

ANDHRA PRADESH.

Mineral resources of the ceded districts  
of Andhra Pradesh

by

N. V. B. S. Dutt.

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# MINERAL RESOURCES OF THE CEDED DISTRICTS OF ANDHRA PRADESH

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## INTRODUCTION

Out of a total area of 27,400 square miles in the Ceded districts of Andhra Pradesh, about a half has been geologically surveyed, using modern maps on 1 inch to 1 mile scale. Some important mineral investigations have also been carried out. This paper presents a review of the known mineral resources and their industrial possibilities in the area so far surveyed. The author is highly thankful to Dr. A. K. Dey, Superintending Geologist, and to Dr. M. S. Krishnan, Director, Geological Survey of India, for kindly permitting him to write up this account of the mineral resources of the Ceded districts of Andhra Pradesh and for going through his manuscript. His thanks are due to Mr. M. S. Venkatram, Superintending Geologist, for his valuable suggestions.

## GENERAL

*The area and its boundaries.*—The mineral map shows the location of the five Ceded districts of the former Madras State, namely, Anantapur, Bellary, Chittoor, Cuddapah and Kurnool, popularly known as the Rayalaseema or the country ruled by the famous King Krishnadeva Raya of Hampi Vijayanagar. With the formation of Andhra State in October 1953, the western major part of the Bellary district has merged with Mysore, and the three eastern taluks have been included in the Anantapur and Kurnool districts. The new State of Andhra Pradesh came in to existence on the first of November 1956, when States all over India were reorganised.

*Topography and drainage.*—The Nallamala is the main mountain range running across the Kurnool and Cuddapah districts. The Erramalla hills on the west and the Velikondas on the east enclose the Kunderu and the Cumbum plains respectively. South of Cuddapah, the Nallamalas merge with the Palkonda (Palakonda †) or Seshachalam hills and extend into the Chittoor district. The rest of the area is a flat plain, studded with isolated ridges and clusters of hills, belonging to the Eastern Ghats. The highest peaks are (1) Manti Konda (Δ3,009) on the Nallamalas, (2) point 2230 on the Erramalas, (3) Penchala Konda (Δ3,626) on the Velikondas and (4) Tellarallapet (Δ3,776) on the Palakondas.

The Penner (Penneru ‡) river flows across the Anantapur and Cuddapah districts with its tributaries, the Kunderu and Sagileru from the Kurnool district in the north and the Chitravati, Papagani and Cheyyeru from the south. The smaller streams, namely, Gundlakamma, Swarnamukhi

and Naga flow north into the Tungabhadra and Hindri or Pennaru to the south.

*Climate and Rainfall.*—The maximum summer temperature in May rises to 114°F. at some places as Kurnool where the winter temperature drops as low as 44° F. at night. The range is considerably less in the elevated forested regions than elsewhere.

The average annual rainfall varies from 20 to 50 inches the mountainous regions receiving more rain than the plain. In the Kurnool district, the south-west monsoon gives more rain west of the Nallamalas than on the east, while it feeds the Cuddapah district more uniformly. The north-east monsoon is more beneficial in the eastern part of the Cuddapah and Kurnool districts than on the west. The annual rainfall increases from south to north in the Nallamalas and the western plain, while in the eastern portion the increase of rainfall is from north to south. Periodically the rainfall is precariously low or unseasonal, especially in the western districts, causing drought and famine conditions.

*Soil and cultivation.*—Either poorly developed black cotton soil or light red soil supporting mainly dry crops is found in the area. Irrigation by tanks and wells is quite characteristic of the area, and intensive cultivation can be promoted by repair of old water sources and by construction of new ones. Canal irrigation can also be planned to the best advantage of the region.

*Forests.*—Considering the rapid decrease of forest wealth in the hill tracts in recent years, it appears that the forests can be protected only by strict enforcement of Forest Laws and by stepping up of afforestation and planned cutting.

*Communications.*—Rail and road communications stand in need of considerable improvement. A rail connection between Broad gauge and Metre gauge lines in the middle part of the Cuddapah and Kurnool districts has long been felt necessary. Certain direct road links such as the one joining Kurnool (15°50': 70°3') with Markapur (15°44': 79°16') through Mantrala Kanama have been neglected. On some of the existing main roads there are no bridges over important streams, as at Jammalamadugu (14°51': 78°23') or Owk (Avuku) (15°13': 78°7').

## GEOLOGY

The rock formations of the Ceded districts are metamorphosed sedimentary and igneous rocks of the Archæan era and unfossiliferous sedimentary rocks of the Cuddapah and Kurnool formations together with their associated intrusive and effusive igneous rocks. The following table shows the geological sequence of rock formations arranged in the order of antiquity after King:

Correct name not used on the topographical sheet.  
‡ Current spelling on the topographical sheet.  
† Popular name of Niduzuvvi (14°39': 78°30').

Kurnool .. .. .	Kundair .. .. . (Kunderu*)	{ Nandyal	{ Purple shaly limestones.
		{ Koilkuntla	{ Purple calcareous shaly flags. grey limestones and flags.
	Paniam (Panem) .. .. .	.. .. .	{ Pinnacled quartzites.
	Jammalamadugu .. .. .	{ Auk (Avuku)	{ Plateau quartzites, purple shales,
{ Narji (Nirji†)		{ Grey calcareous flags. Greenish grey, purple, whitish and grey massive limestones with flag beds towards the base.	
Banganapalle quartzites and sandstones with basal conglomerates.			

## Unconformity

Cuddapah	..	..	}	Kistna (Krishna†)	..	{	Srisaïlam quartzites.
							Kolamnala red and purple slaty shales.
							Irlakonda (Irla Konda) quartzites.
							Traps and associated mineral-bearing veins.
							Cumbum purple and grey slates and shales.
				Nallamalai (Nallamala*)	..	{	Bairenkonda quartzites.
				Cheyair (Cheyyeru*)	..	{	Tadpatri (Pullampet in the east) purple and grey.
							slaty shales.
							Pulivendla (Nagari in the east) quartzites.
				Papaghni	..	{	Vempalle (Vaimpalli) limestones and shales.
							Gulcheru (Guvvalacheruvu) quartzites.

## Unconformity

Archaean	..	..	}	..	..	..	Dolerite dykes.
							Felsites, pegmatites and quartz veins.
							Bellary granite.
							Pegmatites and quartz veins.
						Champion and Peninsular gneisses.	
				Dharwar	..	{	Phyllites and banded ferruginous quartzites, chlorite-
							schists and limestones.
							Epidiorite, hornblende-schists and granulites.

*The Archaeans.*—The Archæans are exposed in the Anantapur district excluding Tadpatri taluk, in the Chittoor district excepting a few outliers of Cuddapah in the eastern part, in Rayachoti taluk of the Cuddapah district and in the western third of Kurnool roughly demarcated by the Kurnool-Gooty (Gutti†) road.

The oldest Archæan rocks of the area belong to the Dharwar system, and are made up of basic igneous intrusive and effusive rocks and highly-altered sediments,

occurring as tightly folded elongated synclinal bands amidst gneisses.

Of the granites and granitoid gneisses, the youngest is the Bellary granite, which stands out in rocky wilderness with castle-like masses and fantastic tors. The rock is more or less porphyritic, consisting of predominating felspar, quartz, mica and hornblende with accessory epidote.

† Correct name not used on the topographical sheet.

\* Current spelling on the topographical sheet.

## Glossary of Telugu words—

Adavi=Forest	Nalla=Grey, black	Eru=River	Tella=White
Chali-Kalamu=Winter	Pala=Milky white	Kanama, Kanuma=Pass	Uru=Village
Enda-Kalamu=Summer	Petu=Plateau	Konda=Hill	Vana=Rain
Erra=Red	Ralla=Stony	Mala=Mountain	

*The Purana group.*—The Puranas consisting of the Cuddapahs and Kurnools constitute the rest of the Ceded districts. The rocks crop out in a crescent-shaped manner, concave towards the east. The Kurnool system covers a large part of the Cuddapah system, in the north-western portion of the Cuddapah district and middle portion of the Kurnool district, west of the Nallamala Range. Quartzites constitute the parallel ridges and easterly-sloping plateaus and traps form some of the flat-topped ridges, while shales, slates and limestones being less resistant weather into the plain. The Papaghni series is exposed along the western margin of the basin; the basal Gulcheru quartzites form steep cliffs overlying the crystalline rocks. The Gulcherus consist essentially of altered sandstone and grits with pebble bands and intercalations of argillaceous beds of variable thickness. The Vempalle limestones are fine grained, siliceous and magnesian, frequently intercalated with chert and often associated with ferruginous shales, especially near the base. They weather to a peculiar oolitic structure. Sills of lava flows occur in the Vempalles, especially at the top of the series.

The Cheyair (Cheyyeru) series apart from its occurrence as outliers in the Kalahasti hills in the Chittoor district, extends from the Tirupati hills in the south-east to the Tungabhadra river in north-west and overlies the Papaghnis with doubtful unconformity. In the north-western area traversed by the Penneru, the Pulivendla stage consisting of quartzites, sandstones, grits, flags, pebbly beds and conglomerates, is comparatively thin, whereas the corresponding Nagari quartzites in the southern area traversed by the Cheyyeru are 1,000 to 1,500

feet thick, and consist of two bands of hard massive quartzites, the lower one being pebbly and the upper somewhat finer-grained, separated by thin laminated flaggy beds, which are occasionally slaty in character. The upper stage of the series called the Tadpatri and the Pullampet in the north-western and southern areas respectively, is a thick sequence of predominating shales, intercalated beds of siliceous limestones, intrusive igneous rocks, ferruginous chert and jasper beds. Towards the top of this stage, the well-cleaved shales weather into 'needles' and limestones with much segregated chert often assume fantastic shapes. The commonest trap rock is a dark coarse-grained, basic dolerite, weathering sometimes spheroidally but more often in massive cubes; some of the types approach basalt in texture. They are remarkably fresh, unlike the much-altered volcanic types of the Dharwar.

The Nallamalai (Nallamala) series, somewhat unconformable to the Cheyairs (Cheyyeru), is exposed principally in the Nallamala and the Velikonda ranges in the eastern portion of the basin. The Bairenkonda stage comprises quartzites, quartzitic sandstones and banded quartzites with grits and intercalations of thin layers of purple shales and shaly sandstones. The quartzites are either massive or thin-bedded, vitreous or subvitreous and mostly fine to medium-grained. The quartzites and sandstones are at places ferruginous with hæmatite filling the interstices between the quartz grains. The Cumbum slaty shale with intercalations of thin-bedded cleaved quartzites is the most extensively developed subdivision of the Cuddapah

system. It varies from fine, silvery talcose beds to coarse earthy clay-slates of different shades of colour and these are occasionally foliated and schistose. They are extensively impregnated with quartz, and are associated with patches of igneous rocks at some places.

The Irlakonda (Irla Konda) quartzites, the lower member of the Kistna (Krishna) series extend over a large area including the Irlakonda plateau overlying the Cumbums. The Kolamanala stage, well displayed in the valley of that name, consists of red and purple earthy or sandy, shales and slates, intercalated with thick bands of quartzites, some of them being ferruginous. The Srisailam quartzites form the plateau on which is situated the famous shrine, higher than the Irla Konda.

The Cuddapahs dip at moderate angles in the western part of the basin, while in the eastern part they display steep dips on the Nallamala central ridge and inversion of the beds in the Velikondas. The Cuddapahs suffered from a great number of faults and the lower Cuddapahs were more affected by these. As will be seen later, many of these faults traversing the Cuddapahs presumably occurred towards the close of the trap intrusions and formed channels for mineralising fluids which penetrated the Cuddapah rocks.

The Banganapalle quartzites and sandstones, the basal stage of the Kurnool system, are exposed along the western margin of the Kurnool outcrop overlying older rocks. They are massive, jointed and current-bedded. A thin impersistent bed of conglomerate containing various types of pebbles and occasionally diamonds occurs at the base of the Banganapalles.

The Jammalamadugu series into which the Banganapalles conformably pass upward, comprise the Narji (Nirji) massive limestones and calcareous flags and the Auk (Avuku) shales. The massive limestones carry flags towards the base and show great lateral variation in composition. The grey cryptocrystalline massive limestones weathering into benches are the most prevalent while the greenish grey, purple and whitish varieties usually occurring as thin beds below the former attain great force in Dhone (Dronachalam) taluk, Kurnool district. The calcareous flags approach the massive limestones in composition near their base, and they become increasingly argillaceous towards the top. They thin down considerably and disappear at places. The Auk (Avuku) shales

are mostly buff, grey, brown or purple, finely laminated and fine-grained. They are siliceous towards the top.

The Paniam quartzites constitute the flat tops of ridges and plateaus to the west of the Kunderu plain. The Plateau quartzites are slightly pinkish, medium-grained, imperfectly banded and current-bedded, while the Pinnacled quartzites are whitish or speckled with limonitic matter, medium to coarse-grained and saccharoidal in texture.

In the Kunderu plain, where the series named after it is exposed, the Koilkuntla limestones forming the lower stage occur mostly along the western margin and also along the eastern in the southern half of the plain. The uppermost stage of the Nandyal shaly limestones crop out in the eastern half. The Koilkuntla limestones are grey massive or flaggy and the flag beds differ from the Narjis in possessing rather imperfect, sometimes wavy, planes of bedding and in being tougher. The Nandyal purple calcareous shaly flags pass upward into the shaly limestones through a bed of purple or light greenish grey hard massive limestones.

There are no younger rocks in the Ceded districts than the Kurnools, leaving apart the few upper Gondwana shales of the eastern part of the Chittoor district, laterites, gravel beds and alluvium. Unlike the Cuddapahs, the Kurnools are either horizontal or gently undulated and suffered only a few faults which, however, are not mineralized.

#### MINERAL DEPOSITS.

The distribution of mineral deposits according to districts is given in Table I.

In the following pages, all the known mineral occurrences are shown according to the geological horizons in which they occur, and their mode of occurrence and origin are explained. The larger deposits are indicated by capital letters and the economically unimportant occurrences are given in italics. The estimated reserves are given where available as also the chemical analyses. The uses of minerals and their industrial possibilities have been discussed. Glossary of some Telugu words pertaining to each subject is given as foot notes.

TABLE I.

Distribution of mineral deposits according to districts.			
Anantapur.	Chittoor.	Cuddapah.	Kurnool.
Asbestos.	.....	ASBESTOS	.....
BARYTES	<i>Barytes.</i>	BARYTES	BARYTES
CALCAREOUS TUFFA.	<i>Calc tufa</i>	<i>Calc tufa</i>	CALC TUFFA
.....	.....	<i>Copper</i>	<i>Copper</i>
Corundum*	<i>Corundum</i>	.....	.....
Diamond	.....	<i>Diamond</i>	Diamond
.....	<i>Galena</i>	<i>Galena</i>	<i>Galena</i>
Gold	Gold	.....	Gold
Iron*	Iron	Iron	IRON
.....	.....	.....	Magnesite
.....	<i>Mica</i>	.....	<i>Manganese</i>
QUARTZ	QUARTZ	QUARTZ	QUARTZ
Red oxide	.....	RED OXIDE	RED OXIDE
Saline efflorescence	SALINE EFFLORESCENCE	Saline Efflorescence	SALINE EFFLORESCENCE
Serpentine	.....	SERPENTINE	Serpentine
STEATITE	Steatite	Steatite*	STEATITE
White clays	.....	WHITE CLAYS	WHITE CLAYS
.....	<i>Yellow ochre</i>	YELLOW OCHRE	YELLOW OCHRE
.....	.....	LIMESTONE for cement.	LIMESTONE for cement.
.....	.....	.....	SLATE

\* Economic value of the deposits is not known.

## ASBESTOS

Asbestos commonly occurs in two forms, namely, fibrous serpentine, chrysotile,  $3\text{MgO} \cdot 2\text{SiO}_2 \cdot 2\text{H}_2\text{O}$  and amphibole variety, tremolite,  $\text{CaO} \cdot 3\text{MgO} \cdot 4\text{SiO}_2$ , the latter being less flexible than the former. Owing to its remarkable flexibility and low heat-conductivity, the short-fibre asbestos is greatly consumed in the manufacture of asbestos-cement products such as roofing cements, shingles, corrugated and flat sheets and pipes, and in fireproof paints, while asbestos of fibre length  $3/8$  inch and over is often mixed with some cotton and used in fireproof fabrics. Its high electrical resistance enables its usage in the insulating field by mixing 15 per cent of the longer grade fibre with 85 per cent magnesia, and its acid-resisting qualities render it well suited for the filtering of acids.

*Distribution.*—The chrysotile asbestos deposits occur in the Vempalle limestones of the Cuddapah district and are being worked only in Pulivendla taluk. Here, all the important deposits are confined at the contact of the intrusive traps with the Vempalle dolomitic limestones, the latter being serpentinised for several feet in thickness. The asbestos zone lies within three feet of the trap and the cross-fibre veins are 30–40 feet in length and up to seven inches in thickness, though generally less than an inch. Subsequent to the trap intrusions into the dolomitic limestones, siliceous emanations from the trap magma acting on the dolomites first formed serpentine and calcite and later developed chrysotile under pressure along cracks in the serpentine zone. The length of fibre is from 0.1 to 0.3 inch.

The asbestos occurrences in the Vempalle limestones of the Ceded districts are the following:—

*Anantapur district—*

Dharmavaram taluk—*Sivapuram* ( $14^\circ 23' : 77^\circ 22'$ )  
In the Archaeans.

Tadpatri taluk—*Chalavemula* ( $14^\circ 45' : 77^\circ 58'$ )  
*Mallagundla* ( $14^\circ 38' : 78^\circ 2'$ ).

*Cuddapah district—*

Cuddapah taluk—*Chimalapenta* ( $14^\circ 26' : 78^\circ 36'$ )  
Kamalapuram sub-taluk—*Rajupalem* ( $14^\circ 26' : 78^\circ 31'$ ).

Pulivendla taluk—*BRĀHMANAPALLE* ( $14^\circ 25' : 78^\circ 12'$ ), *CHINNAKUDALA* ( $14^\circ 27' : 78^\circ 9'$ ), *Errapalle* ( $14^\circ 29' : 78^\circ 33'$ ), *IPPATLA* ( $14^\circ 26' : 78^\circ 11'$ ), *LINGALA* ( $14^\circ 30' : 78^\circ 7'$ ), *Lepatanutala* ( $14^\circ 30' : 78^\circ 6'$ ), *RAMANUTLAPALLE* ( $14^\circ 28' : 78^\circ 9'$ ), *Tallapalle*—*Velamvaripalle* ( $14^\circ 20' : 78^\circ 24'$ ), *Vempalle* ( $14^\circ 23' : 78^\circ 28'$ ).

