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CONTACT METAMORPHISM INDUCED BY THE KŁODZKO–ZŁOTY STOK INTRUSION (SUDETES, POLAND)

The Kłodzko–Złoty Stok intrusion thermally influenced different older rocks in which it have intruded (Bagiński 1986, 1989, 1995, 1998). Within the thermal aureole different new mineral assemblages appeared (the main ones are presented below).

The main mineral assemblages in thermally changed sedimentary rocks of Bardzkie Mts.

METAPELITES
andalusite – cordierite – biotite – quartz – K feldspar
cordierite – K feldspar – biotite – quartz
quartz – andalusite – biotite – graphite
quartz – biotite – muscovite – cordierite
CALC-SILICATE ROCKS
calcite – garnet – diopside
calcite – garnet – diopside – wollastonite
calcite – garnet – diopside – vesuvianite – prehnite
calcite – diopside – plagioclase (An 55–67) – K feldspar – phlogopite – garnet – scapolite –wollastonite
quartz – plagioclase (An 61–75) – clinopyroxene
plagioclase (An 54–88) – quartz – actinolite – biotite

The main mineral assemblages in thermally changed metamorphic rocks of Kłodzko Metamorphic Unit and Lądek–Śnieżnik Metamorphics.

KŁODZKO METAMORPHIC UNIT
hornblende – plagioclase (An 3–36)
hornblende – plagioclase (An 4–43) – biotite – prehnite
hornblende – plagioclase (An 42–54) – diopside – sphene
wollastonite – hedenbergite – quartz – K feldspar – plagioclase (An 21)
calcite – hedenbergite – quartz – garnet – phlogopite
prehnite – quartz – calcite – actinolite – diopside
LĄDEK –ŚNIEŻNIK METAMORPHIC UNIT
quartz – biotite – plagioclase (An 0–36) – K feldspar (microperthite)
quartz – plagioclase (An 28–44) – K feldspar – cordierite
cordierite – K feldspar – sillimanite – andalusite – quartz
hornblende – diopside augite – plagioclase (An 38–45) – sphene
biotite – cordierite – garnet – plagioclase (An 20–35) – sillimanite – quartz
plagioclase (An 29–38) – biotite – hercynite – corundum – sillimanite

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ROOF METAMORPHIC COVER FRAGMENTS
hornblende – plagioclase (An 24–39) – diopside augite – sphene
biotite – quartz – plagioclase (An 46) – sillimanite – hercynite – corundum *enclave*
quartz – biotite – cordierite – plagioclase (An26–36) – K feldspar
quartz – plagioclase (An 27–39) – cordierite – biotite – garnet – hypersthene

Use of several independent geothermometres enabled to obtain temperatures of contact metamorphism induced by the Kłodzko–Złoty Stok intrusion. Thermally metamorphosed rocks at the immediate contact with the intrusion display locally very high temperatures reaching 750 °C (see table below). The highest values have been recorded in samples situated within roof metamorphic cover fragments, however the volume of rocks displaying so high temperatures is limited. The investigated samples coming from the lateral part of the contact recorded lower temperatures exceeding slightly 600 °C (corundum rich hornfelses from Żelazno and skarns from Podzamek). Samples coming from the rocks situated in a distance of several hundred meters from the contact with the intrusion recorded typically lower temperatures, below 500 °C. There is a distinct difference in aureole development dependent on a kind of the metamorphosed rock. There is well developed aureole within metamorphosed sedimentary rocks of the Bardzkie Mts. and vague aureole within metamorphosed rocks of Lądek–Śnieżnik series.

The estimated pressure values are fairly high reaching 3–4 kbar. However, the presence of sillimanite and hypersthene within the aureole support these values.

The highest obtained temperatures in the exocontact rocks of the Kłodzko – Złoty Stok intrusion

Locality/rock	Geothermometer	Temperatures (°C)
Żelazno / garnet–cordierite hornfels	Garnet–biotite (Indares,Martignole,1985)	710
Żelazno / garnet–cordierite hornfels	Garnet–biotite (Ferry i Spear, 1978)	880
Ptasznik / amphibolite	Plagioclase–amphibole (Spear, 1980)	660–710
Ptasznik / amphibolite	Plagioclase–amphibole (Blundy i Holland, 1990)	700
Bodak / biotite–cordierite hornfels	Garnet–orthopyroxene (Harley, 1984)	750
Bodak / biotite–cordierite hornfels	Garnet–cordierite (Lonker, 1981)	720
Trzebieszowice / amphibolite	Plagioclase–amphibole (Blundy i Holland, 1990)	660

The presented results are not very consistent with the values of the Kłodzko–Złoty Stok intrusion magma temperatures presented by Wierzchołowski (1976), amounting to 700 °C (the value concerns the granitic composition of magma). The

reasons for higher temperatures of metamorphosed rocks than the temperatures of magma could be as follows:

- not homogenous composition of the Kłodzko–Złoty Stok magma (acid to basic composition – Lorenc, 1990), the basic magma could have temperatures exceeding 800 °C,
- heat convection could be considerably higher onto the roof than close to the lateral contact,
- more rapid cooling of the lateral part of the intrusion.

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