68519
Great Britain	53158	120543
USA	66574	144741

9. ANALYSIS AND PROSPECTS OF RUSSIAN COPPER BRANCH DEVELOPMENT.

In 1994 the state of copper branch of Russian industry, like Russian nonferrous metallurgy as a whole, was reasonably stable (from the production volume decrease standpoint), comparing with Russian industry as a whole.

As it is seen from the summary tables 4 and 5, copper production in concentrates in 1994 increased by 1.3% as compared with 1993, output of crude copper and refined copper decreased by 18.8% and 1.6%, respectively (for comparison: in 1993 copper production in concentrates, blister and refined copper output decreased by 5.3%, 13.5%, and 17.8%, respectively, comparing with 1992).

As compared with data of relatively satisfactory for Russian industry 1989, the production volume of crude and refined copper in 1993 accounted for only 48.4% and 65.3% of the output level of 1989, respectively.

Production drop in the copper branch is being continued, it is caused by a number of reasons:

- 1. The lack of copper resources takes place, caused by: removing from service resource capacities (owing to depletion) of mining and processing combines (mainly in Ural); breaking most of technological cooperation with enterprises of the CIS and decreasing deliveries of copper concentrate from Kazakhstan, Armenia and Georgia; sharp drop of copper concentrate delivery from Mongolia (Erdenet).
- 2. The copper branch, like Russian nonferrous metallurgy as a whole, is characterized by chronic deficiency of capital investments, and deficiency or the lack of highly efficient domestic equipment, that results in progressing aging of major industrial production funds. In the copper branch such state is especially typical for Ural enterprises producing crude copper.

The copper subbranch, having significant scientific potential and being pioneer in elaborating a number of efficient technologies (for example, smelting in liquid tank) still uses outdated technologies and equipment, which were rejected by western countries owing to both high material and power consumption and ecological reasons.

3. Domestic consumption decreases owing to sharp dropping industrial production in Russia, which closely connected with branches of Defense Industry, as well as to severe financial state of most of consumers.

The situation is also complicated by severe financial state of most of the copper branch enterprises, especially those enterprises that are "in the beginning" and "in the middle" of technological cycle (mines, GOKs). Increasing prices on resources, materials, coal, increasing transport and electric power tariffs resulted in both

increasing prime cost of production and aggravating nonpayment crisis in the production cycle as a whole (mining - processing - metallurgy on the one hand, and metallurgy - TEK (Fuel-power complex) enterprises and railway on the other hand.

Mutual nonpayments of enterprises increase their aspiration to conduct "tolling" operations, the main advantage of which for Russian enterprices is the lack of problems with resources, as well as prepayment of foreign partner.

In 1994 reasonably sharp increasing refined copper production volumes on "tolling" base is mainly due to increasing deliveries from Kazakhstan (Balkhash, Dzhazkazgan) to combine "Uralelektromed".

Notice that, besides tolling operations with foreign partners and enterprises of CIS, in the copper branch "internal tolling" actively works. Copper smelting enterprises of Ural (in particular, the "Uralelektromed") can not buy raw material owing to the lack of working capital; and crude copper (raw material), being processed by the enterprises, is property of a number of domestic commercial firms that buy copper concentrate within Russia, give it for processing to produce crude copper and later on to obtain refined copper; the latter (refined copper) then is exported.

As for resource base, in 1994 mining is stopped at Degtyarsky and Lomovsky mines (Krasnoural'sky combine). In the immediate future the situation in the copper industry may be aggravated by removing from service Uchalinsky and Molodezhny carriers of Uchalinsky GOK, mine III Internatsional, shaft "Krasnogvardeyskaya" of the Krasnoural'sky combine, and Sibaysky carrier of Bashkirsky GOK.

Federal program of russian nonferrous metallurgy resource base development includes, as ones of the immediate tasks (objects): stripping (exploitation) of deep levels of Gaysky mine, Uchalinsky and Uzel'ginsky mines of the Uchalinsky GOK, Sibaysky mine of the Bashkirsky combine.

Financing this program is implemented only partially, nevertheless, the main Ural copper producers - the Gaysky and Uchalinsky GOKs and Bashkirsky MSK, which especially experience extreme deficiency of copper resources, seriously seek to improving their own mineral resource base (see chapter 7), and, that is the crucial, their plans have actual financial basis (support), and their realization is started. The main prerequisite to advantageous realization of the plans is sharp increase in production copper in concentrates at these enterprises in 1994.

In parallel with existing disproportion between Russian enterprises, mining copper resources, and enterprises, processing copper resources, as early as past years sharp misbalance raised between production of intermediate product (refined copper) and final product (rolled copper): the amount of the refined copper was greater than it

was necessary for producing final product (it mainly was caused by hard centralized distributing character of the ex-USSR economics). So decreasing copper consumption in 1990-1993 is caused not only by decreasing solvency of copper consumers and profitability of export operations, but also by reaching realistic equilibrium between production and consumption of copper.

The main Russian copper producer Noril'sky GMK, in spite of extremely unstable situation at the combine, caused by both objective and subjective reasons (chapter 6), did not practically decreased copper production in 1994. Resource reserves and capacities of the combine are reasonably great (for example: in 1994 the copper production accounted for only 55-60% of the output level in the late 1980s). On our data, in 1995 the Noril'sky GMK schedules sharply increasing copper production (up to 340-350 thous. tonnes); it is dufficult now to discuss the possibility of realizing this forecast, but it should be noted that the NGMK overcame the impacts of accidents and reached normal operating conditions.

One would expect refined copper output in 1995 will decrease at the combine "Uralelektromed" and will increase at the Noril'sky GMK as a whole.

On the INFOMINE forecasts, total refined copper production in Russia in 1995 will account for 650-570 thous. tonnes.

Appendix

COPPER CONCENTRATE STATE STANDARD (OST 48-77-74).

COTTER CONCENTRATE STATE									
Mark of concentrate	Grade Cu, % no less,	, %, no more							
	than	Zn	Pb	Mo					
KM0	40	2	2.5	0.12					
KM1	35	2	3	0.12					
KM2	30	3	4.5	0.12					
KM3	25	5	5	0.12					
KM4	23	9	7	0.12					
KM5	20	10	8	0.12					
KM6	18	11	9	0.12					
KM7	15	11	9	0.12					
PPM	12	11	9	0.12					

COPPER BLISTER METAL STATE STANDARD (OST 48-7-21-89).

Mark of	Grade Cu+Au+Ag, % no	Grade of impurity, %, no more					
metal	less, than	Sb	As	Ni	Bi	Pb	
Mch0	99.5	0.03	0.03	0.10	0.002	0.10	
Mch1	99.4	0.05	0.05	0.20	0.005	0.10	
Mch2	99.2	0.08	0.08	0.30	0.010	0.20	
Mch3	98.8	0.15	0.15	0.75	0.020	0.20	
Mch4	98.3	0.20	0.20	0.85	0.030	0.40	
Mch5	97.5	0.30	0.30	0.90	0.040	0.40	
Mch6	96.0	0.35	0.35	1.00	0.050	-	

COPPER REFINED METAL OF MOOK MARK.

Element	Ag	S	Pb	Bi	Sn	Fe	Zn	Ni	As	Sb	P	O
Grade, ppm	20	20	5	2	10	10	10	10	5	4	10	150