In the 7-mile zone, between Lingala and Brahmanapalle, the best developed portions are near Brahmanapalle and Chinnakudala, where for a length of 1-1/2 miles at each, the estimated reserves are 2,56,000 tons.

*Future.*—The asbestos of Pulivendla taluk, Cuddapah district, being mostly of short-fibre type is admirably suited for use in manufacturing asbestos-cement, in which it forms 15 per cent or more by weight. Some asbestos can be used in fire-proof paints.

## BARYTES

Barytes,  $\text{BaSO}_4$ , is mainly used for the production of a non-poisonous white paint pigment, called lithopone, and ground barytes serves as an extender in white paints and, like lithopone, as a filler in heavy paper and cards, enamels and glazes, rubber, plastics, textiles and leather. The 'off-colour' barytes is used for dark-coloured paints. For manufacture of barium chemicals, barytes should contain 90–95 per cent barium sulphate with not more than one per cent of ferric oxide. Owing to its high specific gravity (4.5), barytes is used for weighing muds poured into oilwells to hold back gas during boring operations until the casings are inserted.

*Palle*—Village. *Ratinara*—Asbestos  
*Chinna*—Small

*Distribution.*—Almost all the barytes deposits of the Ceded districts occur either as fillings in fault fissures or as replacement veins in the Vempalle limestones or shales or in associated traps, the largest deposits in the Cuddapah district occurring in and adjacent to traps. Some of the deposits are as large as 30 feet but the thickness of veins which are always irregular is less than seven feet. Over 90 per cent of barytes is off-coloured. Barytes may be associated with quartz but rarely with calcite. Silicification and deposition of barytes have taken place largely in regions which have suffered from faults presumably following the igneous intrusions; mineralising solutions not only filled up the fault fissures but also penetrated the country rocks by replacement.

In gneisses, there is an unimportant vein of coloured barytes at Bairagikhandriga ( $13^\circ 40' : 79^\circ 44'$ ) in Kalahastitaluk, Chittoor district.

The deposits in the Vempalles and associated traps are listed below. All the deposits are replacement veins in limestones unless otherwise stated.

*Anantapur district—*

Anantapur taluk—*Venkatampalle* ( $14^\circ 48' : 77^\circ 50'$ ).

Gooty (Gutti) taluk—*Chintalacheruvu* ( $15^\circ 0' : 77^\circ 46'$ )

*Konapuram* ( $15^\circ 1' : 77^\circ 49'$ ).

KONDAMPALLE ( $15^\circ 3' : 77^\circ 47'$ ) or KRISH-TIPADU ( $15^\circ 4' : 77^\circ 47'$ )—In shale also, close to a hidden trap. Thickness apparently large.

Tadpatri taluk—*Boppepalle* ( $14^\circ 41' : 77^\circ 58'$ )—Both qualities.

*Chandana* ( $15^\circ 5' : 77^\circ 49'$ ).

Dosaleru ( $14^\circ 47' : 77^\circ 55'$ )—Along fault. Indefinite width. Reddish. Fair quantity.

Ellutla ( $14^\circ 40' : 77^\circ 55'$ )—One foot wide. Slightly stained.

Goddumarri ( $14^\circ 36' : 78^\circ 1'$ ) or Daditota R.F. ( $14^\circ 36' : 77^\circ 59'$ ). In shales also. Upto three feet thick. Far away from rail-head.

Kummanamala ( $14^\circ 43' : 77^\circ 57'$ ).

Lakshumpalle ( $15^\circ 7' : 77^\circ 50'$ )—Near trap. Aggregate thickness 10 feet.

Madugupalle ( $14^\circ 43' : 77^\circ 54'$ )—In shale also. Inferior quality. Badly situated for transport.

MUTSSUKOTA ( $14^\circ 51' : 77^\circ 53'$ )—Along fault. In shale also. Two veins 20–30 feet thick. Good quality. Several thousand tons.

NERIJAMUPALLE ( $14^\circ 33' : 78^\circ 1'$ )—Very close to trap. Up to three feet thick. Fair quality.

Obalapuram ( $14^\circ 47' : 77^\circ 55'$ )—In shale also. Up to one foot thick.

*Rangarajukunta* ( $14^\circ 43' : 77^\circ 57'$ ).

Sanjivapuram ( $14^\circ 49' : 77^\circ 55'$ )—In shale also. Prospecting needed.

Tabjula ( $14^\circ 54' : 77^\circ 50'$ )—Along fault, near trap. Several feet wide and over 100 yards long. Associated with calcite.

*Turkapalle* ( $14^\circ 57' : 77^\circ 48'$ ).

Kadiri taluk—*Mudigubba* ( $14^\circ 21' : 77^\circ 59'$ )—Details not known.

*Cuddapah district—*

Kothagangireddipalle—Details not known.

Cuddapah Taluk—*CHIMALAPENTA* ( $14^\circ 26' : 78^\circ 36'$ ) or *TUMMALURU* and Extension R.F.—In shale and trap also. Pit one mile north needs prospecting.

Kotturu ( $14^\circ 24' : 78^\circ 30'$ )—Producing three varieties.

*Maddimadugu* ( $14^\circ 21' : 78^\circ 47'$ ).

Mittamidapalle (14° 26': 78° 44')—In shale also stained, can be improved.

Nandimandalam (14° 24': 78° 32').

Polatala (14° 22': 78° 41')—In shale also. Transport difficult.

Tummaluru (14° 28': 78° 34').

Uppalapalle (14° 26': 78° 32').

Kamalapuram sub-taluk—Kadarivaripalle (14° 26': 78° 31')

Rajupalem (14° 26': 78° 31')—Near trap. Nearly seven feet thick. Associated with calcite and full of inclusions.

Tangedupalle (14° 23': 78° 29')—Upto three feet thick. Fair to poor quality. In *patta* land.

Pulivendla taluk—Bakkannagaripalle (14° 20': 78° 22')—Close to trap contact. Up to six feet thick. Good to fair quality.

Bestavaripalle (14° 23': 78° 15')—In trap. One foot thick. Discontinuous.

Elamvaripalle (14° 24': 78° 14').

Gondipalle (14° 22': 78° 21').

Ippatla (14° 26': 78° 11')—In trap also. Upto 4-1/2 feet thick. Fair quality.

Karnapapayapalle (14° 32': 78° 5')—Upto six feet thick. Further prospecting necessary.

KOTTAPALLE (14° 22': 78° 22')—In Dayalkona In trap. Upto seven feet thick. Good quality.

Midipenta (14° 20': 78° 19')—Upto one foot thick. Discontinuous. Fair quality.

NANDIPALLE (14° 23': 78° 25')—In trap. Upto three feet thick. Fair quality. Further prospecting necessary at some distance from trap-quartzite contact.

Parnapalle (14° 34': 77° 59').

Rachegaripalle (14° 21': 78° 19')—In calcareous tufa at limestone contact with trap and also in trap. Irregular. Good to poor quality.

TALLAPALLE (14° 23': 78° 24') or DUGGANAPALLE (14° 23': 78° 23')—At shale—quartzite junction also. Upto 2-1/4 feet thick.

Velpula (14° 22': 78° 16')

Vempalle (14° 23': 78° 28')—In trap. One foot thick.

DEMULA (14° 22': 78° 19')—In Muggurayakona Between traps.

Venkatapuram (14° 24': 78° 13')—Upto one foot thick. In *patta* land.

Razampeta taluk—Razampeta (14° 14': 79° 39')—Details not known.

#### Kurnool district—

Dhone (Dronachalam) taluk—Ambapuram (15° 23': 78° 6').

BALAPALAPALLE (15° 28': 78° 7') or BETAMCHERLA (15° 27': 78° 9')—Partly along faults. Usually very good.

BOYANAPALLE (15° 9': 77° 50')—In shale also. Highly stained.

Boyancpalle (15° 33': 78° 3').

Bugganipalle R.S. (15° 29': 78° 2')—Poor quality.

BUKKAPURAM (15° 23': 78° 2')—Variable width. Good quality.

Chandrapalle (15° 13': 77° 49')—Along fault. In trap also. At 1,850 feet contour.

Chinna Malkapuram (15° 22': 77° 59')—Along fault. Poor quality.

Dharmavaram (15° 22': 77° 53').

ERRAGUNTA (15° 23': 77° 56')—Fairly good, Associated with quartz.

SUP. D.—2.

GATTIMANIKONDA (15° 32': 78° 14') Partly along fault. In trap also. Fairly regular one. Poor to good quality.

Gutupalle (15° 26': 78° 3')—Along fault also. Majority of poor quality

HUSSAINPURAM (15° 14': 77° 50') or BHAVIPADU (15° 15': 77° 50')—Upto 30 feet. Irregular and sinuous course. Good quality.

Hussainpuram (15° 27': 78° 3')—Impersistent. Apparently good. Not prospected.

Kamalapuram (15° 21': 77° 56').

Karanapikunta (15° 21': 77° 55').

Kochcheruvu (15° 19': 77° 52').

Kolumalapalle (15° 29': 78° 8')—Partly along fault. Fairly good quality.

Komururukottala (15° 26': 78° 5')—Partly along fault. Some good.

Kottapalle (15° 23': 78° 3')—In shale also. Partly good.

Malkapuram R.S. (15° 21': 77° 59')—Fair quality.

Musalayyacheruvu (15° 30': 78° 4') or Muddavaram (15° 30': 78° 6')—Partly along fault.

Nagamallakunta (15° 25': 78° 1').

Nallamekalapalle (15° 8': 77° 47').

Narayanapuram (15° 10': 77° 47').

Papasaniokottala (15° 28': 78° 5')—Partly along fault. In shale also. Fairly good quality.

Peddapaya (15° 10': 77° 50').

RAHIMANPURAM (15° 24': 78° 3')—Region faulted and intruded by trap. Good quality.

RAMAPURAM (15° 17': 77° 52')—Upto three inches thick. Not always good.

Rangapuram (15° 16': 77° 49').

Tapasikonda (15° 28': 78° 4')—Quality good.

VALASALA (15° 24': 77° 59')—Partly along fault. In shale also. Poor quality.

Veldurti (15° 33': 77° 56')—Not visited.

Kurnool taluk—Gadidemadugu (Gargeyapuram)\* (15° 47': 78° 9')—Along fault.

Uyyalavada (15° 38': 78° 5')—or Yaparlapadu (15° 39': 78° 0')—Near trap. Could not be located *in situ*.

The Pulivendla and Bairenkonda quartzites and the Cumbum slaty shales are traversed by veins of barytes at a few places mentioned below. Most of these veins are of no economic value, only the veins near Chennakesavapuram, Chinna Ahobilam, Janapalacheruvu and Mamillapalle contain small workable quantities.

#### In the Pulivendlas—

##### Anantapur district—

Gooty (Gutti) taluk—Konapuram (15° 1': 77° 49')

##### Kurnool district—

Nandyal taluk—Gani (15° 40': 78° 19').

#### In the Bairenkondas—

##### Cuddapah district—

Proddatur taluk—Bhakarapuram (14° 53': 73° 39')

##### Kurnool district—

Sirvel taluk—Bachepalle (15° 5': 78° 37').

Chinna Ahobilam (15° 8': 78° 41').

Tallalingamdinne (15° 12': 78° 36').

#### In the Cumbums—

##### Cuddapah district—

Badvel taluk—Chennakesavapuram (14° 52': 78° 58').

Mamillapalle (15° 6': 78° 58').

\*Correct name not used on toographical sheet.

**Kurnool district —**Cumbum taluk—*Cumbum* (15° 35': 79° 7').*Guntapalle* (15° 14': 78° 57').

Janapalacheruvu (15° 29': 79° 10').

*Kattiarallapalle* (15° 18': 78° 58').*Kondakunta* (x) (15° 24': 79° 5').Markapur taluk—*Pichchaiguntlapalle* (15° 46': 79° 25').Nandyal taluk—*Chelima* (15° 27': 78° 42') or *Basavapuram* (15° 25': 78° 38').

A thin insignificant-vein of barytes occurs in trap intrusive into the Tadpatri shales near Racherla (15° 14': 77° 57'), Dhone (Dronachalam) taluk, and the small occurrence at Kondapuram (14° 47': 78° 11') in Jammalamadugu taluk, Cuddapah district, may probably be in the same rocks. But since barytes is not known to occur in the Tadpatri elsewhere, the occurrence in the Vempalle limestones may be due to the derivation of the sulphate ion in barytes from the limestones as suggested by A.L. Coulson.

**Future.**—The barytes from the Ceded districts is chiefly utilised in the paint industry in northern India and to a certain extent in oil well drilling in India and adjacent countries. Stained material, classed as low grade, is generally utilised in oil well drilling. There is scope for research in improving this material so that better price may be obtained. The establishment of a local paint industry will create a local market. Barytes is the chief ingredient of cheap paints which must possess good opacity. A cheap oxide paint may be made with five per cent red oxide of iron available in the Ceded districts and 95 per cent of barytes. The manufacture of lithopone, which is a calcined, co-precipitated mixture of 70 per cent barytes and 30 per cent zinc sulphide, is said to require proper supervision and expert advice. The barium chemicals may also be manufactured in the Ceded districts.\*

**CALCAREOUS TUFFA.**

Good limes for building purposes contain 94 per cent of calcium oxide, some calcium carbonate,

\* *Bugga*—Spring.*Chelima*—A small pit excavated in stream course for drinking water.*Cheruvu*—Tank.*Dinne*—Lowly earthen elevation usually forming the site of a village.

and less than 0.5 per cent magnesia. Lime-wash distempers are made by adding ochres, blues, etc., to the lime. A solution of casein, trisodium phosphate and a little formaldehyde are also added with advantage. Hydraulic lime that will set under water is a hydrated lime with more than 10 per cent silica. High grade 'lime' or calcium carbonate with less than 2 per cent silica and alumina and very little iron is used as flux in glass, in enamels and glazes, and in the manufacture of chemicals like calcium carbide, bleaching powder and insecticides. It is also used for liming soils, dressing animal skins and water softening, to correct soil acidity and to improve tilth.

**Distribution.**—Calcareous tufa occurs in the Dharwar traps and phyllites, in the Archaean gneisses, in the Vempalle, Narji and Koilkuntla limestones and in the Tadpatri, Cumbum and Nandyal calcareous shales. The occurrence of tufa is listed in Table 2. Tufa is formed in soil overlying the calcareous rocks or in shales interbedded with them by the deposition of the carbonate leached out of the rocks. Hydrothermal waters emanating from intrusive traps are believed to have been responsible for the formation of a deposit in the Vempalles at Kochcheruvu. Springs draining regions of the calcareous rocks deposit tufa at the out-lets layer after layer enclosing blocks of stone, leaves, etc. Such deposits are called 'travertine' deposits.

The thickness and quality of the deposit depend on the calcium carbonate content of the rocks from which it is derived and the amount of percolation taking place in them. Table 3 gives the analyses of some deposits. The deposits are larger in the limestone formations than in the calcareous shales and are fully developed on the top 2-6 feet of the rock or soil, the material near the surface being compact and purer than below.

**Future.**—Some of the deposits, such as those at Palkur, Nandavaram and Rama Tirtham near Panem R. S. (15° 30': 78° 20') and the one at Kona Rameswaraswami near Rayalacheruvu R.S. (15° 3': 77° 49') contain over 52 per cent lime. The high grade limestone at Palkur is useful in glass, enamels and glazes, and in chemical industries mentioned above.\*\*

*Kona*—The course of a stream in hilly region. The head of a *nala*, cut along vertical joints.*Kunta*—Pond.*Muggurayi*—Barytes.*Pedda*—Big.*Penta*—Halting place for carts in the forest.\*\* *Gullarayi*—Travertine deposit.*Kankara*—Hard calcareous tufa.*Morumu, Morusu*—Earthy or powdery calcareous tufa.*Sunnamu*—Lime.

TABLE 2.

**Calcareous Tufa Deposits.**

In the limestones.

In the calcareous shales.

In the Archaeans.	Vempalles	Narjis (Nirjis)	Koilkuntlas	Tadpatri
(1)	(2)	(3)	(4)	(5)
Anantapur district	Anantapur district, Tadpatri taluk.	Anantapur district, Tadpatri taluk.	Kurnool district, Dhone (Dronachalam) taluk, Krishnapuram (15° 36': 78° 3').	Anantapur district, Tadpatri taluk.
	Chillavaripalle (14° 38': 77° 54'), Daditota (14° 36': 77° 59').	KONA RAMESWARA-SWAMI (15° 9': 77° 55') travertine deposit. Over 300,000 tons.		Chinnappuru (14° 56': 77° 52') to Pasaluru (14° 57': 77° 52').
Anantapur taluk, Kamalapuram (14° 53': 77° 32')—30,000 tons.			Kurnool taluk, Karakala (15° 38': 78° 7').	Cumbum
Gooty (Gutti) taluk PAMIDI R.S. (14° 57': 77° 34')—160,000 tons.	Kurnool district, Dhone (Dronachalam) taluk.	Kurnool district, Banganapalle taluk Kaipa (15° 17': 78° 19') white powdery tufa.	Varakuru (15° 41': 78° 11').	Kurnool district, Cumbum taluk.
Chittoor district	Bugganipalle (15° 23': 77° 53).	NANDAVARAM (15° 23' 78° 17') white powdery tufa. 142,000 tons. Dose not vitrify at 1300° C.	Nandikotkur taluk.	Ankalammapalle (15° 13': 78° 53') 20,000 tons
Kalahasti taluk Ratur (13° 42': 79° 48')	Chinna Malkapuram (15° 22': 77° 59'). White powdery tufa. Does not vitrify at 1200° C.	PALKUR (15° 25': 78° 15').	Chintalapalle (15° 44': 78° 17'). Devanuru (15° 44': 78° 16'). Jalakanuru (15° 42': 78° 20'). Khajipet (15° 43': 78° 18')	Baireni (15° 26': 78° 50') travertine deposit in quartzite. 1,600 tons Janapalacheruvu (15° 29': 79° 9') 30,000 tons. Sanjivaraopeta (15° 17': 78° 54') 20,000 tons.
Srinivasapuram (13° 43': 79° 49').				



