

MINERALS

ore than 80 mineral species are found in hydrothermal veins and the oxidized zone of the Belorechenskoye deposit (Table 1). It is expedient to subdivide them, with some arbitrariness, into three groups: "veiny", ore and hypergenic. They are characterized in this present section in that order.

Veiny Minerals

Barite is not only the single commercial mineral resource of the deposit, but it is also the most famous among the collectible minerals of the Belorechenskoye. It has a wide variety of morphologies and occurs as beautiful specimens. Despite its various habits, its "face" is characteristic and easily recognizable.

The main mass of barite is concentrated substantially in barite veins. It is represented here by aggregates of intimately intergrown platy individuals, often filling the whole vein body. The axial parts of the veins are characterized by numerous cavities whose walls are covered by crusts of barite crystals, sometimes excellently formed, overgrowing fluorite and galena crystals, and yet again often covered by aggregates of calcite crystals.

It is possible to distinguish three barite generations. The earliest among them is represented by two types of segregations, different in occurrence conditions, morphologiy and color. The first one is represented by fine-grained pink barite (1-a), composing extensive parts of symmetrically zoned veins. The size of its individual crystals does not exceed a few tenths of a millimeter. The second type (barite 1-b) is represented by coarsely crystalline aggregates of light grey color. It is the main component of most veins. Along with compact and massive accumulations of individuals, it forms spheroidal, platy aggregates, reaching several centimeters across. Simultaneously with the barite 1-b, galena and sphalerite crystallized. Barite crystals of the same generation incrust walls of most cavities.

The second generation had two stages of nucleation. Earlier prismatic crystals (barite 2-a) form groups, overgrowing the barite nd fluorite of the first generation. Later barite (2-b) occurs as flattened crystals, ingrown at their bases into crystals of the barite 2-a and forming inductive surfaces of simultaneous growth with them.

The latest generation (barite 3) is represented by platy crystals overgrowing all previously formed minerals in cavities.

Goniometric measurements on the Belorechenskoye barite crystals revealed faces of 20 different crystal forms. In the barite veins of the deposit. one might distinguish three main morphologic crystal types of this mineral. The first type are individuals of prismatic habit with the most developed faces being {102},

Parallel intergrowth of **calcite** crystals upon **barite** with sprinkling of **marcasite**. 5 cm. Collection and photo: B.Z. Kantor.

