COMBINED OPEN AND UNDERGROUND MINING

Description
The method is designed for combined open and underground mining of sedimentary deposits (coal, salt, gypsum, etc.) and consists in the following. When working-off the last stope of the overburden bench (2) at the boundary between open and underground mining areas (1), a layer of overburden rock (4) is left over the producing bed (3) (see the Figure), with its thickness at least twice the thickness of the producing bed. The width $B$ of the protection pillar is

$$B = H - 3m,$$

where $H$ is the width of the overburden stope, and $m$ is the thickness of the producing bed. Cleaning complex (7) operates in the mounting camera (6), where above-zero air temperature is maintained by local heaters or otherwise. Coal is transported by the conveyer (8). The operation of (7) causes primary roof collapse along with partial collapse of overburden rocks (4) which fill the worked-out area and block the penetration of cold air into the working area. Then overburden (4) is removed by stripping the protection pillar (5), which is also removed to prevent resource loss.

In the common practice, outcropping deposits are usually developed first through open and then underground mining, whereby much of resources are lost in protection pillars left between the open and the underground layers.

Combined open and underground mining
1 – boundary between open and underground mining areas;
2 – last stope of open mining area;
3 – producing bed (coal);
4 – overburden rock;
5 – protection pillar;
6 – mounting camera;
7 – mining face;
8 – conveyor.

Technical appraisal and economic benefits
• 3-5 years shorter construction and start-up of enterprise (compared to the current mining practice for bedded deposits);
• 30-50% lower capital and support expenses;
• 15-20% smaller area of disturbed land and mining lease;
• zero coal losses at the boundary and barrier pillars;
• no fall-throughs, cold air or rain penetrating into underground mining area;
• due regard for climatic, permafrost, and geomechanic mining conditions.

Application areas
Mining industry.
The method is applicable to mineral deposits with 1-5 m thick flat-lying or gently sloping producing beds exposed on the surface or under 25-35 m of Quaternary sediments.

**Development stage**
The method of combined open and underground mining is included into the construction project of the mine "Denisovskaya" (Denisovsky coal deposit, South Yakutia).

**Patent situation**

**Commercial offers**
Contracts for the development of practical recommendations and engineering data.

**Estimated cost**
Under contract.

**Contacts**
Sergey M. Tkach, Cand.Sc., Deputy Director
Mining Institute of the North, Siberian Branch of the Russian Academy of Sciences
43, Prosp. Lenina, Yakutsk, 677018, Russia
Phone: (4112) 44-59-37
Fax: (4112) 44-59-30
E-mail: igds@ysn.ru
http://www.sitc.ru/ync/gorny.htm