**Calcareous Tufa Deposits.**  
*In the limestones.*

<i>In the Archaeans.</i>	<i>Calcareous Tufa Deposits.</i> <i>In the limestones.</i>			<i>In the calcareous shales.</i>
(1)	<i>Vempalles</i> (2)	<i>Narjis (Nirjis)</i> (3)	<i>Koilkuntlas</i> (4)	<i>Tadpatris.</i> (5)
<i>Puttur taluk</i> <i>Oddamalakurta</i> (13° 22': 77° 22')	Kochcheruvu (15° 19': 77° 52'). White powdery tufa. 20,000 tons.	White powdery tufa. 665,000 tons. Does not vitrify at 1200° C.	<i>Rollapadu</i> (15° 44': 78° 22'). <i>Nandyal taluk</i> Bogeswaram Gudi (15° 36': 78° 25')—67,500 tons.	<i>Markapur taluk</i> — Small patches at many places  <i>Nandyals</i>
<i>Tiruttani taluk</i> <i>Cherukunur</i> (13° 10': 79° 32')	Malkapuram R.S. (15° 21': 77° 59'). White powdery tufa. Highly refractory. Periked (15° 23': 77° 52')	Pendlapuram (15° 21': 78° 16'). White powdery tufa. Rama Tirtham (15° 27': 78° 17')—86,000 tons. <i>Koilkuntla taluk,</i> Abdullapuram (15° 0': 78° 7')—12,000 tons. <i>Itikyala</i> (15° 3': 78° 6')—2,000 tons.  Ramabhadrapalle (15° 5': 78° 14')—8,000 tons.	Chennakkapalle (15° 40': 78° 20') 28,800 tons.  <i>Gadivemula</i> (15° 41': 78° 26'). Gani (15° 40': 78° 19'). <i>Manchalakatta</i> (15° 41': 78° 21'). <i>Pasaravayi</i> (15° 39': 78° 29').	<i>Kurnool district,</i> <i>Nandyal taluk</i> Gani (15° 40': 78° 19').  <i>Sirvel taluk</i> Chagalamarri (14° 58': 78° 35')—10,000 tons.
		<i>Kurnool taluk</i> <i>Dandanapuram</i> (15° 51': 78° 1'). <i>Kalluru</i> (15° 49': 78° 2'). <i>Narnuru</i> (15° 43': 78° 5').  <i>Nandikotkur taluk</i> <i>Bijinivemula</i> (15° 56': 78° 15'). <i>Malya'a</i> (15° 53': 78° 15').  <i>Nandyal taluk</i> BOGESWARAM GUDI (15° 36': 78° 25') Travertine deposit in quartzite. 261,000 tons.		

**COPPER**

Copper occurs in nature in native state or as bright green malachite,  $\text{CuCO}_3 \cdot \text{Cu}(\text{OH})_2$ , blue azurite,  $2\text{CuCO}_3 \cdot \text{Cu}(\text{OH})_2$ , tarnished brass-yellow chalcocopyrite,  $\text{Cu}_2\text{S}$ ,  $\text{Fe}_2\text{S}_3$ , lead-grey, metallic chalcocite,  $\text{Cu}_2\text{S}$ , tarnished greenish or bluish, iridescent, pinchbeck brown bornite,  $\text{Cu}_3\text{FeS}_3$ , etc. It is known to man from the earliest times. It finds various uses, such as in alloys and utensils, electrical wires and apparatus and chemical industry.

*Distribution.*—Most of the occurrences of copper-ore in the Ceded districts are insignificant. In the Cuddapah district, traces of malachite are seen in the Pulivendla quartzites in the vicinity of Vempalle (14° 23': 78° 28'). In the Kurnool district, quartz veins carrying thin films or tiny needles of malachite cut across the Archaean crystallines at Halalagondi (15° 29': 77° 4') in Alur taluk. Traces of copper-ores occur in some quartz veins traversing the Tadpatris at Somayazulapalle (15° 35': 78° 11') in

Kurnool taluk, and at Gani (15° 40': 78° 19'), Gumman-konda (15° 39': 78° 18') and Paibagala (15° 37': 78° 22') in Nandyal taluk. A quartz vein in trap associated with the Tadpatris at Kommamarri (15° 12': 77° 52') and a barytes vein traversing the Vempalles at Ramapuram (15° 17': 77° 52') both in Dhone (Dronachalam) taluk, carry stains of malachite. Quartz veins crossing the Cumbum slaty shales carry traces of copper-ores at Chinnevaripalle (15° 24': 79° 9') in Cumbum taluk and at Gajjela Konda (15° 45': 79° 24') in Markapur taluk of Kurnool and at Jangamrajupalle (14° 46': 78° 54') in Badvel taluk of Cuddapah. Details of the occurrence at Mudigubba (14° 21': 77° 59') in Kadiri taluk, Anantapur district, are not known. The copper-ore occurrences in the Archaeans originated during a post-Dharwar magmatic period, while those in the Cuddapahs appear to be genetically related to the trap intrusions with which they are closely associated

At Gani in the Kurnool district some ore is said to have been mined for bell-metal in the past, but little ore is seen at present near the surface. Geophysical prospecting is now being carried out in that area by the Geological Survey of India \*

\*Ragi—Copper

*Kanchu-alla-gunta*—"Bronze stones pits" or pits for copper-ores.

TABLE 3.

*Analyses of Calcareous Tufa.*

(1)	SiO <sub>2</sub> per cent.	R <sub>2</sub> O <sub>3</sub> per cent.	MgO per cent.	CaO per cent.	Reserves (in tons.)
(1)	(2)	(3)	(4)	(5)	(6)
<i>In the limestones—</i> (Vempalles)					
<i>Kurnool district—</i>					
Bugganipalle .. .. .	1.02	1.30	0.69	53.50.	..
Chinna Malkapuram .. .. .	2.39	1.99	4.42	47.53	..
Periked .. .. .	1.51	1.95	0.92	52.63	..
(Narjis)—					
<i>Anantapur district—</i>					
Kona Rameswaraswami .. .. .	2.68	1.62	trace	53.03	Exceeds 300.000

(1)	SiO <sub>2</sub> per cent. (2)	R <sub>2</sub> O <sub>3</sub> per cent. (3)	MgO per cent. (4)	CaO per cent. (5)	Reserves. (in tons). (6)
<i>Kurnool district—</i>					
Abdullapuram .. .. .	5.53	2.60	trace	50.68	12,000
Itikyala .. .. .	5.54	2.41	trace	50.47	2,000
Nandavaram .. .. .	1.80	1.20	1.43	52.37	142,000
Palkur .. .. .	0.88	0.70	2.01	53.24	653,400
Ramabhadrapalle .. .. .	5.92	0.88	0.65	50.94	12,000
Rama Tirtham .. .. .	3.05	1.40	trace	52.71	8,000
	2.36	0.70	0.43	53.40	86,000
<i>In the calcareous shales—</i>					
<i>(Tadpatris)</i>					
<i>Anantapur district—</i>					
Chinnappuru .. .. .	4.06	2.10	trace	51.03	Large
Pasaluru .. .. .	4.38	3.10	trace.	50.59	
<i>(Cumbums)</i>					
<i>Kurnool district—</i>					
Ankalammapalle .. .. .	9.50	2.60	1.33	47.55	20,000
Baireni .. .. .	2.28	2.20	1.33	51.18	1,600
Janapalacheruvu .. .. .	9.72	4.03	0.23	46.74	30,000
Sanjivaraopeta .. .. .	8.96	1.50	1.26	48.00	20,000
<i>(Nandyals)</i>					
Chagalamsarri .. .. .	4.10	2.30	1.77	50.12	10,900

## CORUNDUM

Corundum, A<sub>2</sub>O<sub>3</sub>, ranks next to diamond among minerals in hardness, and is largely used for abrasive wheels made by the incorporation of a binding material such as shellac, with crushed corundum.

*Distribution.*—In the Anantapur district, corundum occurs associated with ultra-basic or syenitic rocks at the following places, but the economic potentialities of the deposits are not known.

- Anantapur taluk—Atmakuru (14° 39': 77° 22').
- Danduvarapalli—(14° 39': 77° 42').
- Padamatyaluru—(14° 30': 77° 22').
- Pasalur—(14° 39': 77° 40').
- Reddipalli—(14° 43': 77° 41').
- Siddaramapuram—(14° 41': 77° 40').
- Thimmapuram—(14° 42': 77° 23').
- Dharmavaram taluk—Muddulacheruvu—(14° 26': 77° 22').
- Motaruchintarlapalle—(14° 14': 77° 24').
- Siyapuram—(14° 23': 77° 21').
- Hindupur taluk—Parigi (13° 54': 77° 28'). Said to have yielded large quantities for export.
- Kalyandrug taluk—Manirevu—(14° 36': 77° 18').
- Nutimadugu—(14° 29': 77° 20').
- Obalapuram (14° 37': 77° 18').
- Palavenkatapuram—(14° 33': 77° 20').

In the Chittoor district, very small quantities of corundum are enclosed in the mica-schist at Yerracheruvupalle (13° 24': 79° 2') in Chittoor taluk, formed probably through metamorphism of a pre-existing aluminous sediment or as a result of crystallisation of excess alumina in a basic igneous rock.

## DIAMOND

Diamond, the transparent crystal form of carbon, often with tints of yellow, grey, green or blue, is the hardest known mineral substance. It has a specific gravity of 3.52 and refractive index of 2.42. The flawless, blue, colourless or green, well formed crystals are valued as gem

stones. The rest with flaws not suitable for gem cutting find extensive use as abrasive, for diamond cutting, glass cutting, diamond drilling and for dies for drawing wire.

*Distribution.*—The Ceded districts cover portions of the ancient Golkonda and Bijapur kingdoms, celebrated for diamonds. Past workings for diamonds occur in the Anantapur, Cuddapah and Kurnool districts.

In the gneissic plain of Gooty (Gutti) taluk, Anantapur district, and Pattikonda taluk, Kurnool district, diamonds have been obtained from the following places:

*Anantapur district—*

- Gooty (Gutti) taluk—*Bodasanipalle* (15° 1': 77° 26').
- Ganjikunta* (5° 1' 77° 23').
- Konganapalle—(15° 11': 77° 33')—More than one large and valuable stone have been obtained during the last 17 years.
- Lattavaram*—(14° 55': 77° 16').
- Mulakalapenta*—(15° 12': 77° 31').
- Pedda Hoturu*—(15° 0': 77° 18').
- Wajra Karur—(15° 1': 77° 23')—Even now yields occasional diamonds after rains.

*Kurnool district—*

- Pattikonda taluk—*Gade Anantapuram*
- Girigatla*—(15° 18': 77° 33').
- Jonnagiri*—(15° 14': 77° 35').
- Kadamaguntla*—(15° 16': 77° 40').
- Pagadravi*—(15° 16': 77° 36').
- Peravali*—(15° 17': 77° 30').
- Tuggali*—(15° 18': 77° 33').
- Upparapalle*—(15° 13': 77° 37').

The source-rock of the diamonds here has been thought to be either altered dolerites or epidote-bearing pegmatites, or a possible former extension of the diamondiferous Banganapalle conglomerates. The Wajra Karur epidiorite, when prospected by an experienced miner, did not reveal a trace of diamond. Some of the dolerite dykes are considered to be contemporaneous with the Cuddapah traps, but from the trap exposures no diamond has been reported so far. There is no trace of conglomerate in this region, the gneisses being covered by thin

soil. On the other hand, abundant debris of pegmatite is found with old diamond workings and Mr. P. Venkayya is said to have possessed a piece of pegmatite with diamond.

In the Cuddapah district, the Penneru gravels between Chennur (14° 34': 78° 49') and Dorlampalle (Obalampalle)\* (14° 33': 78° 50') in Cuddapah taluk and at Kottakolakunta (Kottagullagunta)\* (14° 51': 78° 26') in Jammalamadugu taluk are reported to have yielded diamonds. The old workings north of the Penneru near Kanuparti (14° 34': 78° 49') are said to have been reworked and abandoned in 1830.

The reported occurrences or sites of old workings in the Kurnool district are listed below. They are either in the present stream gravels or in the Banganapalle conglomerate which is the only diamond-bearing horizon in the Purana group of rocks. Rock crystals might have been mined at Basavapuram (15° 25': 78° 38') situated on the Cumbums as tiny pieces of the same are seen in dumps around.

*In the Banganapalle conglomerate—*

Banganapalle sub-taluk—Banganapalle (15° 19': 78° 15')—Diamonds are annually picked after rains. A recent find was valued at Rs. 6,000 in Bombay. (Fig.1)

Dhone (Dronachalam) taluk—*Balapuram* (15° 32': 78° 5').

*Boyanapalle* (15° 32': 78° 8').

*Dhone (Dronachalam)* (15° 24': 77° 53').

*Gattimanikonda* (15° 32': 78° 14').

*Madavaram* (15° 16': 77° 59').

*Muddavaram* (15° 30': 78° 6').

*Munimadugu* (15° 16': 77° 59').

*Pendekallu* (15° 32': 78° 4').

Ramallakota (15° 34' : 78° 0')—Called previously Ravvala-kota or Diamonds-Fort, fine small diamonds are picked up every year after the rains.

*Repalle* and *Virayapalle* (15° 33': 78° 5')—Yielded fine diamonds upto 1/2 carat per ton of conglomerate.

*Timmapuram* (15° 32': 78° 3').

*Yambaye* (15° 34': 78° 7').

Koilkuntla taluk—*Ramavaram* (15° 17': 78° 8')—Annual pickings near hamlets.

Kurnool taluk—*Devamada* (15° 50': 78° 7').

*Komarolu* (15° 34': 78° 10').

*Puduru* (15° 51': 78° 9').

Nandyal taluk—*Chennakkapalle* (15° 40': 78° 20')

*In the present gravels—*

Kurnool taluk—*Joharapuram* (15° 49': 78° 4')—In the Tungabhadra.

*Kalava* (15° 37': 78° 12')—In stream joining the Kunderu.

*Kannamadakala* (15° 42': 78° 12')—In the Kunderu.

*Kontalapadu* (15° 39': 78° 9')—In the Kunderu.

*Lanjapolur* (15° 46': 78° 1')—In the Hindri river. Stones of good shape and quality.

*Panchalingala* (15° 52': 78° 2')—In the Tungabhadra.

*Tandrapadu* (15° 51': 78° 4')—In the Tungabhadra.

*Varakuru* (15° 41': 78° 11')—In the Kunderu.

Nandikotkur taluk—*Bannuru* (15° 44': 78° 14')—In the Kunderu.

*Devanuru* (15° 44': 78° 16')—In the Kunderu.

*Gudipadu* (15° 44': 78° 15')—In the Kunderu.

*Marugutti* (16° 4': 78° 23')—In the Kistna (Krishna).

*Mogili Penta* (16° 4': 78° 38')—In the Kistna (Krishna).

*Muravakonda* (16° 1': 78° 16')—In the Kistna (Krishna).

*Satanikota* (15° 55': 78° 13')—In the Tungabhadra.

Nandyal taluk—*Poluru* (15° 32': 78° 26')—In the Kunderu.

Diamonds, probably washed down from the nearby Banganapalle conglomerate, have been reported from Allahabad (15° 17': 78° 0'), Chanugondla (15° 21': 77° 42'), Peddapodilla (15° 17': 77° 44') and Pyapalli (15° 14': 77° 45') in Dhone taluk. The diamond of the present gravels might have been derived partly from outcrops of the Banganapalle conglomerate lying upstream. The original source from which the diamond was transported into the conglomerate must have been exposed to the processes of weathering only in the Banganapalle age, being submerged under water during the rest of the Cuddapah-Kurnool era. Such might have been the case with the pegmatites of Gooty (Gutti) and Pattikonda referred to above, under the following circumstances. The pegmatites, which are not far from the western border of the present extent of the sedimentaries, might have been submerged by the Cuddapah sea and later covered by thin Cuddapah sediments. At the end of the Cuddapah period, this region emerged from the sea and formed part of the land mass when the thin layers overlying the diamondiferous rocks were eroded and denuded away. Later they might have possibly contributed to the sediments of the Banganapalle epoch. Thereafter the Kurnool sea might have engulfed the diamondiferous rocks once again. This is borne out by the fact that the Banganapalle stage is exposed as a narrow belt in the western part of the Cuddapah basin, thinning gradually towards the east and south, and the Banganapalle sea must have occupied a far smaller area than the earlier Cuddapah basin or the latter Kurnool sea.

It is quite probable that the circumstances which helped in the journeying of the diamonds from their source rock to the Banganapalle conglomerate might not have altered substantially till the spreading of the vast sea of sedimentation of the Narji grey massive limestones. Therefore, it might be expected that the conglomerates associated with the basal layers of the Narjis as well as those at the contact of the Narjis with the Cuddapahs might also carry diamonds. At Petnikota (15° 5' : 78° 3') in Koilkuntla taluk, Kurnool district, where the Cuddapah—Narji contact is seen, a legend is current that people walking along the south-westerly path leading to Kondamayapalle (15° 4' : 78° 2') used to experience a change in their colour to green at about three-quarter mile from Petnikota. This phenomenon might be due to light reflected by a green gem. However, the author did not experience this change in colour when he visited the place in 1948. He was told that it ceased some years ago.

*Future.*—Diamonds are reported to be picked up every year after rains near Wajra Karur in the Anantapur district and near Ramallakota, Banganapalle and the hamlets of Ramavaram in the Kurnool district. All attempts at Wajra Karur to mine diamonds have failed owing to doubts regarding the source rock. The possibilities of diamond mining here could be considered when some more light is thrown on the source rock by the systematic survey now being carried out in that area. In the Kurnool district, the diamondiferous conglomerate forms a large patch south of Ramallakota in an east-west direction and between Banganapalle and Allahabad over a length of 15 miles along the plateau edge where the hamlets of Ramavaram are situated. In recent years the conglomerate near Repalle and Virayapalle has yielded only 1/2 carat of diamonds of fine quality per ton, while only the lower slopes of the ridge near Banganapalle have been pitted. The potentialities of the conglomerate near Ramallakota or in the Banganapalle area can be determined only by detailed prospecting, but this is likely to

\* Correct name not used on the topographical sheet.

prove a highly speculative venture. When systematic prospecting for diamonds is undertaken, it is worthwhile searching also the unconformable contact of the Narjis with the Cuddapahs and the conglomerate bands associated with the Narji basal beds, especially in areas not far from the Tadpatri shale outcrops. In the Cuddapah district occurrences, diamonds appear to be too sparsely distributed in the alluvium and conglomerate to make working remunerative now.<sup>1</sup>

### GOLD

Gold is used for bullion, gold leaf and thread, in alloys and medicine, for decorating porcelain and glass, and gilding less noble metals.

**Distribution.**—(a) *Vein gold.*—In the Anantapur district, gold bearing quartz veins traversing the chlorite-schists of the Dharwar near Ramagiri (14° 18': 77° 30') in Dharmavaram taluk were mined from 1909 to 1927 and 136,739 ozs. of gold were produced. Some gold was also won from the veins in the chlorite-schists near Ramapuram (14° 57': 77° 28') and Venkatampalle (14° 56': 77° 22') in Gooty (Gutti) taluk.

