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Comment on "Integrated Mineralogical Characterization of Banded Iron Ores of Orissa and Its Implications on Beneficiation" by Mohanty *et al*. (2012), Journal of Minerals and Materials Characterization and Engineering, 11, 1133-1142*

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ABSTRACT

Mohanty *et al.* (2012) have wrongly analyzed Mössbauer spectra obtained from various iron ore samples. We criticized their approach suggesting suitable methodology, and suggested to refer earlier work carried out by Nayak *et al.* (2001, 2004) on representative samples from the same geological belt.

Keywords: Mössbauer Spectroscopy; Banded Iron Formation; Goethite; Magnetite; Hematite

In response to the article by Mohanty *et al.* (2012) [1], I wish to bring few technical facts to your kind attention, which I believe questions some of important aspects of results and interpretation presented in this article. Authors have advocated an integrated approach for analyz ing iron ores using various characterisation techniques such as megascopic, microscopic, XRD, Mössbauer spectroscopy, VSM and chemical analysis. However, I understand that authors have wrongly analysed the Mössbauer spectra obtained from samples JKM-03, JKM-07 and JKM-10 presented in **Figure 6**, resulting inaccurately presented results in **Table 1**.

For sample JKM-03, authors have identified hematite and goethite from XRD, whereas they fitted corresponding Mössbauer spectrum with four sextets in **Figure 6**. This is conceptually wrong, as only two sextets required here, one each for hematite and goethite. Additional sextet can only be fitted, in case there is substantial amount of aluminium present in the sample with possibility of partial substitution of iron by aluminium at goethite lattice site [2], as aluminium substituted goethite has reduced field than goethite. But in this case as aluminium concentration is very less (**Table 3**), and hence the possibility of presence of aluminium substituted goethite effectively ruled out. From the appearance of spectrum of JKM-03 in **Figure 6**, after fitting two sextets for this sample, I suspect the reduction of field of goethite, which is mostly due to the presence of small particle size involving microcrystallinity of the goethite crystallites, as observed earlier by Nayak *et al.* [3] in banded iron formations of same geological belt of eastern India. This factor can also result large line width in this type of natural goethite samples. Similarly, for spectra obtained from JKM-07 and JKM-10 presented in **Figure 6**, there is a need to fit two sextets instead of three and four, respectively and hence the obtained Mössbauer parameters required to be correctly presented in **Table 1**.

Moreover in **Table 1**, authors have not provided the expected errors in the calculated Mössbauer parameters making it difficult to understand the significance of the values obtained, and the absence of chi-square (experimental data with fitted data) further limits the understanding of the quality of fitting that authors' obtained. Furthermore, for samples JKM-04 and JKM-08 collected from BIF 1, authors have identified two sextets as magnetite without any differentiation, and assignment of tetrahedral and octahedral sites is necessary [3,4]. In this context, I would like to mention here that Nayak *et al.* [3] also studied representative iron ore samples from same geological belt as Mohanty *et al.* [1] by using comple-

*http://www.scirp.org/journal/PaperDownload.aspx?paperID=28621.

mentary techniques such as microscopic, XRD, Mössbauer spectroscopy for characterizing iron-bearing phases, and the outcomes of both studies complement each other. Furthermore, it may be noted here that the technique is called "Mössbauer spectroscopy", and not "Mossbauer spectroscopy", as mentioned throughout the paper.