Native lements I II II II IV Native elements Silver Ag + Arsenic* As ++ - Graphite C ++ - Sultur* S ++ - Nickeline* NiAs ++++ - Breinhauptite* NiAs ++++ - Ramelsbergite NiAs, +++ - Rareardesbergite NiAs, +++ - Resolutite* NiAs, +++ - Resolutite* NiAs, +++ - Resolutite* NiAs, +++ - Chalcocite Cu,S +++ - Chalcocite Cu,S +++ +++ Galena* PbS +++ +++++ Chalcocite Cu,S +++ +++++ Mileite* NiS +++ +++++++ Relana* PbS +++ <t< th=""><th>Mineral</th><th>Formula</th><th>•</th><th colspan="3">Distribution</th><th></th></t<>	Mineral	Formula	•	Distribution			
Native elements Normal colspan="2">Normal colspan="2"Normal colspan="2"Normal colspan="2"Normal colspan="2"Normal colsp	minicial	Formula		Ι	II	III	IV
Silver Ag + + + + + + + + + + + + + + + + + +			Native elements	-			
Arsenic* GraphiteAs++GraphiteC++Sulfur*S++Nickeline*NiAs+++Breinthauptite*NiAs+++Rammelsbergite*NiAs+++Rammelsbergite*NiAs+++Rammelsbergite*NiAs+++Rammelsbergite*NiAs+++Varuovite**NiAs+++Gersdorffite*NiAsS+++Ullmannite*NiSbS+++AscenopyriteFeAsS+++ChalcociteCu_S++ChalcociteCu_S++ChalcociteGuSS++ChalcociteFeAsS++HgS++++++++Sphalerite*XISS++Sibinite*NiSS++Millerite*NiS+++Sphalerite*AsS++Sibinite*Sb,S,++MolybdeniteMoS2++MolybdeniteNiS2++MolybdeniteNiS2++MolybdeniteNiS2++Pyrine*FeS2++Harrowite*Sb,S,++Pointe*NiNi2S++Promite*NiNi2S++Printe*AsSS++Printe*AsSS++Printe*AsSS++Printe*AsSS++Printe*AsSS++Printe*AsSS++Printe*AsSS++Printe*AsSS++ <td>Silver</td> <td>Ag</td> <td>1 Junio Clemento</td> <td></td> <td>+</td> <td></td> <td></td>	Silver	Ag	1 Junio Clemento		+		
Graphic Suffur*C++Suffur*C++Suffur*S+Arcenides, antimonides, sulfoarsenides and sulfoantimonides+++Nickeline*NiAs++++Breithauptite*NiAs++++Breithauptite*NiAs+++PararammelsbergiteNiAs+++PararammelsbergiteNiAs+++PararammelsbergiteNiAs+++Curvite**NiAs+++Qersdorffite*NiAs+++CalcociteCu/S+++ChalcociteCu/S++ChalcociteCu/S++ChalcociteCu/S++ChalcociteCu/S++ChalcociteCu/S++ChalcociteCu/S++ChalcociteCu/S++ChalcociteCu/S++System++Sphalerite*ZnS++Sphalerite*XiS++Sphalerite*NiS++Sphalerite*Sb2S_3++MolydeniteMoS+++MolydeniteMoS+++Printe*FeS_2+++++++ViolariteFeS2+++++++Printe*Agsb5/S+++ProvisiteAgsb5/S+++ProvisiteAgsb5/S+++ProtestinHHProtestinHProvinte*Caf2+++Provinte*Caf2++++Provinte*Caf2+	Arsenic*	As			++		
Suffirt*S+Arsenides, antimonides, sulfoarsenides and sulfoantimonidesNickeline*Nickeline*Nickeline*Nickeline*Nisb+++RammelsbergiteNisks,+++RammelsbergiteNisks,+++RammelsbergiteNisks,+++Krutovite**Nisks,+++Kutovite**Nisks,+++Villmannite*Nisks,+++Ullmannite*Nisks,+++ChalcociteCu_S+++++Galena*PbS++Sphaleric*ZnS++++++++Metacinnabar?HgS+++++++Metacinnabar?HgS++++++++++MolydoenireMoS_+++++++++Moresite*Sb_S_,+++++++++++++++++++++++++++++++++++	Graphite	C		++			