Short, narrow discontinuous veins of blue or grey quartz some of which may be auriferous in depth, have been recorded at a few places in the schist belts of the Anantapur district.

Anantapur taluk—Aravakuru (14° 45': 77° 28')—Trace.

Talupuru (14° 42': 77° 28')—Trace.

Vepacherla (14° 34': 77° 26').

The Kolar schist belt which enters Kangundi taluk of Chittoor is likewise traversed by auriferous quartz veins at the following places:—

Bisanattam (12° 51': 78° 16')—

Average gold content.	6-7 dwt. <sup>2</sup>	per short ton (2,000 lbs).
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Chinnapartikunta (12° 46': 78° 15')

Average gold content in vein	5.84-6.42	"
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(ii) Chigaragunta old dumps..	0.58	"
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(iii) Govulgunta "	1.44	"
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(iv) Nandymadugu hornblende-schist	1.74	"
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Malappa Konda (12° 43': 78° 16') 3 to 4. south end "

Salachintanapalli (12° 50': 78° 16'). 1.44 "

It is stated that generally dark grey quartz veins in the hornblende-schist carry more gold than white quartz associated with chloritic and other schists. Auriferous veins of blue quartz occur in the Dharwarian ferruginous quartzites and hornblende-schists near Palachchuru (13° 53': 79° 49') in Kalahasti taluk, and attempts to work these have not been successful, the gold content being only upto 1.44 dwt. per short ton.

Traces of gold occur in similar quartz veins at Jonnagiri (15° 14': 77° 35') in Pattikonda taluk of Kurnool. These quartz veins are related to some post-Dharwar granitic intrusions in this area.

(b) *Alluvial gold.*—The alluvials of the Tungabhadra and the Kistna (Krishna) and of smaller streams in the Dharwar are said to carry gold. Such occurrences indicate the presence of auriferous quartz veins upstream. Gold specks weathering out from the mother rock are carried down by the streams into their present position in the alluvials.

<sup>2</sup>Rava or Vajramu—Diamond.

Rati-Sphatikamu—Rock crystal or quartz crystal.

\*1 Tola=7 1/2 dwt.=30 chinna=40 vals=180 grains.

1 dwt=2/15 Tola=4 chinna=5 1/3 vals=24 grains.

<sup>3</sup> Bangaramu, Bangaru—Gold.<sup>1</sup>

**Future.**—Detailed prospecting of the gold occurrences of Dharmavaram and Kangundi taluks mentioned above might reveal the presence of workable deposits. Some of the veins in the latter area contain 4 dwt. of gold per ton of auriferous rock, and appear to be promising. Free collection of alluvial gold from the Tungabhadra and the Kistna (Krishna) by poor people may be permitted. For modern dredging methods to be fruitful, at least 3 grains or 1/2 chinna of gold for cubic yard of sand or gravel should be available over a large area.<sup>3</sup>

### IRON

Iron is the most extensively used of all metals. It forms the framework of all modern industries. The chief iron-ore minerals are steel grey haematite (Fe<sub>2</sub>O<sub>3</sub> with theoretically 70 per cent iron and cherry red streak), iron-black magnetite (Fe<sub>3</sub>O<sub>4</sub> with 72.4 per cent iron and black streak), yellowish-brown limonite (Fe<sub>2</sub>O<sub>3</sub>·H<sub>2</sub>O, with 60 per cent iron) and siderite FeCO<sub>3</sub>, with 48.3 per cent iron, in brown and gray colours with white streak. Pyrite (FeS<sub>2</sub>, with 46.6 per cent iron) is not utilised as a source of iron because of its sulphur content, but is valuable as a source of sulphur in the manufacture of sulphuric acid.

**Distribution.**—In the Dharwar of the Anantapur and Chittoor districts, iron-ores occur associated with haematite quartzites at the following places, unless otherwise stated—

Anantapur district—

Rayadrug taluk—Kontanahalli\* (14° 43': 76° 53')

Chittoor district—

Chittoor taluk—Ayirala (13° 23': 78° 59').

Naraharipeta (13° 6': 79° 8')—Magnetite quartzite.

Kalahasti taluk—Sirasanambedu (13° 51': 79° 52')—Generally low grade, but in places of good workable grade. About 30,000 tons of ore of 60 per cent iron is said to have been quarried from 404.

Puttur taluk—Nevallaguntapalli (13° 30': 79° 18'). In the Purana group of rocks of the Cuddapah and Kurnool districts, iron-ores are segregated in ferruginous quartzites, sandstones and shales of the Pulivendla, Bairenkonda and Irlakonda stages and in fault zones affecting the Cuddapahs, at the following places:—

In the Pulivendlas—

Cuddapah district—

Cuddapah taluk—Chabali (14° 30': 78° 36')—In brecciated quartzite and shale. Partly hidden by a layer of whitish quartzitic sandstone. Composition variable and includes much red oxide, average of 9 samples of good ore giving Fe at 63.26 per cent but the ore is high in phosphorus (over 0.12 per cent).

Chimalapenta (14° 26': 78° 36').

Kasireddi Kunta (13° 54': 79° 19')—Scattered debris and pebbles of limonite.

Pagadalapalle (14° 27': 78° 38')—Poorer than at Chabali.

Pendlimarri (14° 27': 78° 39')—Specular ore in quartz vein.

Kurnool district—

Kurnool taluk—Gondiparla (15° 50': 78° 4')—In streaks and small lenses. In the Vempalles also.

In the Bairenkondas—

Cuddapah and Kurnool districts: In the western ridges of the Nallamala range. Streaks and lenses in the ferruginous sandstones and quartzites.

\* Economic value of the deposit is not indicated for want of information.

*In the Irlakondas—**Kurnool district—*

Nandikotkur taluk—*Indireswaram Gudem* (15° 56': 79° 39')—Streaks and lenses of haematite in quartzites.

*Nidemamidu Penta* (16° 2': 78° 8')—Streaks and lenses of haematite in quartzites.

*Sangameswaram* (16° 1': 78° 20')—Streaks and lenses of haematite in quartzites.

Markapur taluk—*Inaparati Konda* (Δ2, 395-16° 0': 79° 8')—Streaks and lenses of haematite in quartzites.

*In fault zones—**Kurnool district—*

Dhone (Dronachalam) taluk—*Gattimanikonda* (15° 32': 78° 14').

*Gutupalle* (15° 26': 78° 3').

*Kamalapuram* (15° 21': 77° 56').

*Muddavaram* (15° 30': 78° 6').

*Papasamikottala* (15° 28': 78° 5').

RAMALLAKOTA (15° 34': 78° 1') to  
VELDURTI (15° 33': 77° 56').

*Reserves in,**thousand tons.*

	(1)	(2)	(3)	(4)	(5)	(6)
		(10 c.ft.-1 ton)	Si <sup>o</sup> .	Fe	P	S
1. 1395 .. .. .	..	540	..	..	..	..
2. 2 miles east of Veldurti .. .. .	..	8	..	..	..	..
3. Brahmagundam hill .. .. .	..	866	11.66	60.83	trace	1.34
4. Ridge on Ramallakota-Boyanapalle road .. .. .	..	240	23.24	52.42	trace	1.76
5. Gani Ghattu Hill—West end .. .. .	..	48	..	..	..	..
6. Between No. 5 and 1840 .. .. .	..	56	..	..	..	..
7. Gani Ghattu hill at Sarafarajapuram path .. .. .	..	6	..	..	..	..
8. Hill north of 1840 .. .. .	..	270	3.68	64.59	trace	1.41
9. 1 mile of S.E. of Ramallakota .. .. .	..	180	24.80	51.62	trace	1.39
10. 2 miles E.S.E. of Ramallakota .. .. .	..	1,500	..	..	..	..
Total .. .. .	..	3,714	..	..	..	..

In the last region much siliceous material is found associated with the ore forming nearly 80 per cent of total ore, which appears to have been deposited by hydrothermal agency.

Quartz veins carrying specular haematite traverse the Cumbums at the following places in the Kurnool district:—

Cumbum taluk—*Janapalacheruvu* (15° 29': 79° 9')—Associated with manganese oxides and a little calcite.

Markapur taluk—*Devarajughatta* (15° 48': 79° 16').

*Gajjalakonda* (15° 45': 79° 24').

The post-Kurnool fault zones being practically free from iron-ores, the origin of the latter appears to be post-Nallamalai (Nallamala) but pre-Kurnool. The presence of haematite needles in barytes and the abundance of ochreous material in barytes-bearing rocks point to the common parentage of the iron oxides and barytes, as does the association of specular haematite with manganese oxides, calcite and vein quartz, point to the derivation of the latter group from a single source.

In or near the Nallamala range in Nandikotkur taluk of the Kurnool district, ferruginous laterite occurs in small patches as at Are Penta (15° 59': 78° 41') and Chitralla Banda (16° 1': 78° 8'), and concentrations of pisolitic materials form wide patches along streams as near Anantapuram (15° 51': 78° 39'), Bavapuram (15° 56': 78° 33'), Dudyala (15° 53': 78° 33'), Erragudur (15° 50': 78° 32'), Gokavaram (15° 56': 78° 29'), Karivena (15° 51': 78° 33'), Nallakalava (15° 50': 78° 36'), Tudicherla (15° 46': 78° 27') and Vipanagandla (15° 49': 78° 18'). Ferruginous slags indicative of a former iron-smelting industry occur near Sandrapodu (15° 19': 78° 47') in Cumbum taluk, near Galichennayyapalem (15° 37': 78° 35') and Narayana-puram (15° 39': 78° 35') in Nandyal taluk, near Kapiles-waram (16° 0': 78° 21'), Marugutti (16° 4': 78° 23') and

*Sangameswaram* (16° 1': 78° 20') in Nandikotkur taluk, and near Bainapalle (x) (15° 12': 78° 37'), Garla (15° 1', (78° 42'), Kolamalapeta (14° 58': 78° 38'), Pachagundalu Penta (15° 18': 78° 43') and Rudravaram (15° 15': 78° 36') in Sirvel taluk. They are also known to occur in the Nallamalals of the Cuddapah district. Quartzitic sandstones with lenticles of haematite appear to have been worked for iron, and the product is said to have been largely used for ploughs and other agricultural implements, but not suitable for tyres of wheels.

*Future.*—The iron-ore deposits of the Ceded districts are too small to support a steel industry here. For smelting one ton of haematite ore with 60 per cent iron, about half a ton of hard coke recoverable from two-thirds of a ton of coal is required. In terms of volume, three wagons of haematite ore would be reduced by coke available from about eight wagons of coal. The sources of coal used in India for hard coke production are those of the distant Jharia, Giridih, Raniganj and Bokaro fields in Bengal-Bihar area. Further, for use as flux in smelting one ton (2,240 pounds) of pig iron about 900 pounds of limestone with less than 6 per cent combined silica and alumina are required, and even where dolomite is used only high quality material with 5 to 6 per cent insolubles is preferred. From the information available, no large deposits of coking coal, high grade limestone and other ingredients essential for smelting of the iron-ores have come to light in Andhra Pradesh.

**LEAD.**

Lead is a strategic mineral, essential in the manufacture of ammunition, etc. Cubic, grey, metallic galena, PbS, in which silver sulphide is almost always present, is the most common ore of lead in India.

*Distribution.*—The lead-ore occurrences of the Ceded districts given below are only of scientific interest. Galena-bearing quartz veins are associated with the Archaean or the Cumbum slaty shales.

## QUARTZ

*In the Archaeans—**Chittoor district—*

Chittoor taluk—*Voddavaripalle* (13° 18': 78° 51')—  
In dolerite.

*Kurnool district—*

Dhone (Dronachalam) taluk—*Kollakonda* (15° 28': 77° 47'), hamlet of *Chityala* (15° 28': 77° 46')—Massive galena as irregular pockets in the siliceous fault breccia in granitic rocks.

*In the Cumbums—**Cuddapah district—*

Badvel taluk—*Zangamrajupalle* (14° 46': 78° 53')—Rare granules along planes of bedding and jointing.

Cuddapah taluk—*Nagasaniipalle* (14° 42': 78° 48')—Sporadic specks and small granules.

*Kurnool district—*

Cumbum taluk—*Giddalur* (15° 23': 78° 56')—Thin streaks. Associated with an igneous rock.

Nandyal taluk—*Chelima* (15° 27': 78° 42')—Massive galena in small pocket of vein quartz near Dorasani Bhavi. In one instance, namely, 1-1/4 miles south of Chelima, minute grains of galena occur in barytes, associated with quartz, thus pointing to the genetic relation of galena with barytes and quartz. Galena occurs in small pockets in trap sills in the vicinity of *Vempalle* (14° 23': 78° 28') in the Cuddapah district.

The occurrence at Chityala has been prospected and abandoned in recent years.<sup>1</sup>

## MAGNESITE

Magnesite, MgCO<sub>3</sub>, occurs here and there associated with steatite workings in the Vempalle dolomitic limestones near Muddavaram (15° 30': 78° 6') and Musalayyacheruvu (15° 30': 78° 4') in Dhone (Dronachalam) taluk, Kurnool district. The veins vary in thickness from 1 inch to 2 feet. The formation of magnesite might be due to the alteration of dolomite by hydrothermal emanations from trap magma.

The use of magnesite in the manufacture of electrical insulators is described under steatite.

## MANGANESE

The only known occurrences of manganese-ores in the Ceded districts are those in the Puranas near Janapalacheruvu (15° 29': 79° 9') in Cumbum taluk of the Kurnool district, and near the foot of the hill, 2 miles W.S.W. of Settigunta (13° 51': 79° 24') and a mile further west in the Cuddapah district. Near Janapalacheruvu, stringers of manganese-ore, mostly wad (soft amorphous mixtures of impure oxides of manganese, passing into psilomelane), some psilomelane (an impure hydrated oxide with 52 per cent manganese) and very little pyrolusite (MnO<sub>2</sub>, with 63 per cent manganese), associated with specular haematite, a little calcite and quartz traverse the slaty shales. These occurrences, however, are not of economic value. Near Settigunta manganese-ore associated with iron-ore occurs as impregnation in a lateritised zone of fracture in quartzite. The occurrence is also apparently of no economic importance.

## MICA

Ruby mica is reported from pegmatites traversing the Archaean gneisses at Sanapa (14° 37': 77° 28') and Siddaramapuram (14° 40': 77° 20') in Anantapur taluk, Anantapur district, and at Kalavaguntla (13° 7': 79° 8') in Chittoor taluk and Punuguchenukhandriga (13° 24': 79° 24') in Puttur taluk, Chittoor district. The occurrences are of no economic importance<sup>2</sup>.

<sup>1</sup> Sisamu—Lead <sup>2</sup> Abhrakamu—Mica.

Sand paper and 'Flint' paper, coated with crushed quartz, is the cheapest of all abrasive-coated paper, and is widely used for wood, leather, hard rubber, plastics, felt, and rubbed paint and varnish finishes on metals. Vein quartz with less than 0.02 to 0.05 per cent iron content is ground for use in glass, ceramics, paints, etc. It is also used as metallurgical flux, or making ferro-silicon, silicates, refractories, and for miscellaneous sundry uses. Fragments of colourless quartz crystals are employed in making fused quartz ware and physical instruments, selected crystals of quartz are employed in cheap jewellery and for making optical glass, and the most carefully selected ones, 4 inches long and 2 inches in diameter or large enough to give one cubic inch of untwinned, transparent flawless material, are used in radio and telephone instruments.

*Distribution.*—In all the four districts, many veins of quartz, pure and milk white or pink with ferruginous stains, traverse the schists, gneisses or the Cuddapah sedimentaries. They are prevalent, especially in the weakly resistant rocks and along fault zones. In Cumbum taluk, Kurnool district, milk white quartz veins occur in the slaty shales of the Cumbums at Bhupanaguntla (15° 24': 78° 50'), Gobarapalle (15° 18': 79° 2'), Idamakallu (15° 17': 79° 0'), Lingareddipalle (15° 23': 78° 59'), Palugotlapalle (15° 29': 78° 58'), Tatireddipalle (15° 15': 79° 2') and Tripurapuram (15° 22': 78° 59'), within easy reach of the metalled roads. These may be worked locally after finding their suitability in the manufacture of glass-ware, abrasives, etc. The quartz veins are of different ages, the later ones being probably related to trap intrusions.

*Future.*—Quartz veins scattered all over the Archaeans and the Cuddapahs can yield a large tonnage of pure silica of the standard desired in glass industry. The other essential requirements for a glass industry are 2-1/2 tons of coal and 5-1/2 hundredweights or about 1/4 ton of soda per ton of glass produced, besides high grade limestone or 'lime' for harder glass, pure manganese dioxide as decolouriser and borax for producing clear optical glass and insulating glass. In Kalahasti taluk of the Chittoor district, earth soda efflorescences are collected for making bangles and beads on a cottage scale. Experiments should be conducted in the area and elsewhere to determine the annual yield and cost of production of soda. The area is favourably situated for transport, Renigunta (13° 38': 79° 30'), the nearest railway station on the Broad-gauge line, being 84 miles from Madras, the important marketing centre. 'Flint' paper can be manufactured using as bond either glue or a synthetic resin adhesive, at a site where cheap electric power is available<sup>1</sup>.

## RED OCHRE AND OXIDE

Red ochre is a clay permeated with red ferric oxide and red oxide is a soft ferric oxide with little or no clay base. They have a permanent colour with a good covering power, and are employed in paints, oilcloth, linoleum, paper, ceramics and rubber goods and as a pigment in cement. The oxide pigments are widely used for painting exposed iron and steel works, such as the bodies of ships, bridges, railway coaches, etc.

*Distribution.*—In the Dharwars, red ochre or oxide deposits occur in ferruginous phyllites, adjacent to bands of ferruginous quartzites at Velpumadugu (15° 3': 77° 12') in Gooty (Gutti) taluk of the Anantapur district.

On weathering, the ferruginous shale intercalations in the Vempalles have given rise to red ochreous clays at Rajupalem (14° 26': 78° 31') in Kamalapuram sub-taluk, Cuddapah district, and to deep red soil at Malkapuram R.S. (15° 21': 77° 59') in Dhone taluk, Kurnool district.

Deposits of cherry or purplish red oxide occur at some places, associated with iron-ore concentrations in the Pulivendlas.

<sup>1</sup> Palugu-rayi—Quartz.

**Cuddapah district—**

Cuddapah taluk—CHABALI (14° 30': 78° 36').

Razampeta taluk—Erraguntlakota (13° 58': 79° 17').

Siddhavattam (Siddhavatam.<sup>2</sup>) taluk—Mantapampalle (14° 19': 79° 5').**Kurnool district—**

Dhone (Dronachalam) taluk—Gutupalle (15° 26': 79° 3')—A few thousand tons.

