

GEMMOLOGICAL PROPERTIES OF ALMANDINE GARNET GEMSTONE- A CASE STUDY FROM VEMIREDDIPALLE AREA, KRISHNA DISTRICT, ANDHRA PRADESH, INDIA

Nazia Sultana

Research Scholar, Department of Geology, Acharya Nagarjuna University, Andhra Pradesh, India.

Abstract: India is a homeland of many fabulous diamonds and coloured gemstones. Despite the country being inhabited by various civilizations for over 500 years, many parts of India are potentially rich in gemstones. In India, Almandine Garnet was reported from Andhra Pradesh, Telangana, Chhattisgarh and Kerala. The author reported that the Almandine Garnet from Vemireddipalle area, Krishna district, Andhra Pradesh, India, for the first time. Gemmological Properties are studied using Standard methods. The study found that the properties are consistent with Almandine Garnet.

Keywords-Almandine Garnet, colour, hardness, refractive index, fluorescence

I. INTRODUCTION

A gemstone is a piece of mineral crystal which, in cut and polished form, is used to make jewelry or other adornments (The Oxford Dictionary, 2007 and Nancy 2009). The interest of mankind in gemstones is ancient and extends back to the pre-historical times. Archaeological discoveries show that our ancestors collected and treasured gemstones and when used them as ornaments. However, certain rocks (such as lapis lazuli, opal and jade) or organic materials that are not minerals (such as amber, jet, and pearl) are also used for jewelry and are therefore often considered to be gemstones as well. Among the available gemstones, a large amount of them possess one or more of the appealing qualities such as colour, lustre, transparency, brilliance, fire, etc., (Yusuf, 2008).

A gemstone's value is based on its beauty, rarity, durability and history behind that particular stone. The most important physical properties of gemstones are habit, weak planes, hardness, colour, clarity, diaphaneity, size and lustre. India is a homeland of many fabulous diamonds and coloured gemstones. Despite the country being inhabited by various civilizations for over 500 years, many parts of India are potentially rich in gemstones. There are still many tribal areas which are inaccessible and unexplored (Singh, 2014).

Distribution in India

In India, few states have Almandine garnet deposits. Some of the notable states are Andhra Pradesh, Telangana, Chhattisgarh and Kerala. Putrela in the Krishna district of Andhra Pradesh is famous for the occurrence of Almandine garnet (Nazia Sultana and Sankara Pitchaiah, 2018). In Odisha Almandine garnets are reported from the Banjipadar-Sargiguda sector in Kalahandi District, Bagdhapa-Tablai in Sambalpur District (Geology and Mineral resources of Odisha, 2012) and Damjhar-Burhpara-Mantritarai in Nuapada District (Mishra and Mohanty 1998, in Satapathy and Goswami, 2006). In Maharashtra, the Almandine deposits are reported from Wairagarh area (Geology and Mineral resources of India, 2009).

The Present study is concentrated on Gemmological Properties of Almandine Garnet from the Vemireddipalle area of Krishna district, Andhra Pradesh, India.

II. METHODOLOGY

Land Use/Land Cover map is extracted from toposheets of the Survey of India (SOI) 65 C16 (12 sheets) on 1:50,000 scale. The Gemmological properties, i.e., hardness, specific gravity, colour, refractive index, Lustre, Diaphaneity and Fluorescence, luster and transparency, are examined using Standard methods. For this, 23 samples are collected from the pediment zones of hilly terrains.

Hardness is measured using a Mohs Hardness scale. Specific gravity is estimated using the Hydrostatic method. Colour grading chart is used to assess the colour. Refractive index measured using Refractometer. Fluorescence is studied using Ultra Violet light, respectively.

III. RESULTS AND DISCUSSION

In this section, details of Land Use/Land Cover, Gemmological (Physical and Optical) properties are presented.

Land Use/Land Cover

Most of the area has been utilized for crops such as Paddy, followed by Mango Plantation are common in the area(Figure 1).