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Appendix

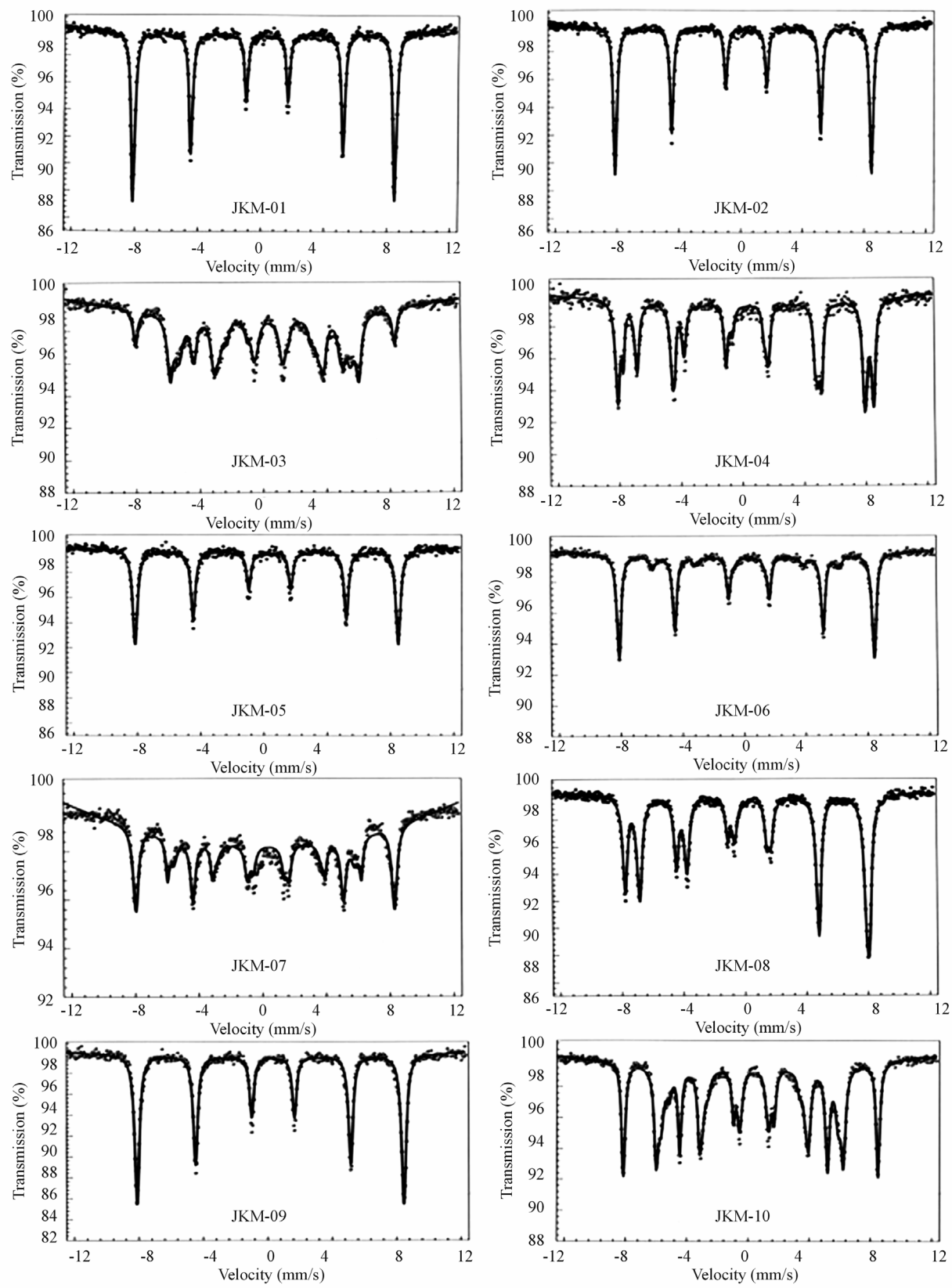

Figure 6. Mossbauer spectra of iron ore samples from different iron formations.

Table 1. Mossbauer parameters of iron ore samples from different iron formations.

Sl. No.	IS (mm/s)	QS (mm/s)	LWD (mm/s)	Bhf (T)	Area (%)	Mineral
JKM-1	0.3489	–0.0940	0.2648	51.6	100	Hematite
JKM2	0.3496	–0.0924	0.2596	51.6	100	Hematite
JKM3	0.3411	–0.0812	0.3103	50.7	16.8	Hematite
	0.3370	–0.1349	0.3811	37	33.8	Goethite
	0.3387	–0.1353	0.3784	33.6	36.9	Goethite
	0.4512	–0.0514	0.3307	28.4	12.5	Unknown
JKM4	0.3497	–0.0431	0.3041	51.6	47.2	Hematite
	0.2221	–0.0408	0.2064	48.6	17.3	Magnetite
	0.6673	0.0188	0.3258	46.2	35.5	Magnetite
JKM5	0.3490	–0.0962	0.3307	51.6	100	Hematite
JKM6	0.3478	–0.0796	0.3051	51.3	85.3	Hematite
	0.3478	–0.1374	0.4555	37.5	14.7	Goethite
JKM7	0.3474	–0.0953	0.3699	50.4	59.5	Hematite
	0.3448	–0.1344	0.2328	37.8	16.7	Goethite
	0.3397	–0.1445	0.4983	35.4	23.9	Goethite
JKM8	0.2698	–0.0067	0.3278	49.3	44.3	Magnetite
	0.6360	0.0059	0.3783	45.8	55.7	Magnetite
JKM9	0.3498	–0.0870	0.3195	51.5	100	Hematite
JKM10	0.3553	–0.1037	0.2626	51.6	35.2	Hematite
	0.3402	–0.1393	0.3006	38	30.3	Goethite
	0.3309	–0.1387	0.4294	36	25.1	Goethite
	0.2550	–0.2041	0.3307	31.8	9.4	Goethite

BIF-I (JKM4 & JKM8), BIF-II (JKM9 & JKM10), BIF-III (JKM1, JKM2, JKM5 & JKM6), Hirapur (JKM3 & JKM7).

Table 3. Chemical analysis of iron ore samples.

Sl.No.	SiO_2	Al_2O_3	Fe_2O_3	MnO	MgO	CaO	Na_2O	K_2O	TiO_2	P_2O_5	LOI*	Sum
JKM1	75.76	1.25	21.38	0.02	0.04	0.14	0.07	0.01	0.03	0.06	2.25	101.01
JKM2	29.68	0.21	68.97	0.11	0.05	0.14	0.01	0.01	0.03	0.08	1.41	100.7
JKM3	1.52	0.71	86.25	0.22	0.06	0.24	0.01	0.01	0.04	0.33	11.12	100.51
JKM4	12.58	0.41	82.97	0.26	1.34	0.66	0.01	0.01	0.03	0.06	1.23	99.56
JKM5	1.23	0.59	96.81	0.03	0.01	0.02	0.01	0.02		0.04	1.53	100.29
JKM6	49.54	0.15	45.72	0.1	0.05	0.1	0.01	0	0.01	0.06	2.44	98.18
JKM7	1.34	1.30	84.62	0.22	0.10	0.30	0.01	0.03	0.46	0.30	11.91	100.59
JKM8	1.02	0.10	96.42	0.39	0.23	0.04	0.01	0.01	0.02	0.05	0	98.27
JKM9	28.49	0.17	70.10	0.02	0.03	0.04	0.02	0.01	0.04	0.06	2.09	101.07
JKM10	1.21	0.17	97.16	0.06	0.11	0.03	0.01	0.01	0.02	0.20	0.85	107.83

*LOI is done at 950°C. Sample No. same as given in **Table 1**.