Considerable quantities of red oxide occur with the iron-ores of the faulted zone from Veldurti (15° 33': 77° 56') to Rāmallakota (15° 34': 78° 1') in the same taluk.

The large deposits of red ochre with associated white clays and yellow ochre at Nandalur (14° 16': 79° 7') or Paturu (14° 16': 79° 5') in Razampeta taluk, Cuddapah district, occur in the Tadpatri shales.

The occurrences of deep red soil near Mahanandi (15° 28': 78° 38') in Nandyal taluk and near Srirangapuram (15° 20': 78° 37') in Sirvel taluk, along the western foot of the Nallamala range, in the Kurnool district, might be attributed to ferruginous shale intercalations in the Bairenkondas.

Pale ochreous shales occur in the Cumbums to the west of Doranala (15° 54': 79° 6') and around Nallaguntla (15° 52': 78° 55') in Markapur taluk, Kurnool district. These may be used locally for colour washing.

At Betamcherla (15° 27': 78° 9') in Dhone (Dronachalam) taluk, large deposits of red ochre occur in the Auk (Avuku) shales. The association of these with white clays and yellow ochre, as in the case of the ochres in the Tadpatri, is probably due to selective leaching and deposition of ferruginous matter.

**Future.**—A paint industry in the Ceded districts can consume much of the red ochre and oxide. In commercial pigments, the linseed oil absorption of raw siennas is 25–70 per cent, of raw umbers 44–53 per cent, and of red oxides 14–28 per cent. Some red ochre and oxide can be utilised as pigment in cement and ceramic industry<sup>3</sup>.

**SALINE EFFLORESCENCE**

**Reh salts** are used for the manufacture of soda-ash and caustic soda, employed in washing clothes and in glass and sodium chemicals. Caustic soda is used in the manufacture of dye-stuffs, refining of vegetable oils, soap, paper, textiles, etc. Earth salt is used by the poor in some places.

**Distribution.**—Saline efflorescence takes place along stream courses and in low-lying areas where the water-table comes close to the surface in soils derived from the gneisses, calcareous slates of the Tadpatri and Cumbum stages, limestones of the Narji (Nirji) and Koilkuntla, and from the Auk (Avuku) inliers in the last. The occurrences are given below with estimated annual yield of some places. The available analyses of a few important occurrences are given in Table No. 4.

**In the Archaeans—****Anantapur district—**

Anantapur and Penukonda taluks—Stretches.

**Chittoor district—**

Kalahasti taluk—At several places north-east and east of Kalahasti (13° 45': 79° 45') and at Chiyavaram (13° 51': 79° 41'). Regular annual yield from discontinuous patches, locally used for making bangles and beads.

**Kurnool district—**

Pattikonda taluk—Davanakonda (15° 32': 77° 33')—Used locally as baking soda.

Gundlakonda (15° 29': 77° 39')—Used locally as baking soda.

Maddikera (15° 15': 77° 25')—Used locally as baking soda.

Sanjivarayanagundu (15° 38': 77° 36')—Used locally as baking soda.

**In the Tadpatri—****Cuddapah district—**

Jammalamadugu taluk—LAVANURU (14° 42': 78° 9')—*Reh* salts.

Venkayyalava (14° 43': 78° 5')—*Reh* salts.

Pulivendla taluk—Dondlavagu (14° 29': 78° 12')—*Reh* salts collected by washermen.

**In the Cumbums—****Kurnool district—**

Cumbum taluk—Several places in the eastern part of the taluk, from Komarolu (15° 16': 79° 0') in the south to beyond Somidevipalle (15° 27': 79° 2') in the north. The annual aggregate yield from the different areas is roughly 800 tons.

BADINENIPALLE (15° 17': 78° 58')—80 tons.

Brahmanapalle (15° 15': 79° 0')—30 tons.

KASINEPALLE (15° 17': 79° 2')—160 tons.

KATTIARALLAPALLE (15° 18': 78° 58')—180 tons.

Kottapalle (15° 17': 79° 3').

Malikepalle (15° 16': 79° 3').

Pitikayagulla 15° 29': 79° 8').

Pullareddipalle (15° 17': 79° 1').

SOMIDEVIPALLE—310 tons.

Tatireddipalle (15° 15': 79° 2')—40 tons.

**In the Narjis (Nirjis)—****Cuddapah district.—**

Cuddapah taluk—Paidikalva (14° 31': 78° 39')—Common salt.

Jammalamadugu taluk—Gundlakunta (14° 57': 78° 25').

KONDASUNKESULA (15° 3': 78° 18')—90 tons annually.

**Kurnool district.—**

Koilkuntla taluk—285 tons annually\*.

Gullasingavaram (15° 15': 78° 10')—35 tons.

LINGAMDINNE (15° 5': 78° 17')—35 tons.

MUKKAMALLA (15° 10': 78° 16')—120 tons.

VEMULAPADU (15° 14': 78° 12')—95 tons.

(Fig. 2).

**In the Koilkuntlas—****Kurnool district—**

Banganapalle sub-taluk—Nandivargam (15° 25': 78° 19').

Nilugondla (15° 15': 78° 14')—25 tons annually.

Timmapuram (15° 24': 78° 18').

Vitlapuram (15° 21': 78° 19').

Nandyal taluk—Vaddagundla (15° 31': 78° 23') *Reh* salts.

Sirvel taluk—Tippanapalle (15° 4': 78° 34').

**In the Auks (Avukus)—****Kurnool district—**

Sirvel taluk—Chintakommadinne (15° 4': 78° 32').

\* During the last 7 or 8 years the saline efflorescence at Gulla-Singavaram and Vemulapadu has been much less than in previous years.

<sup>2</sup> Correct name not used on the topographical sheet.

<sup>3</sup> *Errasudda*—Red ochre. *Erramatti*—Deep red soil.

Lingamayapalle (15° 12': 78° 35') or Narasapuram (15° 10': 78° 35').

In the Nandyals—

Cuddapah district—

Cuddapah taluk—Chinnamachupalle (14° 32': 78° 43')—Common salt.

Eguvapalle (14° 30': 78° 42')—Common salt.

Proddatur taluk—Chennamarajupalle (14° 47': 78° 36').

Gopavaram (14° 47': 78° 34').

Korrapadu (14° 49': 78° 35').

In the saline tracts, porosity of soils is low as evidenced by slow recuperation in wells, probably on account of their calcareous nature. As the rate of percolation is slow in such soils, salts appear to accumulate slowly in them. The source of salts must be the underlying rocks which were formed as marine sediments. In marshy areas, the soil salts tend to move up and efflorescence over the ground surface in hot weather.

Future—The annual yield and cost of recovery of *reh* salts in the Ceded Districts should be investigated in different areas, keeping in view their utility in chemical and glass industries.\*\*

TABLE 4.  
Analysis of Saline Efflorescence

	Cuddapah district.		Kurnool district.									
	Jammalamadugu taluk.	Konda-sunkesula.	Bangana-palle sub-taluk.	Cumbum taluk.					Koilkuntla taluk.			
(1)	(2)	(3)	Badinenipalle	Brahmana-palle.	Kasinepalle	Kattaralla-palle.	Somidevipalle	Tatiredipalle	Lingamdinne.	Mukkamalla.	Vemulapadu.	
Total solid (water soluble at 180° C).	..	..	11.116	6.50	3.22	6.804	10.936	1.156	..	..	..	
HCO <sub>3</sub>	..	0.61	1.52	0.60	7.20	1.53	trace	trace	trace	0.31	1.22	0.31
CO <sub>2</sub>	..	..	0.30	..	..	..	..	..	..	..	0.30	Nil.
SO <sub>4</sub>	..	9.52	1.33	3.04	0.115	0.12	0.60	1.01	0.04	16.06	0.73	0.72
Cl	..	26.63	8.88	4.22	0.72	1.20	3.70	6.11	0.61	13.15	0.89	11.39
NO <sub>3</sub>	..	trace.	..	..	..	..	..	..	..	..	..	Nil.
Al & Fe	..	..	..	trace	0.02	0.04	trace	trace	trace	..	..	Nil.
Ca	..	1.46	0.05	0.33	0.15	0.151	0.36	0.55	0.045	3.84	0.09	0.22
Mg	..	0.16	..	0.12	0.24	0.004	0.06	0.20	0.003	0.11	0.10	0.08
K	..	0.22	0.32	..	..	..	..	..	..	0.49	trace	0.45
Na	..	18.02	7.4	3.81	2.61	1.10	2.12	3.50	0.407	14.32	1.30	7.21

\*\* Chaviti Uppu—saline efflorescence.  
Chavudu—Saline soil  
Kayya—Shallow flat basin for the evaporation of saline solution.

Mada—Conical earthen structure for salt manufacture.  
Uppu—Salt.

#### SERPENTINE

Serpentine, 3MgO. 2SiO<sub>2</sub>. 2H<sub>2</sub>O, is an ornamental building stone, suitable for interior decoration.

Distribution.—Serpentine forms an enveloping zone around asbestos in all occurrences of the latter. Thin, irregular bands of serpentine with a little or no asbestos occur also at the following localities in the Vempalles close to trap contact. The origin of serpentine has been described under asbestos.

Anantapur district—

Gooty (Gutti) taluk—Chintalacheruvu (15° 0': 77° 46').

Tadpatri taluk—Chinna Yekkaluru (14° 55': 77° 48').

Kondapuram (14° 57': 77° 49').

Rayalacheruvu (15° 3': 77° 49').

Vengannapalle (14° 58': 77° 48').

Kurnool district—

Dhone (Dronachalam taluk)—Chandrapalle (15° 13': 77° 49').

Chinna Malkapuram (15° 22': 77° 59')—No trap

Kamalapuram (15° 21': 77° 56')—In trap also.

Kottapalle (15° 23': 78° 3').

Malkapuram R.S. (15° 21': 77° 59')—No trap.

Kurnool taluk—Joharapuram (15° 49': 78° 4').

#### STEATITE

Steatite, composed entirely of cryptocrystalline talc, 3MgO. 4SiO<sub>2</sub>. H<sub>2</sub>O, is used in ceramics, paint, cosmetics, tiles, electric porcelain, as lubricant, filler in asbestos shingles, blocks and slabs, composition floorings, polishes, etc. 'Lava' steatite is valued for making high-frequency electrical insulators in radio, radar, television and similar instruments, and for refractory purposes.

Distribution.—Thin bands of steatite occur in the Archaeans and the Vempalles. They have been formed by the hydration of the magnesian rocks in the Archaeans and by reaction of the magmatic emanations with the dolomitic limestones in the Vempalles as in the case of serpentine.

In the Chittoor district, steatite is associated with the Dharwarian talc-schists or amphibolites occurring as inclusions in biotite-gneisses.

Chittoor taluk—Kotapalli (13° 25': 79° 3')—In talc-schist.

Narasingarayanpeta (13° 11': 79° 13') or Ganga dharanellore (13° 14': 79° 11')—With amphibolites.

Talupulapalli (13° 24': 79° 4')—In talc-schist.

Vezupalli (13° 17': 79° 13')—In talc-schist.

Puttur taluk—Patagunta (13° 26': 79° 18')—In talc-schist.

The steatite occurrences in the Anantapur, Cuddapah and Kurnool districts are in the Vempalles, where they occur in the zones of disturbance or close to traps.



*Anantapur district—*

Anantapur taluk—JULAKALAVA (14°50':77°48')—In disturbed zone. Good lava grade variety. Light grey. Up to 18 inches thick.

Karnapudi (14°46':77°52')—In disturbed beds. Second grade, several hundred tons.

Gooty (Gutti) taluk—Krishtipadu (15°4':77°47').

Tadpatri taluk—Jangamreddipalle (14°22':77°55')—Fairly good bands upto 1 foot thick. One 4 feet thick impure band.

Madugupalle (14°43':77°54')—In disturbed zone. Greenish. Fairly good quality. Thin bands.

Nerijamupalle (14°32':78°1')—Close to trap. Good quality.

TABJULA (14°54':77°49')—Whitish, greenish. Good quality. Upto 18 inches thick.

*Cuddapah district—*

Kothagangireddipalle.

Pulivendla taluk—Parnapalle (14°34':77°59')—Further prospecting necessary.

*Kurnool district—*

Dhone (Dronachalam) taluk—Dhone (Dronachalam) (15°24':77°52').

Chandrapalle (15°13':77°49')—Close to trap. Greenish and impure. Upto 6 inches thick.

MUDDAVARAM (15°30':78°6') or VENKATAGIRI (15°31':78°5')—Some hidden trap. Excellent quality. Upto 4 inches thick.

MUSALAYYACHERUVU (15°30':78°4') or MARRIKUNTA (15°31':78°4')—White to pale green. Soft. Needs prospecting.

Pendakallu (15°32':78°4')—Green. Excellent quality.

Kurnool taluk—Gadidemadugu (Gargeyapuram) (15°47':78°9')—Close to traps. Light greenish grey with streaks of iron ore.

Yaparlapadu (15°39':78°0')—Close to trap.

*Future.*—Steatite may be of use in various industries, mainly ceramic and paint industries. Manufacture of electrical insulators from 'lava' grade steatite, available at some places in the Ceded districts is worth investigating. In this process, steatite is pulverized, mixed with some plastic kaolin, and barium and magnesium carbonates, dry pressed in metal dies, and fired to about 1,400° C. Magnesium carbonate or magnesite occurs associated with steatite at some places in the Kurnool district.

**WHITE CLAYS**

Plastic white clays vitrifying between 1,250° C. and 1,300° C. are useful in the manufacture of stoneware which except art ware is always salt-glazed. Highly plastic clays, in which feldspar and mica occurring in finely divided form constitute 20 per cent and iron oxides 1 per cent are ideal for the purpose. Although white burning clays are valuable in making some of the fine stoneware bodies, the clays generally used in stoneware manufacture get coloured on burning, imparting the usual colour to the stoneware. White clays with low fusion temperatures find other uses as filler in paper and textiles, etc.

*Distribution.*—White clays occur in gneisses, formed by weathering of felspathic materials, at Nagalavaram (15°49':77°59') and Peddapadu (15°48':77°59') in Kurnool taluk, and at Kosanapalle (15°31':77°53') in Dhone (Dronachalam) taluk, Kurnool district.

*I Rachipparay*—Steatite or potstone.

The red-ochreous clays in the Vempalles near Rajupalem in the Cuddapah district contain small pockets of white clays.

In the Tadpatri shales white clays formed as a result of weathering, are exposed at the ground surface along streams. The deposit at Balapuram is attributed to the action of hydrothermal solutions from the traps on shales. Most of the clay deposits of Razampeta taluk, Cuddapah district, come under this group as given below.

*Anantapur district—*

Tadpatri taluk—Balapuram (14°47':77°59')—Sporadic, vitrify at 1,300°–1,350° C.

*Cuddapah district—*

Razampeta taluk—ANANTARAZUPETA (14°0':79°20')—Some fairly plastic, some slightly plastic. Burns purplish grey. Unaffected at 1,275° C. 744,000 tons.

CHINNA ORAMPADU (14°4':79°16')—Slightly plastic. Burns grey to buff. Vitrifies at 1,250–1,300° C. 144,000 tons.

Chitvel (14°10':79°20')—Burns brown. Vitrifies above 1,250° C. 7,200 tons.

HASTAVARAM (14°14':79°7')—Burns grey. Highly plastic. Refractory, but some parts of the deposits high in fusible impurities. 600,000 tons.

Kodur (13°57':79°21')—Fairly plastic. Burns buff. Vitrifies above 1,275° C. 86,000 tons.

Nandalur (14°16':79°7') or Paturu (14°16':79°5')—With purple clays. Fairly plastic. Vitrifies at 1,250° C. 80,000 tons.

Pullampet (14°7':79°13').

Settigunta (13°51':79°24').

Tallapaka (14°14':79°9')—With red clay. Fuses at 1,160° C.

*Kurnool district—*

Nandyal taluk—Gani (15°40':78°19')—Burns light red. Vitrifies slightly at 1,200° C. A few hundred tons.

A few deposits of white clays occur in the Cumbums at the following places:—

*Cuddapah district—*

Razampeta taluk—BHAKARAPETA (14°25':78°57')—Fairly good. Vitrifies at 1,250° C. 112,000 tons.

Obali (14°17':79°14') or Singareddipalle (14°18':79°15')—Some very plastic, some slightly plastic. Burns purplish grey. Vitrifies at 1,250° C. 33,000 tons.

*Kurnool district—*

Cumbum taluk—Giddalur (15°23':78°56')—Fairly plastic. Burns brownish black. Fuses at 1,200° C. 84,000 tons.

Markapur taluk—CHINTAGINJALAPAYA (16°14':79°31'), locally called Akkapalem—Appears to be extensive. Detailed examination is necessary.

Gurrapusala (15°58':79°14')—Small, plastic but vitrifies at 1,250° C.

In the Auk (Avuku) shales of the Kurnool district, white clays are exposed in gullies on hill slopes at the following places:—

Dhone (Dronachalam) taluk—Ambapuram (15°23':78°6') Burns Buff to grey. Fairly plastic. Vitrifies at 1,300° C. 10,000 tons.

**BETAMCHERLA** (15° 27': 78° 9')—Associated with yellow ochre. Slightly plastic. Burns buff. Vitrifies at 1,350° C. 337,000 tons.

*Kommamarri* (15° 12': 77° 52').

**RAMALLAKOTA** (15° 34': 78° 0')—Mixed half with yellow ochre. Non-plastic. 4 per cent grit. Burns white. Refractory at 1,350° C. 500,000 tons.

Koilkuntla taluk—*Bechiraku* (x) (15° 3': 78° 1').

*Kolimigundla* (15° 5': 78° 7').

*Kondamanayanipalle* (15° 8': 78° 3').

Korumanipalle (15° 0': 78° 7').

*Mettupalle* (15° 15': 78° 7').

Kurnool taluk—*Puricherla* (15° 44': 78° 8')—Mostly streaked with colours. Pockets of better quality. Fairly plastic. Burns grey. Vitrifies at 1,350° C. 30,000 tons.

Nandikotkur taluk—*Bijinivemula* (15° 56': 78° 15').

Nandyal taluk—*Bollavaram* (15° 39': 78° 24')—Pure white.

*Gunthem* (15° 37': 78° 15').

*Kottala* (x) (15° 39': 78° 16').

**PAIBAGALA** (15° 37': 78° 22')—Plasticity poor. Little grit. Vitrifies at 1,350° C. 187,000 tons.

*Pangadi* (15° 43': 78° 41').

*Rangaswami* (15° 37': 78° 19').

