The Lower Carboniferous and Middle Devonian strata in the southwestern limb of the Kara-Tau range, in the Syr-Dariya deep fault zone, bear several lead-zinc deposits which are similar in origin and mode of occurrence of metalliferous beds. One of these is the Shalkiya deposit on which the Shalkiya mine has been developed.

Lead-zinc mineralization in the upland branch of the mine is localized in the Dzhigalatinskii horizon and confined to benches of interstratified laminated and thickly laminated dolomites bearing thinly laminated rhythmites. The overall thickness of the commercially exploitable bench ranges from 90 to 195 m. The main ore minerals are sphalerite, galenite, and pyrite. Grey ore, arsenopyrite, chalcopyrite, bornite, and boulangerite are rarer. A characteristic feature is the occurrence of carbonaceous matter in the ores. The ore reserves are concentrated in two sheet-like ore beds (Fig. 1). The upper ore body is 3-40 m, generally 7-20 m, thick and stands apart in a more thinly laminated sub-bench of rhythmites. Its roof bear rocks that are strong enough in samples (Table 1) and are foliated into 3-10 mm thick layers. The roof rocks are weak because of fracturing and thin stratification. The lower ore body has a higher content of useful minerals. Its thickness varies from 3 to 30 m, generally from 6 to 20 m (Table 2).

The interbedding separating the ore bodies in the area with an undislocated stratigraphy has a thickness also in the 3-30-m range and is composed of firmer medium-laminated dolomites. In the sections of the limb overturned by thrust the interbedding thickness rises to 20-40 m.

The major disrupting factors in the deposit area are the Shalkiya fault and Glavnyi (Main) reversed fault, which have a steeply dipping displacer plane and border the commercially exploitable area on the north- and southwest. The deposit is dissected roughly into two equal parts by the Postrudnyi fault with a rupture plane dip angle of 60-80° and a displacement ranging from 20 to 100 m. The Anokhinskii fault, which dissects the strata 300-350 m to the south, has almost the same strike as the Postrudnyi fault. It is characterized by a steep dip and a thick zone (30-40 m) of brecciated rocks. In the submeridional direction the deposit is dissected through 80-250 m by several reversed faults having a dip angle range of 40-50° and a displacement range of 15-20 m. Most of the tectonic failures were caused by breccias and were accompanied by zones of increased jointing and flooding. A characteristic feature of the deposit area is development of thrust disjunctives. They cut the strata with a gentle slope, becoming deeper in the southeasterly direction at an angle of 10-20°. The overturned limb of the syncline is cut by a thrust.

A characteristic feature of the structural failure of the rock mass is steep dip of larger fissures healed by calcite or friction clay and having even and flat surfaces. Smaller fissures are diverse in direction, primarily subhorizontal. The ore bodies and wall rocks are pronouncedly laminated with the layers ranging in thickness from 0.3-0.5 to 20-30 cm.

A system for stripping of the deposit with a floor height of 60 m was adopted as the engineering project for the mine. The haulage level of the upper floor lay at the + 165 m mark (surface marks 250-300 m). The haulage level of the next floor lay at the + 100 m mark.

At present stoping work - the pilot testing of the mining systems - is being executed at the + 165 m level. Preparation of the southern and northern flanks of the field, which are separated by the Postrudnyi fault, is going on at the + 100 m level.

Let us note as well that for working out of the upper levels of the deposit the following are significant:

1) on the upper floor about 2/3 of the reserves are comprised of ores of the upper bed; at the + 100 m level the reserves of the lower ore body containing a more valuable ore go up to 60%;

2) at the + 165 m level there are local areas where both ore bodies occur and can be simultaneously worked out;
3) when the second floor (+ 100 m level) north of the Posrudnyi fault is worked out, over a large area the lower ore body will be overworked by the excavation of the upper ore body at the + 165 m level.

The mining efficiency in opening up of the deposit for exploitation depends primarily on the choice of the mining system and the order of development of stoping of the reserves. In order to settle these matters with reference to the special features of the Shalkiya deposit, it is necessary to take account of the convergence of the upper and lower beds and the consequent interdependence of the workings in the ore bodies and in the adjacent floors as well as the tectonic failure of the deposit that affects development and manifestation of rock pressure. What is rather important for the referred factors, especially at the stage of opening up of the deposits for exploitation and investment limitation, is to balance production from the upper and richer lower ore bodies which differ 1.5 times in gross value of the ore. From these standpoints, we shall discuss in more detail the matters relating to disruption of the mining system and the order of development of mining operations.

For mining of the Shalkiya deposit the Giprotvetmet (State Institute for the Planning of Enterprises of Nonferrous Metallurgy) recommended the following basic alternatives of systems of mining with caving of ore and enclosing rocks: sublevel caving with front ore discharge, chamber-and-pillar system with roof caving, breast stoping with powered support and