Arsenides, antimonides, sulfoarsenides and sulfoantimonidesNickeline*NiAs+++++Breithauptite*NiAs+++++Breithauptite*NiAs++++Breithauptite*NiAs+++BrainamelsbergiteNiAs+++PararammelsbergiteNiAs+++Krutovite**NiAs+++Krutovite**NiAs+++Krutovite**NiAs+++Krutovite**NiAs+++Checkoffite*NiAsS+++ArsenopyriteFeAsS+++Sulfides and sulfoantis+++ChalcociteCu_5S++ChalcociteCu_5S++Sphalerite*ZnS++Sphalerite*ZnS++MetacinnabarHgS++Hillerite*NiS++Millerite*NiS++Millerite*NiS++MolydoniteMoS2++MolydoniteMoS2++Vrite*FeS2++ViolariteFeS2++ViolariteNiS54+Pyragyrite*AgSS53+Pyragyrite*AgSS53++Pyragyrite*AgSS53++Pyragyrite*AgSS53++Pyragyrite*AgSS53++Pyragyrite*AgSS53++Pyragyrite*AgSS53++Pieler 2Cu_mM_XS13, where M = Fe, Zn, X = As, Sb+Aramayote ?AgS553, where M = Fe, Zn, X = As, Sb+ <td>Sulfur*</td> <td>S</td> <td></td> <td></td> <td></td> <td></td> <td>+</td>	Sulfur*	S					+
Nickeline*NiAs $++++$ Breithauptite*NiSb $++++$ RammelsbergiteNiAs2 $++++$ PararammelsbergiteNiAs2 $++++$ NickelskutteruditeNiAs3 $++++$ NickelskutteruditeNiAs3 $++++$ NickelskutteruditeNiAs3 $+++++++++$ Ullmannite*NiSbS $++++++++++++++++++++++++++++++++++++$	501101	Arsenides, antim	onides, sulfoarsenides and	sulfoantimonid	es		
Breithauptite*NiSb+++Rammelsbergite*NiAs_+++ParammelsbergiteNiAs_+++Kutuoite**NiAs_+++Nikks+++NikksGersdorffite*NiAsS+++Ullmannite*NiSbS++ArsenopyriteFeAsS++ChalcociteCu_S+ChalcociteCu_S+Metacinnaba?HgS++Spliteite*ZnS++Spliteite*AsS++CinnabarHgS++Sibinite*AsS++Relagar*+AsS++MolybdeniteFeS_2++Marcasite*FeS_++Splite*SpS_1+MolybdeniteNiS++Marcasite*FeS_++Pyrite*FeS_++Hyragyrite*AgSS+Pyrite*CuFeS_++Hyragyrite*AgSS+Pyrite*CufeS_++Hyragyrite*AgSSS_+ProstiteAgSSS_+ProstiteAgSSS_S+Aramayote ?AgSbS_(Bi,Sb)S_0+Fabilite*CufeS_methere+Fabilite*AgSbS_(Bi,Sb)S_0+Fabilite*AgSbS_(Bi,Sb)S_0+Fabilitite*AgSbS_(Bi,Sb)S_0+Fabilite*AgSbS_(Bi,Sb)S_0+Fabilitite*AgSbS_(Bi,Sb)S_0+Fabilitite*AgSbS_(Bi,Sb)S_0+Fabili	Nickeline*	NiAs	·····, ·····		++++		
Rammelsbergite*NiAs++++PararamelsbergiteNiAs++++Krutovite**NiAs+++Krutovite**NiAs+++Gersdorffite*NiAsS+++Gersdorffite*NiAsS+++Ullmanite*NiSbS+++ArsenopyriteFeAsS+++ChalcociteCu_S S++Galena*PbS+++++++Galena*PbS+++++++Motioninabar ?HgS++Milerite*XS++++++Milerite*NiSS++Sphalerite*Sb_S_S++MolybdeniteMoS_++MolybdeniteMoS_++MolybdeniteMoS_++MolybdeniteMoS_++Pyrite*FeS_++Pyrite*FeS_++Pyrite*FeS_++Pyrasitie*AgsbS_3++Pyrostilpnite*AgsbS_3++Pyrostilpnite*AgsbS_3++Pyrostilpnite*AgsbS_2++Pyrostilpnite*AgsbS_3++Pyrostilpnite*AgsbS_3++Pyrostilpnite*AgsbS_3++Pyrostilpnite*AgsbS_2+Fluorite*Cuf_2FluoritesFluorite*Caf_2++++++++PricesFluorites	Breithauptite*	NiSb			++		
ParamubsbergiteNi A_2 +Krutovite**Ni A_2 ++Krutovite**Ni A_3 ++NickelskutteruditeNi A_3 +++Ulmannite*Ni AS +++Ulmannite*Ni SDS ++ArsenopyriteFeAs++ChalcociteCu,S++Galena*PbS+++++++SplatifiesZnS+++++++Metacinnabar?HgS++CinnabarHgS++++++Millerite*NiS+++Millerite*NiS++++++Subfides and sulfosalts+++++++Cinnabar?HgS++PyrrhotieFe, S++++++Millerite*NiS+++++Subinite**Sb 2S_3+++++MolydeniteMoS2++++++MolydeniteNiS2+++++++ViolariteFeS2+++++++++ViolariteNiNi, S4+++++++++ViolariteFeNi, S4++++++++++++++++++++++++++++++++++	Rammelsbergite*	NiAs			+++		