*Yalappa Konda* (15° 37': 78° 41').

There are two large deposits in the Nandyals—

*Cuddapah district—*

Cuddapah taluk—**RAMPATADU** (14° 29' : 78° 42')—Fuses at 1,160° C. 160,000 tons.

*Kurnool district—*

Nandyal taluk—**PRAEMA** (15° 31' : 78° 37')—Highly plastic. Slightly grey. Vitrifies at 1,350° C. 1,300,000 tons.

Greyish clays occur associated with the Upper Gondwana shales near about Toidavuru (13° 6': 79° 47') in Tiruttani taluk, Chittoor district. Situated under thick soil cover, the clays could not be estimated.

*Future.*—In Razampeta taluk of the Cuddapah district, white clays suitable for stoneware occur close to the Broad-gauge railway line, deposits in the order of importance being at Anantarazupeta, Chinna Orampadu, Bhakarapeta, Koduru, Nandalur and Chitvel. The Hastavaram deposit, parts of which fuse at lower temperatures, should be mixed with highly refractory clays such as those of Ramallakota before use. The probable reserves of these deposits, excluding the Hastavaram deposit, exceeds one million tons. In the Kurnool district, similar clays occur, in the order of importance, at Praema and Betamcherla near the Metre-gauge railway and at Paibagala, Puricherla and Ambapuram. The Praema clays are highly plastic, while the Puricherla clays have poor plasticity. The probable reserves of these deposits exceed 1-1/2 million tons. With these available reserves and proximity to rail transport, it should be possible to start manufacture of stoneware, such as floor tiles, sewage pipes, potteries and objects of art. Chemical stoneware is made by compounding small amounts of kaolin and felspar with various plastic clays. In special types of stoneware, silicon carbide is mixed with clay to improve the conductivity of the body and resistance to temperature changes and to alkaline and chemical solutions. In some cases, barium oxide is added to increase the resistance to the attacks of basic chemicals.\*

\* *Tella-sudda*—White clays.

## YELLOW OCHRE

Yellow ochre, a clay permeated by hydrated ferric oxide, is extensively used, like red ochre, for paints, oil cloth, etc., and as pigment in cement, ceramics, etc.

*Distribution.*—Like the red ochre, yellow ochre deposits occur as pockets in the Vempalles of Cuddapah, and Auks (Avukus) of Kurnool, at localities given below. There are trivial occurrences associated with the Dharwar magnetite quartzites at Chinnasamudram (13° 5': 79° 5') in Chittoor taluk, in a shale intercalation in the Bairenkondas or in the Cumbums near Siddhavattam (Siddhavattam) R.S. (14° 26': 78° 55') in the Cuddapah district, and in the Nandyals at Pasurutla (15° 47': 78° 41') in Kurnool taluk. In all the occurrences ferruginous material has weathered to yellow limonite.

*In the Vempalles—*

*Cuddapah district—*

Cuddapah taluk—**MITTAMIDAPALLE** (14° 26' : 78° 44')

Nandimandalam (14° 26': 78° 32').

**UPPALAPALLE** (14° 26': 78° 32').

*In the Auks (Avukus)—*

*Kurnool district—*

Dhone (Dronachalam) taluk—**AMBAPURAM** (15° 23': 78° 6')—Associated with white clays. 2 million tons.

**BETAMCHERLA** (15° 27': 78° 9')—Associated with white and purple clays. 1.8 million tons.

Bukkapuram (15° 36': 78° 5')—Soft.

*Kortikunta* (15° 35': 78° 2').

Krishnapuram (15° 36': 78° 3')—Poor quality. 67,500 tons.

Nereducherla (15° 12': 77° 55')

Pullagummi (15° 37': 78° 2').

**RAMALLAKOTA** (15° 34': 78° 0')—With white clays. 350,000 tons.

Kurnool taluk—*Diguvapadu* (15° 46': 78° 11').

*Loddipalle* (15° 41': 78° 4').

**UYYALAVADA** (15° 38': 78° 5')—Poor quality. 375,000 tons.

Nandikotkur taluk—*Pangadi* (15° 43': 78° 41').

Nandyal taluk—*Paibagala* (15° 37': 78° 22')—Fine and soft.

Pinnapuram (15° 36': 78° 16')—Fine and soft.

*Rangaswami temple* (15° 37': 78° 19').

*Future.*—The future of yellow ochre in the Ceded Districts is the same as that of red ochre, namely in paints and as pigment in cement and ceramics. The linseed oil absorption of yellow ochre in commercial pigments is 29-49 per cent. +

+ *Pachcha-Sudda*—Yellow ochre.

*Sudda*—Soft shale, clay



Fig. 4.—Sculpture in Limestone, Chennakeswaraswami temple, Pushpagiri (Ref. page 17, 20.)

(PHOTO: N.V.B.S. DUTT.)

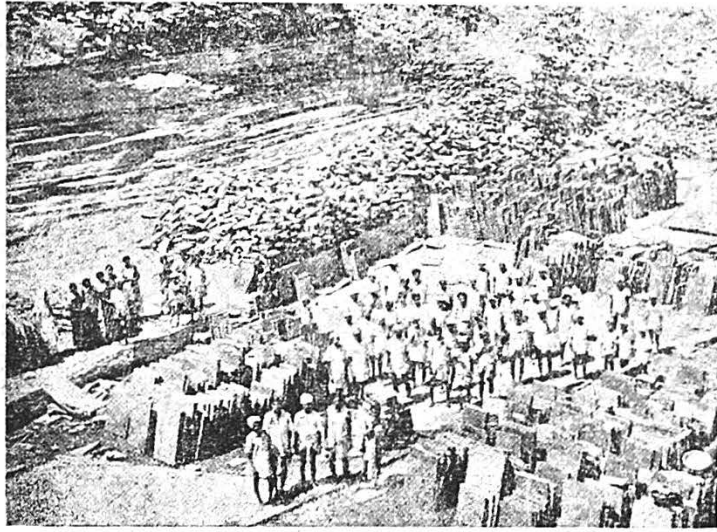


Fig. 5.—'Cuddapah slab' quarry, Niduzuvvi (Nirji).

(Ref. page 18.) (PHOTO: N.V.B.S. DUTT.)



Fig. 6.—Sculpture in quartzite, Sangameswaraswami Temple Animala (Ref. page 20.)

(PHOTO: N.V.B.S. DUTT.)

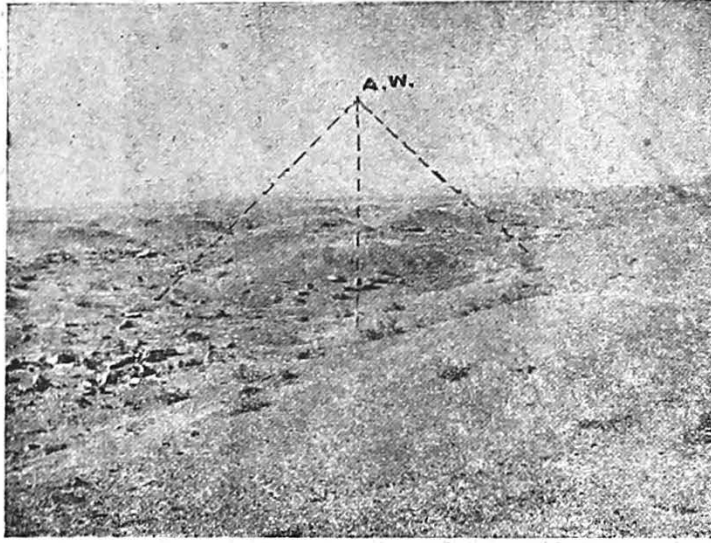


Fig. 1.—Ancient Diamond workings (A.W.) on ridge west of Banganapalli (Ref. page 9.)

(PHOTO: N.V.B.S. DUTT.)

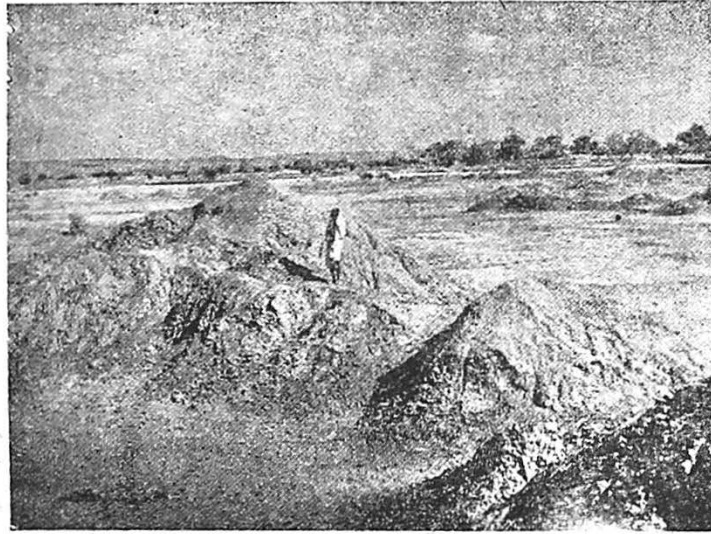


Fig. 2.—Conical Earthern Structures ('Mada-s.) for Salt Manufacture, Vemulapadu (Ref. page 13.)

(PHOTO: N.V.B.S. DUTT.)



Fig. 3.— Structure for Tulasi, carved in trap, Ramallakota.

(Ref. page 17.)

(PHOTO: N.V.B.S. DUTT.)

## ORE GENESIS

In Table No. 5 an attempt has been made to indicate the mode of formation of minerals of economic importance

TABLE 5.

*Economic minerals and their mode of occurrence.*

<i>Geological conditions.</i>	<i>In associated traps.</i>	<i>Fault fissure fillings.</i>	<i>Replacements or in quartz veins.</i>	<i>Segregations, secondary enrichments, residual deposits.</i>
(1)	(2)	(3)	(4)	(5)
Nandyal calcareous shale and shaly limestone.	..	..	..	Calcareous tufa, white clays and yellow ochre
Koilkuntla limestone	..	..	..	Calcareous tufa
Auk (Avuku) ferruginous shale	..	..	..	Red ochre, white clays and yellow ochre
Narji (Nirji) limestone	..	..	..	Calcareous tufa
Banganapalle diamondiferous conglomerate.	..	..	..	Diamond
Irlakonda (Irla Konda) ferruginous quartzite.	..	..	..	Iron-ore
Cumbum calcareous shale	..	..	Barytes, copper-ore, galena, iron-ore, manganese-ore and quartz.	Calcareous tufa and white clays.
Bairenkonda ferruginous quartzite and shale.	..	..	Barytes and quartz.	Iron-ore and red soil.
Tadpatri calcareous or ferruginous shale.	Barytes, copper-ore, galena and quartz.	..	Copper-ore and quartz.	Calcareous tufa, red ochre and white clays.
Pulivendla quartzites	..	Barytes, iron-ore and quartz.	Barytes, copper-ore, iron-ore and quartz.	Iron-ore and red oxide.
Vempalle dolomitic limestone and ferruginous shale.	Barytes and quartz	Do.	Asbestos, barytes, copper-ore, iron-ore, magnesite, quartz, serpentine and steatite.	Calcareous tufa, red ochre and yellow ochre.
Archaean gneisses and diamondiferous pegmatites.	Galena	..	Copper-ore, mica and quartz.	Diamond, white clays and calcareous tufa.
Dharwar ferruginous quartzites and phyllites, mica-schists, syenites, basic and ultra-basic rocks, talc-schists and amphibolites.	..	..	Corundum, gold, quartz and steatite.	Calcareous tufa, iron-ore, red oxide and ochre and white clays.

During the Dharwar period, iron and manganese oxides were deposited along with the sediments and after the uplift and folding of the strata, the silica and other impurities were leached out leaving the segregate of ore near the surface.

The igneous activity which accompanied some of the pre-Cuddapah earth movements has probably been responsible for the diamondiferous pegmatites, mica and corundum, quartz veins carrying gold, copper-ores and galena, while the formation of steatite is due to hydrothermal solutions.

All the mineral deposits of the Purana group, except for some calcareous tufa, red ochre, white clays and yellow ochre, are confined to the Cuddapahs and associated traps. Evidence of mineralisation is found in all stages of the Cuddapahs excepting the Kistnas (Krishnas) which have not yet been completely mapped on a large scale, as well as in the associated traps. The faults traversing the Kurnools are free from mineral deposits. It is clear therefore that here the formation of the primary minerals, whose origin may be ascribed either directly or indirectly to an igneous source, was due to the trappean activity and that the intrusion of the traps was post-Tadpatri and doubtfully post-Cumbum but definitely pre-Kurnool.

The deposition of the Kurnools on the eroded surface of the Cuddapahs commenced in a narrow sea in the western part of the Cuddapah basin. The diamonds in the basal Kurnool conglomerates (Banganapalle) were derived presumably from the subaerial denudation of the adjoining Archaean rocks.

The only mineral deposits common to the Cuddapahs and the Kurnools are those such as clays resulting from weathering of the rock types through the natural agencies of water, heat and cold.

## USEFUL ROCK TYPES

Granites, gneisses and traps, limestones and quartzites, all are useful as building stone and road metal. It is not proposed to list in this paper all the working quarries of rocks, only their useful properties will be indicated.

## GRANITES GNEISSES AND TRAPS

The Ceded districts abound in handsome types of granites and gneisses. They are close-grained or porphyritic, and occur in pleasing shades of red, grey or white and occasionally green. Because of regular jointing they are readily quarried and dressed. In the temple of Ramallakota in the Kurnool district, there is a beautiful structure full of images and designs in trap for Tulasi. (Fig. 3).

Rollers, grindstones and mortars are extensively made of these rocks.

## LIMESTONES

Massive limestones and dolomite, especially the former, and the recrystallised types called marbles are excellent building stones, the uniformly fine to medium grained varieties of good colours being ideal ornamental and lithographic stones (Fig. 4).

They find use as an ingredient of artificial stone, concrete aggregate, ballast, etc. The flagstones are extensively quarried for flooring and roofing slabs. The most important industrial use of limestone is in cement making. For Portland cement, the raw-mix should contain about 75 per cent calcium carbonate and 20 per cent silica, alumina and iron oxide all together, silica alone being not less than 10 per cent and the magnesia, alkalis and other ingredients being less than 5 per cent, preferably less than 3. High grade limestone or dolomite is used as fluxing stone in the melting of iron. Still purer form of limestone finds

various uses in glass, ceramics and chemical industries, in agriculture, tannery and water works.

*Distribution.*—Of late, considerable attention has been paid to the limestones of the Cuddapah and Kurnool districts for use in cement manufacture. They form the Vempalle, Narji (Nirji) and Koilkuntla stages and also occur as intercalations in the Tadpatri, Cumbum and Nandyal shales. The massive limestones are quarried for building purposes, rollers, tubs and road-metal. The chemical composition of the limestones is variable within the same formation both vertically and laterally depending upon the sources from which they were derived. Generally speaking, the Vempalle limestones are dolomitic while the Narji (Nirji) and Koilkuntla limestones contain magnesia in traces. The silica content is lower in the grey and whitish bands of the Narji (Nirji) massive limestones than in the purple and greenish grey bands and calcareous flags and in the Koilkuntla limestones. Some of the last mentioned in Sirvel taluk of the Kurnool district and their southward continuation in Proddatur taluk, Cuddapah district, as well as the limestone band in the Nandyals are low in silica and magnesia. Though these limestones are not sufficiently rich to be used as a flux in iron-smelting, they are eminently suitable for cement manufacture. According to the author, the available reserves in outcrops of the Narji (Nirji) grey and whitish massive limestones and the adjacent layers of the calcareous flags, from west of Cuddapah to beyond the Tungabhadra in the north are of the order of 640 million tons in Kamalapuram and 3,000 million tons in Jammalamadugu taluks, Cuddapah district, and 5,000 million tons in Koilkuntla, 660 million tons in Banganapalle, 475 million tons in Dhone, 1,250 million tons in Kurnool and 770 million tons in Nandikotkur taluks, Kurnool district. Reserves of the limestones together with their average composition are given in Table No. 6. These reserves are liberal estimates with no deductions made for solution cavities and depressions. They have to be proved by well spaced borings. The analyses, being very few give only an idea of chemical composition of the limestones.

The Narji (Nirji) calcareous flags and some of the Koilkuntla limestones are very extensively quarried for

slabs in the Cuddapah and Kurnool districts because they can be easily split along their bedding planes (Fig. 5).

Flag beds associated with the lower bands of the Narji (Nirji) massive limestones carry siliceous laminae and yield tough slabs, superior in quality for roofing and flooring purposes to those from the calcareous flags. They are largely quarried along the railway line between Rangapuram ( $15^{\circ} 24' : 78^{\circ} 4'$ ) and Bugganipalle ( $15^{\circ} 29' : 78^{\circ} 12'$ ) railway stations and also along the new road from Betamcherla to Banganapalle across ridges. The slabs are popularly known as 'Cuddapah slabs.'

*Future.*—Limestones suitable for cement-making are immense in the Cuddapah and Kurnool districts. The largest deposits of Jammalamadugu and Koilkuntla taluks which are at present of little importance for want of cheap transport facilities will be an asset when the railway communication is established within the area. Of the Localities along the Railway lines close to the limestone belt, Gopalapuram ( $14^{\circ} 36' : 78^{\circ} 38'$ ) and Kamalapuram ( $14^{\circ} 36' : 78^{\circ} 40'$ ), situated in the sandy tract of the southern area and Kurnool, Betamcherla and Panem of the northern area, enjoy good water-supply. For one ton of ordinary Portland cement about 0.42 ton of coal and 1.48 tons of limestones are required besides some aluminous clay low in magnesia and iron oxides, and gypsum about 4 per cent by weight of cement. On this basis, a factory with a capacity of 500 tons daily, would require about 1/4 million tons of limestone, 63,000 tons of coal and 6,000 tons of gypsum per year of 300 working days. The available reserves of limestones near Kurnool, Betamcherla, Panem, Kamalapuram and Gopalapuram would be large enough to support the factory for several hundred years. Coal will have to be brought from Kottagudem or Singareni coal-field of the Khammam (Kambhammettu\*) district or from Tandur coal-field of the Adilabad district and gypsum from Sullurpet in the Nellore district or from the Trichinopoly (Tiruchirapalli\*) district of Madras State.

\*Correct name not used on topographical Sheets.

TABLE 6.