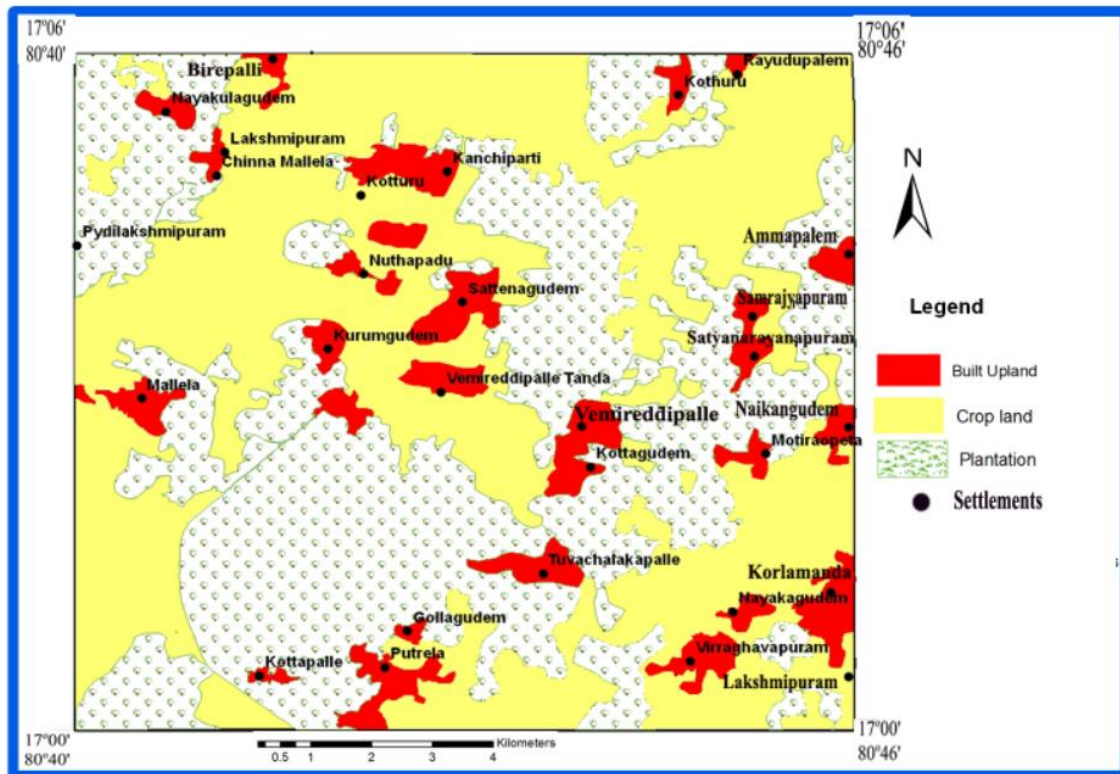


Figure 1 Land Use/Land Cover map of Vemireddipalle area

Physical Properties of Gemstone

Though there are many mineral physical properties. Hardness and Specific gravity are important. The observations are shown in table 1.