Krutovite**NiAs++NickskutteruditeNiAs+Gersdorffite*NiAsS+++Gersdorffite*NiAsS+++ArsenopyriteFeAsS++ChalcociteCu_S++Galena*PbS++++++Splaterite*ZnS+++++++Splaterite*ZnS+++++++Metacinnabar ?HgS++PyrhotiteFe _{1,2} S+++Millerite*NiS+++Subinite**AsS+++MolybdeniteMoS2++++++MolybdeniteMoS2+++++++ViolariteFeS2+++++++ViolariteFeS3+++++++ViolariteFeNi254+++Pyrostilpnite*AgSbS3++Pyrostilpnite*AgSbS3++Pyrostilpnite*AgSbS3++Pyrostilpnite*AgSbS4++Pyrostilpnite*AgSbS3++Pilorite*Cu ₁₀ M ₂ X ₅ N ₃ , where M = Fe, Zn, X = As, Sb+++++Faherz ?Cu ₁₀ M ₂ X ₅ N ₃ , where M = Fe, Zn, X = As, Sb++++++Fuorite*Caf2_+++++++Fluorite*Caf2_+++++++++++++Fluorite*Caf2_+++++++++++++++++++++++++++++++++	Pararammelsbergite	NiAs			+		
NickelskutteruditeNiAs+Gersdorffite*NiAsS+++Ullmannite*NiSbS+++ArsenopyriteFeAsS++ChalcociteCu_S++Galena*PbS+++++++Sphalerite*ZnS+++++++Metacinnabar ?HgS++VirrhoiteFe _{1,3} S++++++Nillerite*NiS+++Realgar**AsS++-MolybdeniteMoS2++-MolybdeniteNiS++++++Pyrite*FeS2++++++Pyrite*FeS2++++++ViolariteNiS4+-PolydymiteNiNi2S4++++Pyrargyrite*Ag5bS3++Pyrangyrite*Ag5bS5++Faherz ?Cu ₁₀ M ₂ X ₄ S _{1,3} where M = Fe, Zn, X = As, Sb+Fluorite*CaF2++++++Fluorite*CaF2++++++Fluorite*CaF2++++++Fluorite*CaF2++Fluorite*CaF2++Fluorite*CaF2++++++Fluorite*CaF2++++++Fluorite*CaF2++++++Fluorite*CaF2+++++++Fluorite*CaF2+++++++Fluorite*CaF2+++++++++Fluorite*CaF2++++++++++ <td>Krutovite**</td> <td>NiAs</td> <td></td> <td></td> <td>++</td> <td></td> <td></td>	Krutovite**	NiAs			++		
Gersdorfflte*NiAsS $+++$ Ullmannite*NiSbS $+++$ ArsenopyriteFeAsS $++$ ArsenopyriteFeAsS $++$ ChalcociteCu ₃ S $+$ $+$ Galena*PbS $++$ $++++++$ Sphalerite*ZnS $++$ $+++++++$ Metacinnabar?HgS $++$ $+++++++$ Metacinnabar?HgS $++$ $++$ PyrrhotiteFe _{1,x} S $++$ $++$ SbloheniteNiS $++$ $++$ MolybdeniteMoS ₂ $++$ $++$ Marcasite*FeS ₂ $++$ $+++$ Pyrte*FeS ₂ $++$ $++++++++$ VidariteNiS ₄ $+$ $++++++++++++++++++++++++++++++++++++$	Nickelskutterudite	NiAs			+		
Ulimanite*NiSbS $++$ ArsenopyriteFeAsS $++$ Sulfides and sulfosaltsChalcociteCu,S $+$ $+$ Galena*PbS $++$ $++++++$ Sphalerite*ZnS $++$ $++++++$ Sphalerite*ZnS $++$ $+++++++$ Metacinnabar ?HgS $+$ $+$ PyrrhotiteFe,_i,S $++$ $+$ Millerite*NiS $++$ $+$ Stibnite**Sb,S_3 $+$ $+$ MolybdeniteMoS2 $++$ $+$ Marcasite*FeS2 $++$ $+++++++$ ViolariteFeNi,S4 $+$ $+$ ViolariteFeNi,S4 $+$ $+$ Pyrostilpnite*AgSbS3 $+$ $+$ Pyrostilpnite*AgSbS3 $+$ $+$ PiorotitePiorotisp $+$ $+$ Fahlerz ?Cu1 ₁₀ M ₂ X ₄ S11, where M = Fe, Zn, X = As, Sb $+$ Fluorite*CaF2 $+$ $+$ Fluorite*CaF2 $+$ $+$ FluoritesPiorotes $+$ $+$ Fluorite*CaF2 $+$ $+$ FluoritesCaF2 $+$ $+$ FluoritesCaF2 $+$ $+$ FluoritesCaF2 $+$ $+$ FluoritesFluorites $+$ $+$ FluoritesFluorites $+$ $+$ Fluorite*CaF2 $+$ $+$ FluoritesFluorites $+$ $+$ Fluorite* <td< td=""><td>Gersdorffite*</td><td>NiAsS</td><td></td><td></td><td>+++</td><td></td><td></td></td<>	Gersdorffite*	NiAsS			+++		
ArsenopyriteFeASS++Sulfides and sulfosaltsChalcociteCu_S++Galena*PbS+++++++Galena*ZnS+++++++Sphalerite*ZnS+++++++Metacinnabar?HgS++CinnabarHgS++PyrnhoticFe _{1-x} S++Millerite*NiS++Stibnite**AsS++MolybdeniteMoS2++MolybdeniteMoS2++MolybdeniteNiS+MolybdeniteNiS2++MolybdeniteNiS2++MolybdeniteNiS2++MolybdeniteNiS2++MolybdeniteNiS2++MolybdeniteNiS2++MolybdeniteNiS2++MolybdeniteNiS2++MolybdeniteNiS2++MolybdeniteNiS2++MolybdeniteNiS2++Pyrite*FeS2++Margyrite*Ag3Sb3++PolydymiteNiNi2S4+ProustiteAg3Sb5+Aramayoite ?Ag3Sb5+Aramayoite ?Ag3Sb5+Fluoride*Cu ₁₀ A_XA_{51} , where $M =$ Fe, Zn, $X =$ As, Sb+Fluorite*CaF2+++++++++++++++++++++++++++++++++	Ullmannite*	NiSbS			++		