## Analyses of limestones from Cuddapah and Kurnool districts.

Areas	SiO <sub>2</sub>	R <sub>2</sub> O <sub>3</sub> (Al <sub>2</sub> O <sub>3</sub> + Fe <sub>2</sub> O <sub>3</sub> ).	CaO	MgO	Number of samples.	Reserves ( in million tons) to a depth of 40 ft. and remarks.
(1)	(2)	(3)	(4)	(5)	(6)	(7)
<i>Limestone Band in the Nandyals</i>						
<i>Kurnool district</i>						
<i>Sirvel taluk—</i>						
Erraguntla ( $15^{\circ} 17' : 78^{\circ} 31'$ ), Jillella ( $15^{\circ} 21' : 78^{\circ} 28'$ ), Motakalal- palle ( $15^{\circ} 24' : 78^{\circ} 33'$ ), Peruru ( $15^{\circ} 16' : 78^{\circ} 32'$ ).	18.83	3.85	40.80	3.04	11	Greenish grey and purple bands. Greenish grey band only.
	15.24	3.73 (2.01+1.72).	42.60	3.63	5	
<i>Koilkuntla Limestones</i>						
<i>Cuddapah district</i>						
<i>Kamalapuram sub-taluk—</i>						
Erragudipadu ( $14^{\circ} 37' : 78^{\circ} 37'$ ) ..	24.14	2.35	39.59	0.24	1	
<i>Proddatur taluk—</i>						
Nilapuram ( $14^{\circ} 53' : 78^{\circ} 41'$ ), Pedda- settipalle ( $14^{\circ} 46' : 78^{\circ} 31'$ ).	22.00	1.97	40.69	0.28	3	

Areas.	SiO <sub>2</sub>	R <sub>2</sub> O <sub>3</sub> (Al <sub>2</sub> O <sub>3</sub> + Fe <sub>2</sub> O <sub>3</sub> ).	CaO	MgO	Number of samples.	Reserves (in million tons) to a depth of 40 ft. and remarks.
(1)	(2)	(3)	(4)	(5)	(6)	(7)
<i>Kurnool district</i>						
<b>Banganapalle sub-taluk—</b>						
Appalapuram (15° 20': 78° 19'), Banganapalle (15° 19': 78° 15'), Cheruvupalle (15° 24': 78° 16').	25.57	3.65	38.54	0.10	4	
<b>Koilkuntla taluk—</b>						
Joladarasi (15° 15': 78° 21')	31.89	4.24 (2.10+2.14)	34.46	trace	6	
<b>Kurnool taluk—</b>						
Varakuru (15° 41': 78° 11')	23.63	1.50 (0.45+1.05)	40.70	0.45	6	
<b>Nandikotkur taluk—</b>						
Nagaluti (15° 48': 78° 15'), Nandi- kotkur (15° 52': 78° 16').	30.35	4.16 (2.03+2.13)	35.53	0.19	12	
<b>Sirvel taluk—</b>						
Southern part	10.60 —30.64	0.80 —3.90	47.27 —34.67	trace— 2.38	15	
<i>Narji (Nirji) Calcareous Flags</i>						
<i>Cuddapah district</i>						
<b>Jammalamadugu taluk—</b>						
Jammalamadugu (14° 51': 78° 23'), Purvasungamanchipalle (14° 47': 78° 27'), Salevariuppalapadu (14° 54': 78° 24').	13.74	3.42	45.32	0.34	3	279 for 20 feet thickness.
<b>Kamalapuram sub-taluk—</b>						
Niduzuvvi (14° 39': 78° 30')	13.19	1.40	46.31	0.72	1	40 for 20 feet thickness
<i>Kurnool district</i>						
<b>Dhone taluk—</b>						
Betamcherla (15° 27': 78° 9') in- cluding a small part of Nandyal taluk.	22.05	2.72	40.60	0.91	10	
Krishnapuram (15° 36': 78° 3'), Siddanagatta (15° 34': 78° 4').	25.46	3.56	38.23	0.30	4	
Koilkuntla taluk—including Ban- ganapalle enclaves between Owk (Avuku) (15° 13': 78° 7') and Bhogasamudram (15° 1': 78° 1').	17.57	3.24 (2.36+0.88).	43.45	0.27	15	940 for 30 feet thickness for all suitable outcrops in the taluk.
<b>Kurnool taluk—</b>						
Kurnool (15° 50': 78° 3')	29.22	8.96 (5.36+3.60).	31.39	1.50	17	
Uyyalavada (15° 38': 78° 5')	21.43	1.86	41.73	0.43	3	
<b>Nandikotkur taluk—</b>						
Satanikota (15° 55', 78° 13')	32.36	8.10 (4.43+3.67).	32.43	0.45	3	
<i>Narji (Nirji) Grey and Whitish Massive Limestones</i>						
<i>Cuddapah district</i>						
<b>Jammalamadugu taluk—</b>						
Jammalamadugu, Talamanchipatnam (14° 57': 78° 19').	10.45	1.95	47.72	0.53	7	2,640
<b>Kamalapuram sub-taluk—</b>						
Koduru (14° 36': 78° 32'), Nidu- zuvvi.	13.97	1.58	45.32	0.60	2	600

Areas.	SiO <sub>2</sub>	R <sub>2</sub> O <sub>3</sub> (Al <sub>2</sub> O <sub>3</sub> + Fe <sub>2</sub> O <sub>3</sub> ).	CaO	Mgo	Number of samples.	Reserves (in millions tons) to a depth of 40 ft. and remarks.
(1)	(2)	(3)	(4)	(5)	(6)	(7)
<i>Kurnool district</i>						
Banganapalle sub-taluk— Banganapalle .. ..	16.24	1.10	46.24	0.18	1	660
Dhone taluk— Betamcherla—including a small part of Nandyal taluk.	13.60	2.23	46.46	0.58	77	425
Krishnapuram .. ..	15.77	2.41	45.14	0.21	2	50
Nereducherla (15° 12': 77° 55') ..	10.86	3.60	47.01	trace	1	
		(2.48+1.12).				
Koilkuntla taluk—Including Bangana- palle enclaves between Owk (Avuku) and Bhogasamudram.	11.32	3.04	47.31	trace	18	4,700 for 60 feet thick- ness, for all outcrops in the taluk.
		(2.27+0.77).				
Kurnool taluk— Kurnool or west of Hindri river ..	14.01	2.48	45.65	0.84	13	More than 200.
Gadidemadugu (Gargeyapuram) (15° 47': 78° 9') to Uyyalavada.	15.65	2.79	44.72	0.29	3	1,050.
Ridge west of Somayajulapalle (15° 35': 78° 11').	14.08	1.28	46.17	0.11	2	
Nandikotkur taluk— Satanikota to Brahmanakotukuru (15° 49': 78° 12').	17.81	2.52	43.87	0.07	8	770.

*Narji (Narji) Purple and Greenish Grey Massive Limestones with Flag Beds.*

<i>Kurnool district.</i>						
Dhone taluk— Betamcherla—including a part of Nandyal.	26.17	3.10	37.88	1.06	46	
Nereducheria .. ..	30.63	6.83	34.91	trace	1	
Ramallakota (15° 34': 78° 1') ..	30.50	3.50	34.98	0.41	1	
Kurnool taluk— Kurnool .. ..	12.95	2.10	46.90	trace	1	
<i>Vempalle Limestones</i>						
Anantapur and Cuddapah districts.	9.70	2.15	31.10	15.8	10	

Besides cement making, limestone also provides raw materials for asbestos-cement, artificial stone, concrete aggregate, etc. 1

QUARTZITES AND SANDSTONES

Quartzites and sandstones are excellent building materials. They also find use in grindstones, mortars, sharpening stones, hones and scouring powder. Quartzite with a maximum of two per cent iron and alumina is employed in the manufacture of silica bricks bonded with less than two per cent lime and used in the open-hearth furnace roofs. Quartzite and sandstone with a maximum of one per cent, preferably less than 0.02 per cent iron, is useful in glass making.

*Distribution.*—Quartzites and sandstones form five stages in the Cuddapahs and two in the Kurnools. They are quarried at several places mainly for building stone or road metal and to a less extent for making rollers, mortars, and grinding stones. The great masterpieces of rock sculpture enshrined in the immortal temples of Animala (14° 28': 78° 31'), Gandikota (14° 49': 78° 17'),

and Ramallakota, exhibiting the same pattern of workmanship as the temples of Hampi, Vijayanagar, and those of Ahobilam (15° 8': 78° 41'), Mahanandi (15° 28': 78° 38') and other places in the Ceded districts have all been chiselled and carved out of quartzitic sandstones. (Fig. 6.)

The Paniam quartzites are not quite tough and suitable for intricate work. The Stambhagiriswami temple on the quartzite plateau of Uppalapadu is therefore built of massive limestone. These rocks also form the sculptured walls of Chennakeswaraswami temple on the Pushpagiri hill (△ 756-14°36': 78°46') of the Bairankonda quartzites in Cuddapah tahsil (Figure 4).

*Future.*—Some of the quartzites and sandstones of the Nallamala and the Palakonda Ranges and the Paniam pinnacled quartzites on the west of the Kunderu plain, on crushing and washing, may provide materials for refractories and glass-making industry 2.

SLATES

Slates are quarried largely for school slate. A compact homogeneous sericitic material free from graphite and iron oxides is useful for electrical insulation purposes.

1. *Banda, Gadde.*—A natural stone bench separated along joints.

*Bilamu-rayi, Biluku-rayi.*—Bilam stone or massive limestone.

*Chappata, Napa-rayi.*—Limestone slab.

*Chintapuvu-rayi.*—Limestone with intermixtures of purple and greenish grey.

*Kaki-rayi.*—Thin grey calcareous flag.

*Kavu-rayi.*—Purple massive limestone.

*Konda.*—Massive rock or hill.

*Nalla-biluku-rayi.*—Grey massive limestone.

*Nara-rayi.*—Tough flaggy limestone with ill-developed cleavage.

*Pindi-rayi.*—Whitish massive limestone.

*Pora.*—A layer, as in limestone slabs.

*Sudda-biluku, Sudda-chattu Sudda-rayi.*—Buff argillaceous flags, shale.

2. *Yerra-rayi.*—Red stone or quartzite.

*Isuka, Turva.*—Sand.

*Tuvva-rayi.*—Sandstone.



The waste material at the quarries finds use in paints, in making slate pencils, as aggregate for concrete, etc.

**Distribution.**—Slates have been formed by compaction and local metamorphism of fine clay sediments during the post-Cuddapah earth movements. In the Kurnool district, there is a band of commercially workable slate within the Cumbums extending from near Chinna Obanayanipalle (15° 33': 79° 11') in Cumbum taluk to Mallapeta (15° 49': 79° 23') in Markapur taluk, at the north-east extremity of the slate belt, about 24 miles long and two miles wide. Nayudipalle (15° 44': 79° 19') and Peddayachavaram (15° 46': 79° 20') are important localities in the belt. Individual bands of slates good enough for the manufacture of slates rarely exceed ten feet in length. Quality varies from band to band and sometimes even within the same band along strike.

Fairly good workable slate bands also occur in the neighbourhood of Gurrapusala (15° 58': 79° 14') and in the Ganapavaram R.F. area in Markapur taluk.

*Definite possibilities.*

(1)

Cement and allied industries—Portland cement, coloured cement, fireproof cement, asbestos cement products, artificial stone.

Electric insulators .. .. .

Lime-wash distempers .. .. .

Lithopone and paint industry—White, red, umber, yellow, grey paints, fireproof paint.

Sand or flint-paper .. .. .

Stoneware manufacture—

Floor tiles, sewage pipes, potteries, objects of art ..

*Possibilities to be investigated—*

Chemical Industry—

Barium compounds, sodium compounds, calcium carbide, bleaching powder, insecticides, silicates, etc.

Glass Industry .. .. .

Grinding wheels .. .. .

Prospecting for diamond may be started in some selected areas, but it will be a highly speculative venture.

Detailed prospecting of the gold occurrences is necessary before commencing gold mining. From available analyses, one or two occurrences in Kangundi taluk of the Chittoor district appear to be promising. Collection of alluvial gold may be encouraged.

Earth-salts may be exploited on cottage industry scale.

The present slate industry should be organised on a well-coordinated scientific basis.

**Future.**—At present over 90 per cent of the slates quarried go waste. Use of machinery, proper quarrying methods, careful preparation and organisation of industry are essential to minimise waste. The samples tested showed that they were suitable for use as electrical insulators, such as switch boards. The waste material may be utilised as stated above.\*

INTEGRATED MINERAL INDUSTRY IN THE CEDED DISTRICTS.

The industrial uses of minerals and their utilisation in future local industries have been stated under individual minerals, in the preceding pages. Industries which are definitely possible and those which need further investigation, based on the raw materials available in the Ceded districts, are indicated below:—

*Available raw materials.*

(2)

Limestones, shales or clays, asbestos, red ochre or oxide, steatite, yellow ochre.

Steatite, magnesite, slate.

Calc-tufa, red ochre or oxide, yellow ochre.

Barytes, slate, red ochre or oxide, yellow ochre, vein quartz, asbestos, steatite.

Vein quartz

White clays

for enamels and glazes: barytes, calc-tufa, red ochre or oxide, yellow ochre.

Barytes, calc-tufa, saline efflorescence, vein quartz.

Quartzite and sandstone, vein quartz, barytes, calc-tufa, earth soda.

Corundum.

The foregoing account of the mineral wealth of the Ceded districts is by no means complete, still about 14,000 square miles of the area remaining to be mapped on one inch to one mile scale, but the lines upon which mineral industries in the Ceded districts can be developed have been outlined.

An understanding of the mode of occurrence and origin of the mineral deposits of an area is of great help in the search for mineral deposits. It is seen that most minerals occur more particularly with certain geological formations. Some idea of the geological formations still to be surveyed on the modern one inch to one mile maps in each district can be had from the following table.

TABLE 7.

*Areas remaining to be mapped on  
1 inch=1 mile.\*\**

District	Total area (in sq. miles).	Remaining area (in sq. miles).	Geological formations
(1)	(2)	(3)	(4)
Anantapur .. .. .	7,837	5,653	Dharwar and Archaean crystallines.
Chittoor .. .. .	5,931	2,911	Dharwar, Archaean crystallines and Cheyyair (Cheyyeru) series.
Cuddapah .. .. .	5,923	3,489	Dharwar, Archaean crystallines, Cheyyair (Cheyyeru) and Nallamaki (Nallamala) series.
Kurnool .. .. .	9,275	1,809	Nallamalai (Nallamala) and Kistna (Krishna) series.

\* Palaka—Slate.

\*\*At the close of the field-season 1953-54.

## MINERAL PRODUCTION

The annual production of minerals in the different districts of the former Andhra State and their values, together with corresponding figures for the whole of India, is given in table 8 below, and a summarised statement of these in table 9, for comparative study. The district-wise annual mineral production figures for Telangana area could not be given as they were not readily available. It would be seen from the data that during the period 1946 to 1954, the Ceded districts, which are the sole producer of chrysotile asbestos in India, contributed 82 per cent by value of this mineral, though small in output, besides 99.5 per cent of barytes, 52.1 per cent (17.4 per cent by value) of ochre and 17.9 per cent (1.3 per cent by value) of steatite, produced in India. Production of gold, iron-ore and calcite also commenced. During the same period the contribution of the coastal districts was 10.9 per cent (8.7 per cent by

value) of mica, 5.9 per cent (7.0 per cent by value) of manganese-ore and 6.5 per cent (6.8 per cent by value) of chromite produced in India. Mining of graphite, kyanite and iron-ores also started here. The total value of minerals, excluding the building stones and salt, produced in the former Andhra State till 1954, comes to Rs. 17,00,00,000. Of this the share of the Ceded districts is 11.5 per cent. The greater share of the coastal districts is accounted for by manganese-ore and mica, whose total value alone exceeds Rs. 14,80,00,000. It is pertinent to point out here, that the proportion of manganese-ore and mica produced in the former Andhra State to the total Indian output has dwindled from 100 per cent and 33 per cent respectively, prior to 1900, to the present percentages of 6 and 11, which is not due to a diminution in the production in Andhra, but to the steadily increasing output in other parts of the country.

TABLE 8.

Comparative statement showing quantity and value of minerals produced in the former Andhra State and their respective figures for the whole of India.

