Ancient Indian Knowledge of Oceanography

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Abstract

Oceans (or) the *Samudra* occupy more space on this earth. The study of oceans, their contents, etc. is collectively termed as *Oceanology* (or) *Oceanography.* The people in India, from the Vedic times have had definite knowledge of oceans and its several routes, ocean navigation and ocean trade. The knowledge of ocean waves, tides and the like are also seen in *Ṛgveda,* the *Sāmaveda* and *Atharvaveda* show four types of oceans and deal on the wealth within these water bodies. The Vedic people where acquainted with some sort of ocean vegetation (or) plankton which they call as *'Samudrasyābakā'*. By the time of the *Rāmāyaṇa* (III.74.25),the idea (or) knowledge of the seven oceans had come to prevail. The *Rāmāyaṇa* reveals good knowledge of ocean fauna, ocean wealth, and the lunar pattern causing tides. The *Mahābhārata*shows that Indians knew ocean navigation well and their knowledge of oceanic flora and fauna was well-established. Kautilya's *Arthaśāstra*, establishes that ocean navigation and coastal shipping was well-developed by his time. According to thePurāṇas*,* the seven oceans were named and also measured. The Purāṇas throw light on the fact of the colour of the sea being formed due to scattering of light. The concept of *Vadavāgni* (submarine fire) and the amplitude of tides are mentioned in the Purāṇas quite accurately. Jain works like *Tattārthādhigama*of Akalaṅkadevaand *Vṛhatkṣetrasamāsa* (*Tīkā*) enumerate the different oceans and show that Indians were much advance in navigation and maritime commerce. In the Buddhist text *Vinayapitaka*, the seed of Oceanographyis clearly discernible. This text was acquainted with concepts of bathymetric survey, underwater topography, and continental shelf, types of abysses, salinity, rocks, pearls, corals, and mineral contents together with its fauna. An attempt is made in this article to explore the depths of the rich knowledge of the ancient people on the oceans and also to compare with modern Oceanography.

1. Introduction

Samudra or Ocean occupies a major part of the Earth's surface and it plays a vital rolein regulating the earth's climate. It supplies food and mineral resources, and is the finaldestination of many waste products.

The study of oceans, their contents, etc. is collectively termed as Oceanology (or)Oceanography. Physical oceanography, chemical oceanography, biological oceanography andgeological oceanography are the four separate branches of Oceanography.

Physical Oceanography is the study of temperature, waves, currents, and tides ofseawater. Chemical Oceanography is the study of the composition of seawater and

thebiogeochemical cycles that affect it. Biological Oceanography is the study of the biologicalorganisms in the ocean fish and marine mammals. Geological Oceanography is the study ofthe structure, features, and evolution of the ocean basins.

2. Physical Oceanography

The *Ṛgveda* IX.50.1 shows knowledge of oceans waves -सिन्धोरूर्मेरिव स्वनः।Ṛgveda I.19.7-8 talks about wind as the cause of movement in ocean water. Again *Ṛgveda* I. 48.3presents an idea about high tide, when it saysसमुदे न श्रवस्यवः।

The *Ṛgveda* X.32.6, talks about fire with in the waters, probably the *vaḍavāgni*,
निधीयमानमपगूळ्हमप्सु प्र मे देवानं व्रतपा उवाच । इन्द्रो विद्वाँ अनु हि त्वा चचक्ष तेनाहमग्ने अनुशिष्ट आगाम् ॥

The *Taittirīya Samhitā* records the phenomena of the tides when it says (TS IV. 2. 8. 1) समुद्रम् अभितः पिन्वमानम्।where the term *abhitaḥ* implies tides on all sides.

The *Vājasaneyi-Samhitā* (VS 8.28)refers to the tides as "*the gathered flood of ocean*".

The *Śatapatha Brāhmaṇa* (SB I.1.3.5; IX.1.2.3) says that the oceans flow in everydirection. This *Brāhmaṇa*, a work that contains wonderful and in-depth cultural data, gives anidea of the ocean currents for the first time in Indian literature. For instance SB VII.1.1.13, gives information about ocean current flowing southwards from east and IX.1.2.3 talks aboutocean flowing all around the world from left to right.