Sulfides and sulfosaltsSulfides and sulfosaltsChalcocite Cu_2S ++Galena*PbS+++++++Sphalerite*ZnS+++++++++Sphalerite*ZnS++++++++++Metacinnabar?HgS++PyrrhotiteFe _{1,x} S+++++SubjectNiS+++++Realgar**AsS++-MolybdeniteMoS2++++++MolybdeniteMoS2+++++++MolybdeniteNiS+++++++Virite*FeS2+++++++++++++++++++++++++++++++++++	Arsenopyrite	FeAsS		++			
$\begin{array}{cccccccccccccccccccccccccccccccccccc$	risenopynee	101155	Sulfides and sulfosalts				
Galena* PbŚ ++ +++ ++++++ Sphalerite* ZnS ++ +++++++ Metacinnabar ? HgS + + Cinnabar HgS + + Pyrnotite Fe _{1,x} S ++ + Millerite* NiS ++ + Realgar** AsS ++ + Stibnite** Sb ₂ S ₃ ++ + Molybdenite MoS ₂ ++ + Marcasite* FeS ₂ ++ ++ Pyrite* FeS ₂ ++ ++++++ Vasite NiS ₂ + + Volarite FeNi ₂ S ₄ + + Polydymite NiNi ₂ S ₄ + + Proustite Ag ₃ SbS ₃ + + Pyrostilpnite* Ag ₃ SbS ₃ + + Miargyrite ? Ag ₅ Sb ₂ Sb ₂ S + + Fahlerz ? Cu ₁₀ M ₂ X ₄ S ₁₃ , where M = Fe, Zn, X = As, Sb + + Fluorite* CaF ₂ ++++++++++++++++++++++++++++++++++++	Chalcocite	Cu ₂ S		+		+	
$\begin{array}{cccccccccccccccccccccccccccccccccccc$	Galena*	PbŠ			++	++++	
Metacinabar ?HgS+Metacinabar ?HgS+CinnabarHgS+Pyrrhotite $Fe_{1,x}S$ ++Millerite*NiS++Realgar**AsS++Stibnite**Sb ₂ S ₃ +MolybdeniteMoS ₂ ++Marcasite*FeS ₂ ++Pyrite*FeS ₂ ++VasiteNiS+Chalcopyrite*CuFeS ₂ ++ViolariteFeNi ₂ S ₄ +PolydymiteNiNi ₂ S ₄ +Pyratyrite*Ag ₃ SbS ₃ +Pyratyrite*Ag ₃ SbS ₃ +Miargyrite ?Ag ₃ SbS ₅ +Aramayoite ?Ag ₃ SbS ₂ +Fahlerz ?Cu ₁₀ M ₂ X ₄ S ₁₂ , where M = Fe, Zn, X = As, Sb+Fluorite*CaF ₂ +++++++	Sphalerite*	ZnS		++	++++	++++	
CinnabarHgS++Pyrrhotite $Fe_{1,x}S$ ++++Millerite*NiS++++Realgar**AsS++++Realgar**Sb_2S_3++MolybdeniteMoS2+++++Marcasite*FeS2++++++Marcasite*FeS2++++++VasciateNiS2+++++VasiteNiS2+++++VolariteFeNi2S4++++PolydymiteNiNi2S4++++Pyrargyrite*Ag3Sb53++-Pyrargyrite*Ag3Sb53++-Aramayote ?Ag3Sb23+-Fahlerz ?Cu ₁₀ M ₂ X ₄ S ₁₃ , where $M = Fe, Zn, X = As, Sb$ +-Fluorite*CaF2 Fluorides ++++++	Metacinnabar ?	HgS			+		
Pyrhotite $Fe_{1x}S$ ++ Millerite* NiS ++ Realgar** AsS ++ Stibnite** Sb ₂ S ₃ + Molybdenite MoS ₂ ++ Marcasite* FeS ₂ ++ Marcasite* FeS ₂ ++ Pyrite* FeS ₂ ++ Visite NiS ₂ + Chalcopyrite* CuFeS ₂ ++ Violarite FeNi ₂ S ₄ + Polydymite NiNi ₂ S ₄ + Polydymite NiNi ₂ S ₄ + Proustite Ag ₃ SbS ₃ ++ Pyrostilpnite* Ag ₃ SbS ₃ + Miargyrite ? Ag ₃ SbS ₃ + Miargyrite ? Ag ₃ Sb ₂ (Bi,Sb)S ₆ + Fahlerz ? Cu ₁₀ M ₂ X ₄ S ₁₃ , where M = Fe, Zn, X = As, Sb + Geocronite ? Pb ₁₄ Sb ₆ S ₂₃ + Fluorides ++++++++++++++++++++++++++++++++++++	Cinnabar	HgS			+	+	
Millerite* NiS ++ Realgar** AsS ++ Realgar** AsS ++ Stibnite** Sb ₂ S ₃ + Molybdenite MoS ₂ ++ Marcasite* FeS ₂ ++ Marcasite* FeS ₂ ++ Marcasite* FeS ₂ ++ Visite NiS ₂ + Chalcopyrite* CuFeS ₂ ++ Violarite FeNi ₂ S ₄ + Polydymite NiNi ₂ S ₄ + Proustite Ag ₃ AsS ₃ ++ Pyragyrite* Ag ₃ SbS ₃ ++ Miargyrite ? Ag ₃ SbS ₃ + Miargyrite ? Ag ₃ SbS ₆ + Fahlerz ? Cu ₁₀ M ₂ X ₄ S ₁₃ , where M = Fe, Zn, X = As, Sb + Geocronite ? Pb ₁₄ Sb ₆ S ₂₃ + Fluorides ++++++++++++++++++++++++++++++++++++	Pvrrhotite	Fe. S		++			
