

# **Economic evaluation and provenance of placer gold from district Charsadda and Nowshera, Pakistan**

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## **Abstract**

Charsadda and Nowshera districts are located N-W and S-E in Peshawar basin and comprises River Kabul, Swat, Naguman and seasonal tributaries. Regional geochemical survey was carried out to assess the economic potential of stream sediments and pan concentrates. All the stream having catchment area up to 25 km were marked for samples collection. A total of 51 pan concentrate (HMC) and 124 stream sediment (SS) samples were collected from the study area. Both HMC samples and SS samples were analyzed for Au, Ag, Cu, Pb, Zn, Ni, Cr, Cd and Co using Atomic Absorption Spectrometer (AAS). Morphological features of separated gold grains (more than twenty four colors and four specks) were studied using Scanning Electron Microscope (SEM) and stereomicroscope.

Result of pan concentrates for Au, Ag, Cu, Pb, Zn, Ni, Cr, Co and Cd have maximum values (in ppm) of 45, 20, 130, 203, 55, 699, 541, 36 and 6 respectively. In tributaries, maximum values for Au are 25 ppm, 6 ppm, and 4 ppm collected from Girgichi Khwar, Kheyali river and Kaga khwar in Charsadda District, while in Nowshera maximum values are 45.456 ppm, 18.065 ppm, 5.5 and 3.025 ppm from Attock Old Bridge Khwar, Shnay Wannay Khwar, Kemy khwar and Saparey Khwar respectively. Mean concentration of Au in pan concentrate samples are 3.86 ppm. Morphological features such as roundness, flatness, folding, refolding, pits and grooves of gold grains (colors, specks) have been observed using SEM images and Stereoscope Images. Majority of the gold grains are sub-rounded to well rounded, outline and shape of majority of gold grain is simple, majority of grain are flat have pits and grooves on surface showing flaky and porous appearance. These kind of morphologies are indicative of high degree of transport distance. The heavy minerals from the study area include fluorite, apatite, garnet, zircon, tourmaline, amphibole, rutile, monazite, topaz, pyroxene, magnetite, tremolite, epidote, hematite, Ilmenite and rock fragments in both the districts of study area.

From economic point of view the anomalous concentrations of Au is present in Girgichi Khwar, Kheyali river and Kaga khwar of district Charsadda and Attock Old Bridge Khwar, Shnay Wannay Khwar, Pittao Khwar, Kemy khwar and Saparey Khwar of Nowshera District. The morphology of gold grains and the presence of heavy minerals (of igneous and metamorphic origin), it can be concluded that these minerals are derived from distal sources.