The *Maitrāyaṇi Upaniṣad* (IV.2) affirms that tides are uncontrollable - समुद्रवेलेव दुर्निवार्यम्।

The *Rāmāyaṇa* also mentions that the lunar pattern causes tides to take place in theOcean (I.55.20: विवर्धमानो वीर्येण समुद्रपर्वणि।and II.6.27: पर्वसु उदीर्णवेगस्य सागर्स्येव निस्स्वनः।

The *Rāmāyaṇa* also enumerates the presence of *vaḍavāgni* in IV. 40. 49:
तत्र विक्रोशतां भूतानां साजरौकसाम् ।
श्रूयते च समर्थानां दृष्टवा तद्वडवामुखम् ॥

There are references to other features of the ocean like the island, bays, or *kaccha*(V.1.195). Ocean deeps and submarine mountains are also referred in IV.41.20.

The Māhābhārata records that the coastal people were well aware of the phenomenaof tides and knew that the moon is its cause, I. 21. 11 -चन्द्र-वृद्धिक्षयादुद्गृत्तोर्मिसमाकुलम् ।and the new and full moon days are special occasions (V.151.56) -समुद्रस्यव पर्वणि ।

The concept of *vaḍavāgni* persists right from the Vedic times and has been developedover time. The Purāṇas give information about *vaḍavāgni* – its origin, its nature, its epicenter, its effects both negative and positive and its role in the destruction of the universeknown as Pralaya.

The tides, their causation, amplitude and various other aspects are found mentioned inthe Purāṇas almost accurately. A clear description of tides being influenced by the waxingand waning of moon is given in the *Matsyapurāṇa*, (123. 30ab-34ab):
उदयतीन्दौ पूर्वे तु समुद्रः पूर्यते सदा ।
क्षयवृद्धी समुद्रस्य शरिवृदधिक्षये यथा ।

Poet Kālidāsa has also talked about the oceans and their properties in his kāvyas.He was acquainted with the concept of

the seven oceans. He also knew about the tidesand their causes (*Raghuvamśa*, XIII. 14):

प्रवृत्तमात्रेण पयांसि पातुमावर्तवेगाद्भ्रमता घनेन ।
आभाति भूयिष्ठमयं समुद्रः प्रमथ्यमानो गिरिणेव भूयः।।

The *Kumārasambhava*, III. 67, records:

हरस्तु किञ्चित् परिलुप्तधैर्यश्चन्द्रोदयारंभ इवाम्बुराशिः ।

In addition to all these we also get to know information about the use of compass madeof magnet which always points to North and South. The *Mahābhārata* (XII.211.3),*Kumārasambhava* (II.59) and many other texts refer to this *ayaskānta*. An eminent historianhas said the following about the mariner's compass which is an indispensable tool foroverseas voyage: "The Hindu compass was an iron fish which floated in the vessel of oil andpointed to the north. The fact of this older Hindu compass seems placed beyond doubt by theSanskrit work *Macchayantra*".

3. Biological Oceanography

The *Vājasaneyi-Samhitā* 17.4 records that there was a type of ocean vegetation orplankton and they called this life as 'समुद्रस्याबका'.

The *Rāmāyaṇa* reveals the exhaustive knowledge about the ocean fauna (VI.4.13) andocean wealth (I.3.8).

Indians knowledge of oceanic flora and fauna is considerable. Whales, large fishes,sharks, tortoises, creatures of various forms by thousands and crocodiles are specificallymentioned in the *Māhābhārata*(I. 21. 4a, 5b):

तिमिङ्गिलझषाकीर्णं मकरैरावृतं तथा ।
उग्रैर्नित्यमनाधृष्यं कूर्मग्राहसमाकुलम् ॥

The coastal people were aware of the pearls and other wealth of the ocean (I.21.3):

ददृशातेऽर ते तत्र समुद्र निधिमम्भसाम् ।
महान्तमुदकागाधं क्षोभ्यमाणं महास्वनम्॥

Kautilya was fully acquainted with corals, pearls and the place of their occurrence and theprocess of their fishing, in the *Nāvadyakṣa* section.

Poet Kālidāsa also tells us that the ocean has many things like mountains, sharks,large fishes, coral reefs and conches. In addition, he talks about the sandy beaches, oysters and pearls. (*Raghuvamśa*, XIII. 8,11ab):

रसातलादादिभवेन पुंसा भुवः प्रयुक्तोद्वहनक्रियायाः ।
अस्याच्छमम्भः प्रलयप्रवृद्धं मुहूर्त्तवक्त्राऽऽवरणं बभूव ॥

मातङ्गनक्रैः सहसोत्पतद्भिर्भिन्नात् द्विधा पश्य समुद्रफेनान् ।

Tripati (1969)in his book wrote that in the *Vinayapiṭaka*, "the seed of oceanography is clearlydiscernible. The text for the first time has tried to discuss or present the subject systematically". He has also presented a concept of bathymetric survey, underwatertopography of the ocean floor, continental shelf, some types of abysses, and fixity of its waterlevel, its universal salinity, rocks, pearls, corals, and large number of mineral contents together with its fauna.