Table 1 Physical and Optical Properties of Almandine Garnet from Vemireddipalle

Sample No	Color	Hardness	Specific Gravity	Refractive index	SR/DR	Fluorescence	Lustre	Diaphaneity
1.	Purplish Red	7.5	4.02	1.795	SR (ADR)	Inert	Vitreous	TP
2.	Dark Purplish red	7.5	4.15	1.792	SR (ADR)	Inert	Vitreous	STP
3.	Purplish Red	7.5	4.01	1.793	SR (ADR)	Inert	Vitreous	STP
4.	Purplish Red	7.5	4.08	1.792	SR (ADR)	Inert	Vitreous	TP
5.	Purplish Red	7.5	4.14	1.790	SR (ADR)	Inert	Vitreous	TP
6.	Purplish Red	7.5	4.03	1.795	SR (ADR)	Inert	Vitreous	TP
7.	Purplish Red	7.5	4.02	1.795	SR (ADR)	Inert	Vitreous	TP
8.	Dark Purplish red	7.5	3.97	1.795	SR (ADR)	Inert	Vitreous	TL
9.	Dark Purplish red	7.5	3.99	1.795	SR (ADR)	Inert	Vitreous	TL
10.	Medium Purplish red	7.5	3.99	1.792	SR (ADR)	Inert	Vitreous	TL
11.	Dark Purplish red	7.5	3.96	1.793	SR (ADR)	Inert	Vitreous	TL
12.	Dark Purplish red	7.5	4.10	1.795	SR (ADR)	Inert	Vitreous	TL
13.	Purplish Red	7.5	3.97	1.795	SR (ADR)	Inert	Vitreous	STP
14.	Purplish Red	7.5	4.05	1.795	SR (ADR)	Inert	Vitreous	STP
15.	Purplish Red	7.5	3.98	1.795	SR (ADR)	Inert	Vitreous	STP
16.	Dark Purplish red	7.5	4.01	1.795	SR (ADR)	Inert	Vitreous	STP
17.	Medium Purplish red	7.5	3.95	1.795	SR (ADR)	Inert	Vitreous	TP
18.	Dark Purplish red	7.5	3.95	1.795	SR (ADR)	Inert	Vitreous	TP
19.	Medium Purplish red	7.5	3.98	1.795	SR (ADR)	Inert	Vitreous	TP
20.	Dark Purplish red	7.5	3.97	1.795	SR (ADR)	Inert	Vitreous	STP
21.	Medium Purplish red	7.5	4.12	1.795	SR (ADR)	Inert	Vitreous	TL
22.	Medium Purplish red	7.5	4.08	1.795	SR (ADR)	Inert	Vitreous	TP
23.	Purplish Red	7.5	4.01	1.795	SR (ADR)	Inert	Vitreous	TP

SR-Single Refractive; ADR- Anomalous Double Refractive; TP-Transparent; STP- Semi-Transparent; TL-Translucent.

Hardness

Hardness is the ability to withstand abrasion by other materials (<http://gemologyproject.com/>). The hardness <7 is less preference in the case of gemstone. If the hardness is above 7 it takes better polish and display great luster. It is an important consideration, when designing and wearing jewelry. As, overall wearability grade hardness takes into an account (Nazia Sultana et al., 2019).The samples have 7.5 hardness, and they take a good polish and show a great luster.

Specific gravity

Specific gravity is a way to express the relative density of a gemstone. The author observed that the specific gravity lies between 3.95 and 4.18.

Optical Properties

Under Optical properties Colour, Refractive index, Lustre, Diaphaneity and Fluorescence are observed in table 1.

Colour

Colour is an important property to identify a gemstone. It results from the way gemstones absorb light. When white visible light passes through a gemstone some of the energy is reflected and some of the energy of the white light is absorbed in gemstone which caused colour in gemstone (<http://shodhganga.inflibnet.ac.in>). It influences the value of gemstones. The Almandine garnet samples show medium to dark purplish red colour.

Refractive index

The ratio between the optical density of the gemstone and that of air is known as the Refractive Index (RI) of a gem (Read, 1983). Gems with a higher RI tend to show more brilliance. It is observed that the Refractive index of Almandine garnet varies from 1.790 to 1.795. These high values are caused for more brilliance.

Lustre

Lustre is the optical effect created by light reflecting from the surface of the stone and is directly related to the quality of the surface polish, which can be produced on a stone (Read, 1983). The samples exhibit Vitreous lustre.

Diaphaneity

This is the degree to which a stone transmits light. Transparency, or its converse, opacity, can be described for identification. In the present study, samples are transparent to translucent.

Fluorescence

The emission of light from within a substance while it is being exposed to direct radiation, or in certain cases to an electrical discharge in a vacuum tube, is known as fluorescence (Dana and Ford, 1922). Inert fluorescence is observed in the samples.

As per the scientific studies, garnet minerals has no optic sign, birefringence and pleochroism.

IV. CONCLUSION

Almandine Garnet is a variety of Garnet group. Gemmological properties are studied using standard methods. The samples are purplish red in colour and they show vitreous lustre and transparent to translucent. Inert fluorescence is observed and the hardness is high, Specific gravity is also high. Based on these observations the mineral is confirmed as Almandine Garnet.

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