Realgar** AsS ++ Stibnite** Sb_2S_3 + Molybdenite MoS_2 ++ Marcasite* FeS_2 ++ Pyrite* FeS_2 ++ Vasite NiS_2 + Chalcopyrite* CuFeS_2 ++ Violarite FeNi ₂ S_4 + Polydymite NiNi ₂ S_4 + Polydymite Ag_3AS_3 + Pyrostilpnite* Ag_3SbS_3 + Miargyrite ? Ag3Sb_2(Bi,Sb)S_6 + Faherz ? Cu ₁₀ $M_2X_4S_{13}$, where $M =$ Fe, Zn, $X =$ As, Sb + Fluorides Fluorides +	Millerite*	NiS			++		
Stibuite** Sb ₂ S ₃ + Molybdenite MoS ₂ ++ Marcasite* FeS ₂ ++ Pyrite* FeS ₂ ++ Vacasite NiS ₂ + Chalcopyrite* CuFeS ₂ ++ Violarite FeNi ₂ S ₄ + Polydymite NiNi ₂ S ₄ + Polydymite Ag ₃ AsS ₃ + Pyrargyrite* Ag ₃ SbS ₃ ++ Miargyrite ? Ag ₃ SbS ₂ + Aramayoite ? Ag ₃ Sb ₂ (Bi,Sb)S ₆ + Fahlerz ? Cu ₁₀ M ₂ X ₄ S ₁₃ , where M = Fe, Zn, X = As, Sb + Fluorides ++++++++++++++++++++++++++++++++++++	Realgar**	AsS			++		
Molybdenite $M_{0}S_{2}^{2}$ ++ ++ Marcasite* FeS ₂ ++ +++ Marcasite* FeS ₂ ++ +++ Pyrite* FeS ₂ ++ ++++ Vaesite NiS ₂ ++ ++++++ Chalcopyrite* CuFeS ₂ ++ +++ Chalcopyrite FeNi ₂ S ₄ + +++ Violarite FeNi ₂ S ₄ + +++ Polydymite NiNi ₂ S ₄ + +++ Proustite Ag ₃ AsS ₃ + - Pyrargyrite* Ag ₃ SbS ₃ +++ - Miargyrite ? Ag ₃ SbS ₂ + - Aramayoite ? Ag ₃ Sb ₂ (Bi,Sb)S ₆ + - Fluorides + - - - Fluorides + - ++++++ CaF ₂ Fluorides +++++++	Stibnite**	Sb ₂ S ₂				+	
Marcasite* FeS_2^{2} $++$ $++++++$ Pyrite* FeS_2 $++$ $+++++++$ VaesiteNiS2 $+$ $+$ Chalcopyrite*CuFeS2 $++$ $+++++++$ Violarite $FeNi_2S_4$ $+$ $+$ PolydymiteNiNi2S4 $+$ $+$ Proustite Ag_3AS3 $+$ $+$ Pyrargyrite* Ag_3BS3 $+$ $+$ Pyrostilpnite* Ag_3SbS_3 $+$ $+$ Miargyrite ? $Ag35b_2$ $+$ $-$ Aramayoite ? $Ag_3Sb_2(Bi,Sb)S_6$ $+$ $-$ Fahlerz ? $Cu_{10}M_2X_4S_{13}$, where $M = Fe, Zn, X = As, Sb$ $+$ Fluorides $Fluorides$ $+$ $+$ Fluorides	Molybdenite	MoS		++			
Pyrite* FeS_2^2 ++ ++++ +++++ Vaesite NiS2 + Chalcopyrite* CuFeS2 ++ +++ Violarite FeNi ₂ S4 + Polydymite NiNi ₂ S4 + Proustite Ag ₃ ASS3 + Pyrargyrite* Ag ₃ SbS3 ++ Pyrostilpnite* Ag ₃ SbS3 + Miargyrite ? Ag ₃ SbS2 + Aramayoite ? Ag ₃ Sb2(Bi,Sb)S6 + Fahlerz ? Cu ₁₀ M ₂ X ₄ S ₁₃ , where M = Fe, Zn, X = As, Sb + Fluorite* CaF2 ++++++	Marcasite*	FeS			++	++++	
VaesiteNiS2+Chalcopyrite*CuFeS2++++Chalcopyrite*FeNi2S4+ViolariteFeNi2S4+PolydymiteNiNi2S4+ProustiteAg3AsS3+Pyrargyrite*Ag3SbS3++Pyrostilpnite*Ag3SbS3+Miargyrite ?Ag5bS2+Aramayoite ?Ag3Sb2(Bi,Sb)S6+Fahlerz ?Cu10M2X4S13, where $M =$ Fe, Zn, $X =$ As, Sb+Fluorite*CaF2+++++++	Pvrite*	FeS		++	+++	++++	
Chalcopyrite*Cu $\stackrel{2}{FeS_2}$ +++++++ViolariteFeNi $_2S_4$ +PolydymiteNiNi $_2S_4$ +ProustiteAg $_3AsS_3$ +Pyrargyrite*Ag $_3SbS_3$ ++Pyrostilpnite*Ag $_3SbS_2$ +Miargyrite ?AgSbS $_2$ +Aramayoite ?Ag $_3Sb_2(Bi,Sb)S_6$ +Fahlerz ?Cu $_{10}M_2X_4S_{13}$, where $M =$ Fe, Zn, $X =$ As, Sb+Geocronite ?Pb $_{14}Sb_6S_{23}$ +FluoridesFluorides	Vaesite	NiS			+		