4. Geological Oceanography

The people of India, from the Vedic period onwards, seem to have had a deeply extensiveknowledge of oceans along with its routes, navigation and trade. *Ṛgveda* I.116.5 confirmsthis idea when it thanks the Aśvins for navigating 'a ship with hundred oars':

यदश्विना ऊहथुर्भुज्यमस्तं शतारित्रां नावमातस्थिवांसम्।

In the same context,the *Ṛgveda* (I.116. 3-4) talks about travelling to another placeprobably an island –समुद्रस्य धन्वन् आर्द्रस्य पारे..... ।

The time at which the oceans were classified into seven different types cannot be datedaccurately because the classifications had been varied in numbers. The *Ṛgveda*, X.136.5 mentionstwo oceans namely eastern and western: उभौ समुद्रावा क्षेति यश्च पूर्व उतापरः ।Ṛgveda, IX.33.6 (रायः समुद्रांश्चतुरोऽस्मभ्यं सोम विश्वतः।) and X.47.2 (चतुश्समुद्रं धरुणं रयीणाम्।) talk about four oceans and X.90.15 (सप्तास्यासन् परिधयः।) is interpreted by Mahīdhara asseven oceans. Du Perron was of the opinion that this idea was 'adopted by Persians' (Tripati, 1969).

The *Sāmaveda* (IV.14) and the Atharvaveda (XIX.27.3) show us that there were fouroceans and they also tell us about the wealth that was available within these oceans.

By the time of the Rāmāyaṇa period, the knowledge of the seven oceans had come to prevailas seen in the *Āranya kānda* (74. 25: चिन्तितेऽभ्यागतान् पश्य सहितान् सप्त सागरान्।75. 4:सप्तानां स समुद्राणामेषु तीर्थेषु लक्ष्मण्।). It talks of the saline ocean - लवणार्णवम्।[1](I.1.72;IV. 58. 32), ocean of fresh or pure water (IV.40.47: क्षीरोदं समतिक्रम्य ततो द्रक्ष्यत वानराः।जलोदं शागरश्रष्ठ...॥), the Milk ocean (IV.40.43: ततः पाण्डरमेघाभं क्षीरोदं नाम सागरम्।) and the Red sea[2] (VI.40.39:).

The *Mahābhārata* establishes the classification of the seven oceans (VI.11.6,10) butnames only six – *Lavaṇa*, *Ghṛta*, *Dadhi*, *Surā*, Jaloda and *Kṣīroda* (leaving out *Ikṣu*). By thistime Indians seem to have developed ocean navigation well. In the *Vanaparva* it refers tomerchants crossing the ocean by ship (III.31.24).

In the chapter on *Nāvādhykṣa* in the Adhikarana II of the Kautilya's *Arthaśāstra*, theauthor establishes that ocean navigation and coastal shipping was well-developed.

Manusmṛti testifies to the flourishing state of ocean navigation and trade when it saysthat, the boat hire must be proportional to the places and time which refers to passages alongthe bank of rivers, at sea there is no settled freight (VIII.406):

दीर्घाध्वनि यथादेशं यथाकालं तरो भवेत् ।
नदीतीरेषु तद्विद्यात्समुद्रे नास्ति लक्षणम् ॥

The seven oceans, according to the Purāṇas were named – Lavaṇa,Iksu, Surā Ghrta, Dadhi, Dugdha and Jalodak. They were measured in terms of *Yōjana* (*Yōjana* is the Vedic measure of distance. One *Yōjana* is about 12-15 miles, Krishnamurthy Sastry, 1989).

Some Jain works like the commentary of Akalaṅkadeva on the *Tattārthādhigama*, andthe *Vṛhatkṣetrasamāsa-tīkā* enumerate 8 conspicuous oceans: 1.*Lavaṇoda*, 2. *Kaloda*, 3.*Puṣkaroda*, 4. *Varunoda*, 5. *Kśiroda*, 6.*Ghṛtoda*, 7. *Ikṣūda*, 8. *Nandiśvaroda*. The*Vṛhatkṣetrasamāsa-tīkā* adds *Aruṇavaroda* as the ninth ocean.

The Jains possessed a very fanciful idea about the causation of tides. The*Āvaśyakasūtra* tells us that Indians were much advanced in navigation and maritimecommerce.

