APPRAISAL OF GEM DEPOSITS IN BADALKUMBURA REGION OF SRI LANKA WITH SPECIAL EMPHASIZE ON THE PROVENANCE

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Introduction

Badalkumbura Divisional Secretariat in the Monaragala District of Uva Province, in Sri Lanka, is one of the major locations of gem occurrences in the South-Eastern slope of the central highlands. *Kumbukkan Oya* and *Menik Ganga* are the main surface drainages which annually recharged mostly with North-Eastern monsoonal rain. Further, both of these streams are supported by widely distributed perennial and seasonal network of tributaries. According to the Monaragala - Panama 1:100,000 geology map published by the Geological survey and Mines Bureau of Sri Lanka, the Badalkumbura region belongs to the Highland Complex and it is located close to the boundary of Highland and Vijayan Complexes (Figure 1a). This area consists of high grade metamorphic rocks such as calc gneiss, garnet sillimanite graphite gneiss, biotite gneiss, and chanockitic gneiss (Figure 1.b).

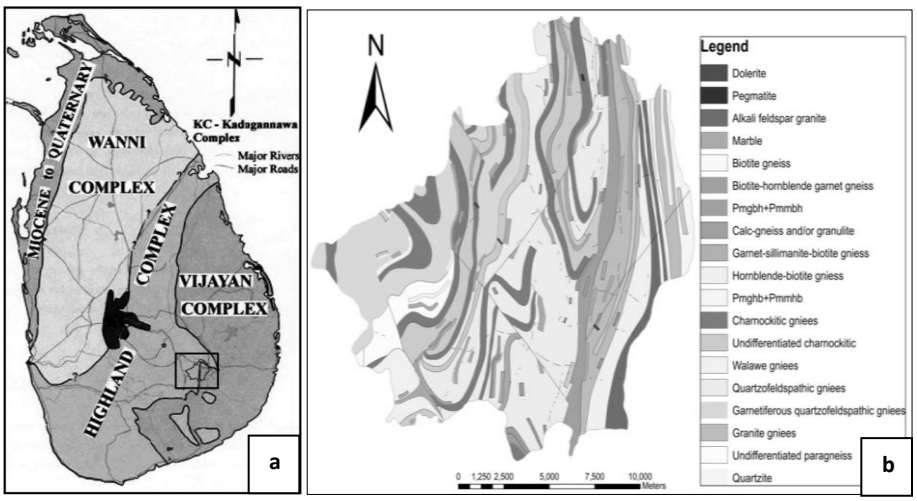

Figure 1. Geological position (a) and detailed lithology (b) of the study area - Badalkumbura Divisional Secretariat (Source - GSMB 1:100,000 map series)

Both primary and secondary gem deposits can be found in the area, according to the previous researchers. This study is focused to evaluate potentiality of gem deposits in the Badalkumbura Divisional Secretariat with special emphasize on their provenance.

Methodology

Preliminary field investigations were carried out to identify localized gem fields. Based on textural, structural, mineralogical and geological observations, gem fields were

categorized into primary and secondary gem occurrences. Extent and distribution of the identified gem fields were demarcated. Based on the GIS and Remote Sensing techniques, extent and distribution of these gem fields were further analysed and preliminary gem potential map was prepared. Based on this preliminary map, exploratory auger sampling was conducted in selected sites representing each gem fields, for further laboratory investigations.

The gem bearing gravel layer of each site was carefully selected from the sampled sedimentological successions. Selected gem bearing gravel layers were thoroughly washed to retain the coarser fraction by draining off the finer clay fraction. The coarser fraction was subjected to sieve analysis. Then, mineral identification was carried out for 125 µm, 250 µm, and 500 µm grain sizes using gemmological microscope. The graphical representation of particle size distributions of each sample was compared with available references to identify the causes of origin.

Results and Discussion

According to the field observations, primary gem occurrences are commonly associated with impure calc gneiss and garnet-sillimanite-graphite gneiss which were formed by silica under-saturate conditions at the Precambrian times to produce both minerals corundum and spinel (Figure 2a). Due to the higher weathering susceptible mineralogical composition of both parent source rocks give rise to form residual primary gem deposits rich with spinel, corundum, garnets etc. (Figure 2b) until they expose for denudation.

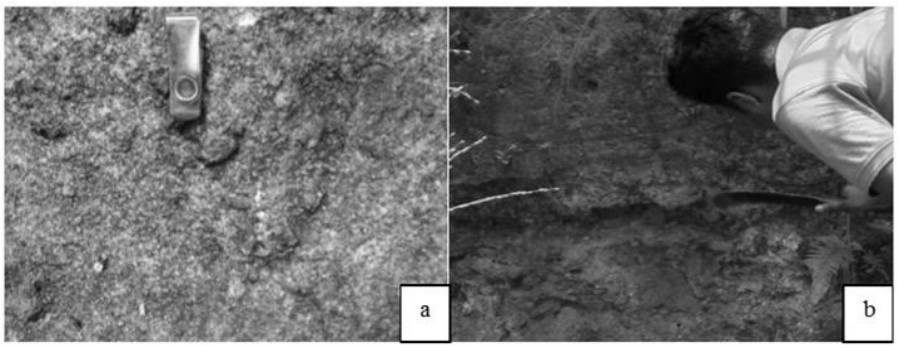

Figure 2. Marble with spinel as source rock (a) and a residual primary gem deposit (b) of the study area - Badalkumbura Divisional Secretariat