ViolariteFeNi $_2$ +PolydymiteNiNi $_2$ S4+ProusiteAg $_3$ AsS $_3$ +ProusiteAg $_3$ SbS $_3$ +Pyrargyrite*Ag $_3$ SbS $_3$ +Pyrostilpnite*Ag $_3$ SbS $_2$ +Miargyrite ?AgSbS $_2$ +Aramayoite ?Ag $_3$ Sb $_2$ (Bi,Sb)S $_6$ +Fahlerz ?Cu $_{10}M_2X_4$ S $_{13}$, where $M =$ Fe, Zn, $X =$ As, Sb+Geocronite ?Pb $_{14}$ Sb $_6$ S $_{23}$ +FluoridesFluoridesCaF $_2$ +++++++++++++++++++++++++++++++++	Chalcopyrite*	CuFeS		++	++	+++	
PolydymiteNiNi $_2S_4$ +ProusiteAg $_3AsS_3$ +Pyrargyrite*Ag $_3SbS_3$ ++Pyrostilpnite*Ag $_3SbS_3$ +Miargyrite ?AgSbS $_2$ +Aramayoite ?Ag $_3Sb_2(Bi,Sb)S_6$ +Fahlerz ?Cu $_{10}M_2X_4S_{13}$, where $M =$ Fe, Zn, $X =$ As, Sb+Geocronite ?Pb $_{14}Sb_6S_{23}$ +FluoridesFluoridesFluorite*CaF $_2$ +++++++	Violarite	FeNi _s S.			+		
Prousite Ag_3AsS_3 +Prousite Ag_3AsS_3 +Pyrargyrite* Ag_3SbS_3 ++Pyrostilpnite* Ag_3SbS_3 +Miargyrite ? Ag_3SbS_2 +Aramayoite ? $Ag_3Sb_2(Bi,Sb)S_6$ +Fahlerz ? $Cu_{10}M_2X_4S_{13}$, where $M =$ Fe, Zn, $X =$ As, Sb+Geocronite ? $Pb_{14}Sb_6S_{23}$ +FluoridesFluorides	Polvdymite	NiNi ₂ S.			+		
Pyrargyrite* Ag_3SbS_3 ++Pyrostilpnite* Ag_3SbS_3 +Miargyrite ? Ag_3SbS_2 +Aramayoite ? $Ag_3Sb_2(Bi,Sb)S_6$ +Fahlerz ? $Cu_{10}M_2X_4S_{13}$, where $M =$ Fe, Zn, $X =$ As, Sb+Geocronite ? $Pb_{14}Sb_6S_{23}$ +FluoridesFluorite* CaF_2 +++++++++++++++++++++++++++++++++	Proustite	Ag_2AsS_2			+		
Pyrostilpnite* Ag_3SbS_3 +Miargyrite ? Ag_3SbS_2 +Aramayoite ? $Ag_3Sb_2(Bi,Sb)S_6$ +Fahlerz ? $Cu_{10}M_2X_4S_{13}$, where $M =$ Fe, Zn, $X =$ As, Sb+Geocronite ? $Pb_{14}Sb_6S_{23}$ +FluoridesFluorides	Pvrargvrite*	Ag ₂ SbS ₂			++		
Miargyrite ? $AgSbS_2$ +Aramayoite ? $Ag_3Sb_2(Bi,Sb)S_6$ +Fahlerz ? $Cu_{10}M_2X_4S_{13}$, where $M = Fe$, Zn , $X = As$, Sb +Geocronite ? $Pb_{14}Sb_6S_{23}$ +FluoridesFluoridesCaF2Oxides and hydroxides	Pvrostilpnite*	Ag ₂ SbS ₂			+		
Aramayoite ? $Ag_3Sb_2(Bi,Sb)S_6$ +Fahlerz ? $Cu_{10}M_2X_4S_{13}$, where $M = Fe$, Zn , $X = As$, Sb +Geocronite ? $Pb_{14}Sb_6S_{23}$ +FluoridesFluoridesCaF2Oxides and hydroxides	Miargvrite ?	AgSbS			+		
Fahlerz ? $Cu_{10}M_2X_4S_{13}$, where $M = Fe$, Zn , $X = As$, Sb +Geocronite ? $Pb_{14}Sb_6S_{23}$ +FluoridesFluoridesFluorite* CaF_2 +++++++++	Aramavoite ?	Ag ₂ Sb ₂ (Bi,Sb)S ₂			+		
Geocronite ? $Pb_{14}^{10}Sb_6S_{23}$ + Fluorite* CaF_2 +++ ++++ Oxides and hydroxides	Fahlerz ?	$Cu_{10}M_2X_4S_{12}$, where M	= Fe, Zn, X = As, Sb		+		
Fluorite* CaF ₂ +++ ++++ Oxides and hydroxides	Geocronite ?	$Pb_{10} Sb_{2} S_{22}$., , ., ., .		+		
Fluorite* CaF ₂ +++ ++++		14 6 23	Fluorides				
2 Oxides and hydroxides	Fluorite*	CaF			+++	++++	
		2	Oxides and hydroxides				
Arsenolite** As ₁ O ₂ ++	Arsenolite**	As_2O_2	• · · · · · · · · · · · · · · · · · · ·				++
Hematite $Fe_{2}O_{2}$ ++ ++	Hematite	Fe ₂ O ₂			++		++
Uraninite* UO_{2}^{2} ++++	Uraninite*	UO,			++++		
Quartz* SiO ₂ ++++ +++ ++	Quartz*	SiO		++++	+++	+++	++
Hausmannite** $Mn^{2+}Mn^{3+}O$ +	Hausmannite**	$Mn^{2+}Mn^{3+}O$				+	
Coronadite** $Pb(Mn_2^{++}Mn^{2+})_{50}O_{12}$ ++	Coronadite**	$Pb(Mn_7^{4+}Mn^{2+})_{50}O_{50}$					++
Goethite* FeOOH $+$ $+++$	Goethite*	FeOOH			+		+++
Oxides of Ti TiO, ++	Oxides of Ti	TiO		++			