Oceanography and ocean navigation also took big leaps of improvement during the

[1]शतयोगनविस्तीर्ण पुप्लुवे लवणार्णवम् । उपायो दृश्यतां कश्चित् लङ्घने लवणाम्भसः ।

[2]Not the present Red sea.

Buddhist period. They were the first group of people who introduced an element of scientificstudy to the oceans. This is apart from the fact that they were very well-versed with thecommercial importance of the oceans as highways for transport and communication.

On the practical side, Indian navigation reached its highest peak during the reign of theChola dynasty but it is not often mentioned in history. Rājarāja, the Great (985-1014 A.D.)and his successor, made a great efforts to improve Indian navigation which reached itspinnacle during their rule. There are several inscriptions about Rājendra Chola that help us tounderstand that the Cola dynasty had vastly improved the knowledge of oceanography andhydrometeorology. Inscriptions dated between 1024-1043 C.E provide a graphic detailedaccount of Rājendracola's overseas campaigns. It is said that the Cholas reduced the Bay ofBengal to a 'domestic Chola lake'.

5. Chemical Oceanography

As indicated in the beginning of the article, chemical Oceanography concentrates on analyzing thecomposition of seawater and the biogeochemical cycles that affect it. From our literaturestarting from the Vedas, we come to know very little about the chemical contents of the seawater. Of the seven oceans enumerated earlier, one can understand the terms *lavaṇārṇava*meaning salty ocean and the *Jaloda* referring to fresh water. The other terms, *Ghṛta*, *Dadhi*,*Surā*, *Kṣīroda* and *Ikṣu* do not give us any details about their contents. Hence, much is notknown about chemical oceanography, from the texts.

6. Conclusion

A vast majority of the earth's surface is covered in water. In order to understand theearth's changing climate, we have to look into the facts related to ocean circulation and thecoupling of the ocean and atmosphere. This brings into account the vast diversity of flora andfauna of the ocean critical to the Earth's biogeochemical cycles.

The science of oceanography can be used to discover many things that are stillunknown in our oceans. Despite the absence of modern technology and equipment in ancienttimes, our ancestors have been well aware of the importance of the oceans in our daily lifeand thus they have presented the various details about the ocean from their observations.

This article is a humble attempt to bring out our ancient Indian knowledge ofoceanography and how it is on par with modern oceanography with all its four majordivisions, namely, Physical, Biological, Geographical and Chemical Oceanography.

Bibliography

1. *Arthaśāstra*, ed. by R. P. Kangle, MLBD, Delhi, 1986.

2. *Atharvaveda*, Text with Tr. And notes by R.L.Kashyap, SAKSI, Bangalore, 2011.

3. *Kathāsaritsāgara of Somadevabhatta*, Parimal Publications, Delhi, 1930.

4. *Kumārasambhava*, ed. with Tr. by M.R. Kale, MLBD, Varanasi, 1986.

5. *Manusmriti*, Nirnay Sagar Press, Mumbai, 1946.

6. *Matsyamahāpurāṇam*, ed. with tr. by N.S. Singh, Nag Publishers, Delhi, 1997.

7. *Panchatantra of Viṣṇu Sarma*, with the commentary of Sri Jivanandavidya Sagar, Calcutta, 1892.

8. *Raghuvamśa*, Nirnayasagar Press, Bombay, 1932.

9. *Ṛgveda Samhita*, ed. by Damodar Satvalekar, Svadhyaya Mandal, Pardi.

10. *Samaveda*, *Uttara Archaka*, R.L.Kashyap, SAKSI, Bangalore, 2011.

11. *Śatapatha Brāhmaṇa*, ed. by Weber, Chowkhamba Sanskrit Series, Varanasi, 1964.

12. *Srīmad Mahābhārata*, in 6 Vols., Gita Press, Gorakpur.

13. *Srāmad Vālmīki Rāmāyaṇa*, ed. by K. Chinnaswami Sastrigal and V.H. Subrahmanya Sastri, M.L.J. Press, Madras, 1958.

14. Krishnamurthi Sastry, R. *Krishna Yajurvediya Taittiriya Samhita, Vedartha Dipika Sahitamu*. Edited, Translated and Commented by Siromani Ramavarapu Krishnamurthi Sastry, 1-7 *Kāṇḍas* in Telugu, Sri Tirumala Tirupati Devasthanams (TTD), Religious Publications Series No: 324, Tirupati, 1989.

15. Tripathi, M.P. *Development of Geographic Knowledge in Ancient India*. Bharatiya Vidya Prakashan, Varanasi, 1969.