The denudation process on such primary residual deposits ends up with the formation of secondary gem deposits following the local drainage network. Also, geomorphology along these drainage networks is the governing factor to form such gem deposit at a specific localized point or a region along the stream courses. Ridge and valley uneven topography of Northern and the North-Western region of the study area comprise mostly weathered residual type gem deposits with the combination of secondary colluvial type gem deposits (Figure 3a and c). Due to violence nature of young stage river courses grab debris with gems from those deposits and secondary alluvial type gem deposits (Figure 3b,d,e) were form when they meet the planer morphology. Continuation of this process during the long period of time form extended secondary gem deposits. Well graded particle size distribution curves also prove that provenances of primary gem deposits and

the secondary colluvial type gem deposits. Well sorted particle size distributions are characterized by the identification of secondary alluvial type gem deposits in this region.

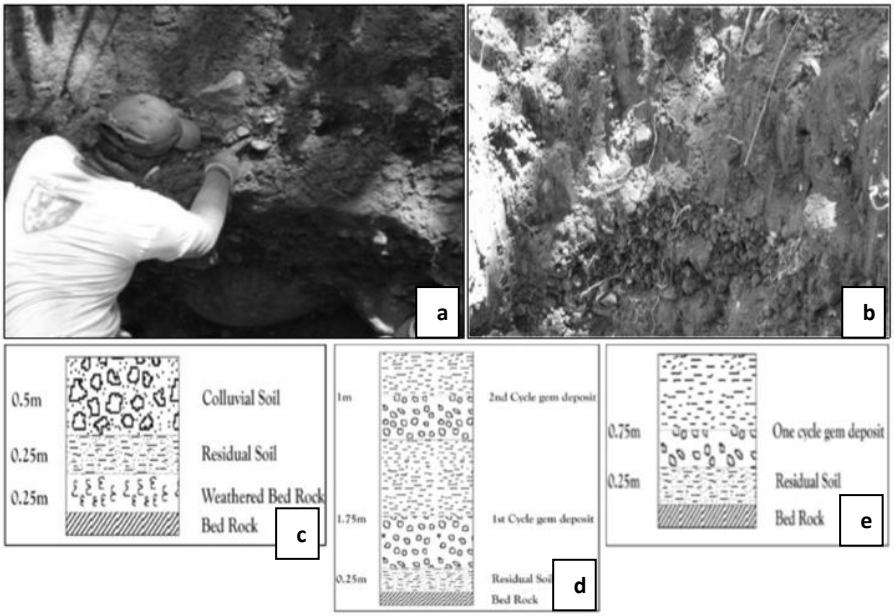

Figure 3. (a) Colluvial gem deposit. (b) Alluvial gem deposit. Geological successions of (c) colluvial gem deposit (d,e) alluvial gem deposits in the study area.

Based on the microscopic studies, 0.3% of yellow sapphire, 0.1% of blue sapphire, 0.5% of geuda (low quality corundum which can be turned into gem quality corundum by heat treatment), 4% of spinel, 2% of garnet, 1% of zircon and tourmaline are the main gem minerals found in these gem fields (Figure 4).

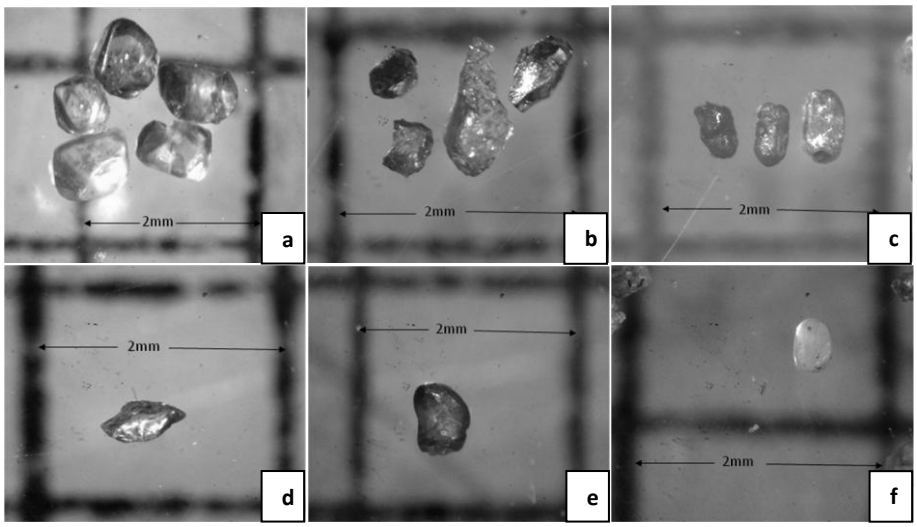

Figure 4. Main gem minerals found in these gem deposits (a) Spinel (b) Garnet (c) Zircon (d) Blue sapphire (e) Yellow sapphire (f) Geuda

Conclusions

According to the field and laboratory analysis, Badalkumbura Divisional Secretariat can be recognized as a high gem potential area. This area has primary gem occurrences and also colluvial and alluvial types of gem deposits as secondary gem fields which are rich in precious gems. 0.3% of yellow sapphire, 0.1% of blue sapphire, 0.5% of geuda, 4% of spinel, 2% of garnet, 1% of zircon and tourmaline are the average gem mineral percentage in these gem fields. However, this study should be carried out for its upper basin region with the view of further provenance confirmations.

References

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