Table 1. Minerals of the vein complex and oxidation zone of the Belorechenskoye deposit

Carbonates										
Calcite*	CaCO ₂	++	+++	++++	+++					
Siderite	FeCO ₃	+								
Dolomite*	$CaMg(CO_3)_2$	+	++++							
Ankerite**	$CaFe(CO_3)_2$		++							
Aragonite**	CaCO ₃				++					
Strontianit*	SrCO ₃			++						
Cerussite**	PbCO ₃				++					
Malachite*	$Cu_2CO_3(OH)_2$				+++					
Azurite*	$Cu_3(CO_3)_2(OH)_2$				++					
Schröckingerite**	$NaCa_3(UO_2)(CO_3)_3(SO_4)F-10H_2O$				++					
	Sulphates									
Barite*	BaSO.		++	++++						
Anglesite**	PhSO.				++					
Gypsum*	CaSO.•2H.O				+++					
Melanterite**	$FeSO \cdot 7H_{-}O$				++					
Brochantite**	$Cu_{4}(SO_{4})(OH)_{2}$				+					
Antlerite**	$Cu_4(SO_4/2(SH)_6)$ $Cu_5(SO_4)_6(OH)_6$				+					
Devilline**	CaCu.(SO.).(OH).•3H.O				+					
Serpierite**	$CaCu_4(SO_4)_2(OH)_6 SH_2O$				+					
Jarosite*	$KFe_{2}(SO_{2})_{2}(OH)_{2}$				+++					
Plumbojarosite**	$PbFe_{2}(SO_{2})_{1}(OH)_{1}$				+					
	Phosphates									
Fluorapatite	$Ca_5(PO_4)_3F$	++								
Autunite	$Ca(UO_2)_2(PO_4)_2 \cdot 10 - 12H_2O$				+					
	Arsonatos									
Pharmacolite**	$C_{a}(A_{s}O, OH) \cdot 2H, O$				++					
Rösslerite**	$M_{\sigma}(A_{SO} \cap H) \cdot 7H \cap$				+					
Hörnesite**	$Mg(AsO) \cdot 8HO$				++					
Parasymplesite**	Fe (AsO) •8H O				+					
Annabergite*	Ni (AsO) •8H O				+++					
Picropharmacolite**	$C_{a} Mg(AsO OH) (AsO) \cdot 11H O$				++					
Nováčekite**	$M_{g}(IIO_{1}) (A_{SO_{1}}) \bullet 9-12H_{1}O_{2}$				+					
Uranospinite ?	$C_{2}(IIO_{2}) (ASO_{2}) (IIO_{4}) (ASO_{2}) (IIO_{2}) (ASO_{2}) (IIO_{2}) (IIO_{2})$				+					
Metazeunerite	$Cu(UO_{2})_{2}(AsO_{4})_{2} + 0 H_{2}O$				+					
hieldze unente	Silicates									
Coffinite*	$U[(SiO_{i}), (OH),]$		++							
Hemimorphite**	$Zn_{i}[Si_{0}O_{i}](OH)_{*}H_{*}O$				+					
Kaolinite*	$Al_{a}[Si_{a}O_{c}](OH)$	+	++	++	++					
Dickite**	$Al_{a}[Si_{a}O_{c}](OH)$			++	+++					
Hallovsite**	$Al_{a}[Si_{a}O_{c}](OH) \cdot 0-2H_{a}O$				++					
Muscovite	KAl _a [AlSi ₂ O ₁₀](OH) ₂	+++								
Chlorite	$(M,AI)_{c}[(Si,AI),O_{10}](OH)_{c}$, where $M = Mg$. Fe	+++	++							
Albite	Na[AlSi ₂ O ₆]	+++								
Microcline	K[AlSi,O]	++++								

Note: I - feldspar-quartz veins, II - dolomite veins, III - essentially baritic and related to them (sulfide-calcitic, fluoritic, etc.) veins, IV - hypergene formations.

Degree of mineral distribution: ++++ – major vein and ore minerals, +++ – common minerals, ++ – minor minerals, + – rare minerals. * – minerals of the Belorechenskoye deposit, studied by the authors; ** – minerals, found for the first time at the deposit by the authors; ? – mentioned in the mineralogical literature, but diagnostics seems doubtful.

During compilation of the table, we used the following publications: Dymkov *et al.*, 1970; Zubov, Kazantsev, 1970; Melkov, Sergeeva, 1971, 1992; Annenkova *et al.*, 1972; Kazantsev, 1977, and our own data