Minerals	1892		1893		1894		1895	
	Quantity (Tons)	Value (Rs)	Quantity (Tons)	Value (Rs)	Quantity (Tons)	Value (Rs)	Quantity (Tons)	Value (Rs)
	(1)	(2)	(1)	(2)	(1)	(2)	(1)	(2)
<b>GOLD—</b>								
Chittoor .. ..	..	..	(a)	(a)	(a)	(a)	(a)	(a)
<b>MANGANESE-ORE—</b>								
Visakhapatnam ..	674	(b) 4,583	3,130	(b) 21,284	11,410	(b) 77,588	15,816	(b) 1,07,549
India .. ..	..	..	..	..	..	..	..	..
<b>MICA—</b>								
Nellore .. ..	(a)	(a)	(a)	(a)	(a)	(a)	(a)	(a)

Minerals.	1896		1897		1898		1899	
	Quantity (Tons)	Value (Rs)	Quantity (Tons)	Value (Rs)	Quantity (Tons)	Value (Rs)	Quantity (Tons)	Value (Rs)
	(1)	(2)	(1)	(2)	(1)	(2)	(1)	(2)
<b>GOLD—</b>								
Chittoor .. ..	(a)	(a)	(a)	(a)	2,854 oz.	1,64,895	(a)	18,915
India .. ..	..	..	..	..	(a)	2,40,40,410	(a)	2,57,61,675
<b>MANGANESE-ORE—</b>								
Visakhapatnam ..	56,869	(b) 3,86,699	74,467	(b) 5,06,376	60,449	4,11,390	87,126	5,92,935
India .. ..	..	..	..	..	..	..	..	..
<b>MICA—</b>								
Nellore .. ..	(a)	(a)	3,264 cwt. (c)	3,17,745	3,206 cwt. (c)	3,24,420	7,071 cwt. (c)	3,90,525
India .. ..	..	..	11,608 cwt. (c)	10,68,510	10,947 cwt. (c)	8,28,350	22,599 cwt. (c)	11,00,580

Minerals.	1900		1901		1902		1903	
	Quantity (Tons)	Value (Rs.)	Quantity (Tons)	Value (Rs.)	Quantity (Tons)	Value (Rs.)	Quantity (Tons)	Value (Rs.)
	(1)	(2)	(1)	(2)	(1)	(2)	(1)	(2)
<b>GOLD—</b>								
Chittoor .. ..	(a)	255	..	..	..	..	..	..
India .. ..	(a)	2,33,77,360	..	..	..	..	..	..
<b>MANGANESE-ORE—</b>								
Visakhapatnam ..	92,458	(d) 8,41,368	76,463	(e) 7,49,337	68,171	(f) 7,83,967	63,452	(g) 7,36,043
India .. ..	1,27,814	11,60,160	1,20,891	11,86,785	1,57,779	18,08,070	1,71,806	19,91,115
<b>MICA—</b>								
Nellore .. ..	19,517 cwt. (c)	6,96,075	4,421 cwt. (c)	2,53,125	3,755 cwt. (c)	2,89,800	3,330 cwt. (c)	2,71,778 (h)
India .. ..	33,175 cwt. (c)	16,43,310	16,298 cwt. (c)	10,50,510	20,412 cwt. (c)	13,13,910	21,548 cwt. (c)	12,94,455

TABLE 8.—*contd.*

Comparative statement showing quantity and value of minerals produced in the former Andhra State and their respective figures for the whole of India—*contd.*

Minerals	1904		1905		1906		1907	
	Quantity (Tons)	Value (Rs.)	Quantity (Tons)	Value (Rs.)	Quantity (Tons)	Value (Rs.)	Quantity (Tons)	Value (Rs.)
	(1)	(2)	(1)	(2)	(1)	(2)	(1)	(2)
<b>DIAMONDS—</b>								
Anantapur .. ..	(a)	(a)	(a)	(a)	(a)	(a)	(a)	(a)
Kurnool .. ..	(a)	(a)	(a)	(a)	(a)	(a)	(a)	(a)
<b>MANGANESE-ORE—</b>								
Visakhapatnam ..	53,602	(f) 5,59,471	63,789	(i) 6,65,808	1,11,501	(j) 11,63,729	1,36,169	(l) 14,21,264
India .. ..	1,50,190	21,36,645	2,47,427	39,40,440	5,71,495	1,31,17,485	9,02,291	2,04,29,940
<b>MICA—</b>								
Nellore .. ..	4,840 cwt.	(k) 4,42,134	8,220 cwt.	(m) 6,36,228	24,420 cwt.	(o) 14,54,211	15,865 cwt.	(q) 10,28,052
India .. ..	22,164 cwt.	(f) 16,62,300	25,641 cwt.	(n) 19,42,306	52,543 cwt.	(p) 39,01,318	52,203 cwt.	(r) 45,88,644

Minerals	1908		1909		1910		1911	
	Quantity (Tons)	Value (Rs.)	Quantity (Tons)	Value (Rs.)	Quantity (Tons)	Value (Rs.)	Quantity (Tons)	Value (Rs.)
	(1)	(2)	(1)	(2)	(1)	(2)	(1)	(2)
<b>CORUNDUM—</b>								
Nellore .. ..	..	..	..	..	(a)	(a)	(a)	(a)
<b>DIAMONDS—</b>								
Anantapur .. ..	(a)	(a)	(a)	(a)	(a)	(a)	(a)	(a)
Kurnool .. ..	(a)	(a)	111.37 carats.	705	(x) 5.5 carats.	195	(x) 8.75 carats.	45
India .. ..	..	..	147.35 carats.	16,335	77.74 carats.	8,850	52.96 carats.	8,670
<b>GOLD—</b>								
Anantapur .. ..	..	..	..	..	2,332 oz.	1,51,800	5,284 oz.	3,12,525
India .. ..	..	..	..	..	5,72,919.94 oz.	3,30,37,290	5,83,567.18 oz.	3,35,72,145
<b>MANGANESE-ORE—</b>								
Visakhapatnam ..	94,676	(f) 9,88,193	59,818	5,90,700	46,441	5,92,125	58,915	6,99,615
India .. ..	6,74,315	77,57,490	6,44,660	90,58,620	8,00,907	1,27,37,325	6,70,290	97,30,515
<b>MICA—</b>								
Nellore .. ..	11,249 cwt.	(s) 7,20,496	(u) 8,948 cwt.	(v) 6,63,047	(r) 3,586 cwt.	(y) 2,56,578	(u) 7,462 cwt.	3,87,780
India .. ..	53,543 cwt.	(f) 38,55,096	32,903 cwt.	(w) 22,50,565	22,699 cwt.	(z) 15,08,349	33,896 cwt.	10,58,280
<b>SAMARSKITE—</b>								
Nellore .. ..	..	..	..	..	..	..	24 cwt.	1,335
India .. ..	..	..	..	..	..	..	..	..
<b>STREATITE—</b>								
Kurnool .. ..	..	..	..	..	20	1,200	166	3,315
Nellore .. ..	..	..	..	..	8	315	126	5,100
Total .. ..	..	..	..	..	28	1,515	292	8,415
India .. ..	..	..	..	..	244	16,620	920	30,390

Minerals	1912		1913		1914		1915	
	Quantity (Tons)	Value (Rs.)	Quantity (Tons)	Value (Rs.)	Quantity (Tons)	Value (Rs.)	Quantity (Tons)	Value (Rs.)
	(1)	(2)	(1)	(2)	(1)	(2)	(1)	(2)
<b>CORUNDUM—</b>								
Nellore .. ..	(a)	(a)	(a)	(a)	..	..	..	..
<b>DIAMONDS—</b>								
Anantapur .. ..	(u)	(a)	(a)	(a)	(a)	(a)	(a)	(a)
Kurnool .. ..	19.17 carats.	165	37 carats.	330	(a)	(a)	(a)	(a)
India .. ..	27.74 carats.	6,165	115.70 carats.	26,865	..	..	..	..
<b>GARNET—</b>								
Nellore .. ..	1 cwt.	4	..	..	..	..	..	..
India .. ..	..	..	..	..	..	..	..	..
<b>GOLD—</b>								
Anantapur .. ..	7,269 oz.	4,27,485	11,019 oz.	6,47,910	19,873 oz.	12,44,385	23,870 oz.	15,19,860
India .. ..	5,90,554.92 oz.	34,0,77,090	5,95,761.11 oz.	3,43,78,755	6,07,388.07 oz.	3,50,75,985	6,16,728.24 oz.	3,55,47,690

TABLE 8.—contd.

Comparative statement showing quantity and value of minerals produced in the former Andhra State and their respective figures for the whole of India—contd.

Minerals	1912—contd.		1913—contd.		1914—contd.		1915—contd.	
	Quantity	Value	Quantity	Value	Quantity	Value	Quantity	Value
	(Tons)	(Rs.)	(Tons)	(Rs.)	(Tons)	(Rs.)	(Tons)	(Rs.)
	(1)	(2)	(1)	(2)	(1)	(2)	(1)	(2)
<b>MANGANESE-ORE—</b>								
Visakhapatnam .. ..	54,758	9,34,305	44,127	7,91,535	26,375	3,51,120	288	6,270
India .. ..	6,33,080	1,32,66,060	8,15,047	1,81,65,510	6,82,898	1,31,58,960	4,50,416	1,39,43,190
<b>MICA—</b>								
Nellore .. ..	13,484	5,52,225	11,200	7,12,410	5,989.5	5,42,100	3,894	3,10,920
India .. ..	cwt. (ii). 43,832	14,59,290	cwt. (ii). 45,761	17,29,835	cwt. 40,506.6	13,21,350	cwt. 27,139.7	11,12,083
<b>SAMARSKITE—</b>								
Nellore .. ..	29 cwt.	1,215	3 cwt.	105	43 cwt.	1,815	..	..
India .. ..	..	..	..	..	..	..	..	..
<b>STEATITE—</b>								
Kurnool .. ..	..	..	545	66,540	210	23,640	..	..
Nellore .. ..	40	360	20	780	60	10,725	45.7	6,103
Total .. ..	..	..	565	67,320	270	34,365	..	..
India .. ..	788	22,890	2,525	1,00,500	999	62,190	1,077.1	38,670
<b>Minerals</b>								
	1916		1917		1918		1919	
	Quantity	Value	Quantity	Value	Quantity	Value	Quantity	Value
	(Tons)	(Rs.)	(Tons)	(Rs.)	(Tons)	(Rs.)	(Tons)	(Rs.)
	(1)	(2)	(1)	(2)	(1)	(2)	(1)	(2)
<b>BARYTES—</b>								
Kurnool .. ..	..	..	..	..	2,724	44,215	2,590	15,615
India .. ..	..	..	..	..	..	..	..	..
<b>GOLD—</b>								
Anantapur .. ..	22,371	14,21,835	20,529	13,05,990	17,831	10,08,285	11,018	6,16,934
India .. ..	oz. 5,98,369.69	3,45,45,345	oz. 5,74,293.01	3,33,28,335	oz. 5,36,118.32	3,09,02,280	oz. 5,07,260.56	2,44,68,639
<b>MANGANESE-ORE—</b>								
Visakhapatnam .. ..	2,755	43,395	1,682	27,960	2,230	50,730	2,778	58,041
India .. ..	6,45,204	2,13,00,390	5,90,813	2,25,16,200	5,17,953	2,22,26,025	5,37,995	1,77,82,795
<b>MICA—</b>								
Nellore .. ..	15,675 cwt.	4,34,175	6,050	6,85,770	6,544.7	4,61,593	8,320.6	5,25,800
India .. ..	43,399.8 cwt.	16,38,660	cwt.(ii) 40,907.6	21,24,072	cwt.(ii) 54,710.3	23,79,517	cwt. 45,783.7	21,98,426
<b>SAMARSKITE—</b>								
Nellore .. ..	..	..	67 lb.	30	1.5 cwt.	67	..	..
India .. ..	..	..	..	..	..	..	..	..
<b>STEATITE—</b>								
Kurnool .. ..	10.45	1,740	10.3	1,725	10.1	1,650	4	662
Nellore .. ..	50.5	3,765	19.5	1,155	51	3,270	74	4,762
Total .. ..	60.95	5,505	29.8	2,880	61.1	4,920	78	5,424
India .. ..	1,213.7	39,420	2,966.7	78,720	4,538.3	1,15,626	6,807	97,058
<b>Minerals</b>								
	1920		1921		1922		1923	
	Quantity	Value	Quantity	Value	Quantity	Value	Quantity	Value
	(Tons)	(Rs.)	(Tons)	(Rs.)	(Tons)	(Rs.)	(Tons)	(Rs.)
	(1)	(2)	(1)	(2)	(1)	(2)	(1)	(2)
<b>ARYTES—</b>								
Kurnool .. ..	678	15,528	1,457	47,603	1,742	41,500	1,603	22,749
India .. ..	..	..	..	..	..	..	..	..
<b>GOLD—</b>								
Anantapur .. ..	13,645 oz.	8,03,535	10,108 oz.	7,21,359	8,388 oz.	6,08,673	1,519 oz.	1,01,016
India .. ..	4,99,067.61	2,73,31,158	4,32,722.59	3,07,58,627	4,38,015.04	2,78,63,654	4,22,306.56	2,55,39,638
<b>MANGANESE-ORE—</b>								
Visakhapatnam .. ..	7,386	2,78,820	16,593	4,04,460	7,845	1,57,875	22,524	8,19,750
India .. ..	7,36,439	3,58,60,720	6,79,286	2,30,56,020	4,74,401	1,37,31,420	6,95,055	3,32,39,760
<b>MICA—</b>								
Krishna .. ..	83 cwt.	2,701	8 cwt.	499	..	..	..	..
Nellore .. ..	11,160.8 cwt.	5,60,979	4,297 cwt.	2,05,149	1,246.2 cwt.	89,254	8,671 cwt.	3,14,703
Total .. ..	11,243.8 cwt.	5,63,680	4,305 cwt.	2,05,598	..	..	..	..
India .. ..	46,952.5 cwt.	23,50,775	32,488 cwt.	15,93,566	31,878.1 cwt.	12,02,704	33,855.2 cwt.	15,87,945
<b>SAMARSKITE—</b>								
Nellore .. ..	2.5 cwt.	101	..	..	..	..	..	..
India .. ..	..	..	..	..	..	..	..	..
<b>SLATE—</b>								
Kurnool .. ..	..	..	213	345	108	210	113	225
India .. ..	..	..	52,218.5	1,73,093	39,785	1,66,009	13,291	1,95,190
<b>STEATITE—</b>								
Nellore .. ..	32	2,864	40.5	5,866	70.4	3,969	77	4,417
India .. ..	3,853.4	1,07,555	8,049.0	1,02,187	4,753.5	62,651	7,023.5	81,558

TABLE 8.—*contd.*

Comparative statement showing quantity and value of minerals produced in the former Andhra State and their respective figures for the whole of India—*contd.*

Minerals	1924		1925		1926		1927	
	Quantity	Value	Quantity	Value	Quantity	Value	Quantity	Value
	(Tons)	(Rs.)	(Tons)	(Rs.)	(Tons)	(Rs.)	(Tons)	(Rs.)
	(1)	(2)	(1)	(2)	(1)	(2)	(1)	(2)
ASBESTOS—								
Cuddapah .. .. .	13.5	5,400	16.0	4,796	18.4	5,529	22.0	6,604
India .. .. .	125.3	18,826	..	..	58.4	10,529	67.7	13,554
BARYTES—								
Kurnool .. .. .	783	11,341	580	7,760	350	1,400	851	5,550
India .. .. .	2,303	31,341	1,450	17,660	2,311	9,244	1,719	9,890
COPPER—								
Nellore .. .. .	..	..	..	..	4	160	10	400
India .. .. .	..	..	..	..	20,949	46,68,304	16,882	45,13,605
GOLD—								
Anantapur .. .. .	3,646 oz.	2,38,603	288 oz.	16,517	930 oz.	53,219	2,395 oz.	1,37,320
India .. .. .	3,96,351.1 oz.	2,54,01,316	3,93,875.1oz.	2,22,57,562	3,84,158.5oz.	2,17,64,783	3,84,272.5oz.	2,18,00,629
MANGANESE-ORE—								
Kurnool .. .. .	390	11,926	6	173	..	..	..	..
Visakhapatnam .. .. .	31,811	6,53,715	26,909	7,87,360	21,698	5,00,343	31,992	7,55,572
Total .. .. .	32,201	6,65,641	26,915	7,87,533	..	..	..	..
India .. .. .	8,03,006	3,78,07,291	8,39,461	3,48,09,026	10,14,928	3,47,10,784	11,29,353	3,81,12,776
MICA—								
Nellore .. .. .	10,908 cwt.	4,97,307	14,378 cwt.	5,91,390	11,271 cwt.	5,98,532	9,265 cwt.	5,93,374
India .. .. .	40,908 cwt.	20,58,917	45,990 cwt.	21,99,516	41,924 cwt.	22,19,367	42,614 cwt.	24,52,055
SLATE—								
Kurnool .. .. .	8	15	..	..	..	..	..	..
India .. .. .	13,400	1,90,956	..	..	..	..	..	..
STEATITE—								
Kurnool .. .. .	4	245	4	244	3	210	..	..
Nellore .. .. .	108	6,538	82	5,724	65	2,411	87	3,917
Total .. .. .	112	6,783	86	5,968	68	2,621	..	..
India .. .. .	3,073	71,337	8,526	2,01,086	9,674	1,50,260	5,053	1,04,732

Minerals	1928		1929		1930		1931	
	Quantity	Value	Quantity	Value	Quantity	Value	Quantity	Value
	(Tons)	(Rs.)	(Tons)	(Rs.)	(Tons)	(Rs.)	(Tons)	(Rs.)
	(1)	(2)	(1)	(2)	(1)	(2)	(1)	(2)
ASBESTOS—								
Cuddapah .. .. .	8.5	1,275	88.4	3,160	33.2	1,190	..	..
India .. .. .	156.5	21,735	318.4	16,160	..	..	6.0	70
BARYTES—								
Cuddapah .. .. .	..	..	..	..	..	..	1,335	8,750
Kurnool .. .. .	620	4,610	802	5,151	5,633	42,578	4,158	33,490
Total .. .. .	..	..	..	..	..	..	5,493	42,240
India .. .. .	3,096	19,610	3,750	22,739	6,797	49,562	5,654	43,206
MANGANESE-ORE—								
Kurnool .. .. .	..	..	..	..	50	513	..	..
Visakhapatnam .. .. .	29,094	6,10,772	24,533	3,17,781	13,213	1,52,361	5,389	63,045
Total .. .. .	..	..	..	..	13,263	1,52,874	..	..
India .. .. .	9,78,449	3,11,04,093	9,94,279	2,10,51,802	8,29,946	1,62,03,186	5,37,844	98,13,879
MICA—								
Nellore .. .. .	8,838	4,77,328	10,085	5,45,854	11,177	6,40,014	6,893	3,41,094
India .. .. .	45,112 cwt.	24,10,499	53,231 cwt.	26,59,759	52,727 cwt.	26,68,986	38,963 cwt.	20,37,634
STEATITE—								
Nellore .. .. .	49	2,331	17	176	35	1,910	50	1,000
India .. .. .	5,539	1,30,070	7,217	2,76,483	6,857	2,06,086	5,135	1,21,508

Minerals	1932		1933		1934		1935	
	Quantity	Value	Quantity	Value	Quantity	Value	Quantity	Value
	(Tons)	(Rs.)	(Tons)	(Rs.)	(Tons)	(Rs.)	(Tons)	(Rs.)
	(1)	(2)	(1)	(2)	(1)	(2)	(1)	(2)
ASBESTOS—								
Cuddapah .. .. .	..	..	..	..	5.4	1,620	27	1,267
India .. .. .	90.0	9,000	..	..	25.4	4,140	62.7	4,567
BARYTES—								
Anantapur .. .. .	116	1,726	216	2,045	100	625	..	..
Cuddapah .. .. .	1,359	18,535	3,974	29,810	2,536	25,222	3,626	20,500
Kurnool .. .. .	949	6,213	1,354	8,592	623	4,396	936	5,560
Total .. .. .	2,424	26,474	5,544	40,447	3,259	30,443	4,562	26,060
India .. .. .	2,957	29,372	5,651	41,517	3,813	35,265	5,493	34,954

TABLE 8.—contd.

Comparative statement showing quantity and value of minerals produced in the former Andhra State and their respective figures for the whole of India—contd.

Minerals	1932—contd.		1933—contd.		1934—contd.		1935—contd.	
	Quantity	Value	Quantity	Value	Quantity	Value	Quantity	Value
	(Tons)	(Rs.)	(Tons)	(Rs.)	(Tons)	(Rs.)	(Tons)	(Rs.)
	(1)	(2)	(1)	(2)	(1)	(2)	(1)	(2)
<b>COPPER—</b>								
Nellore .. .. .	365	6,900	..	..	..	..	..	..
India .. .. .	1,76,071	46,57,964	..	..	..	..	..	..
<b>MANGANESE-ORE—</b>								
Kurnool .. .. .	..	..	300	1,649	..	..	..	..
Visakhapatnam .. .. .	8,049	42,148	16,698	98,540	20,145	1,61,316	15,885	1,47,883
Total .. .. .	..	..	16,998	1,00,189	..	..	..	..
India .. .. .	2,12,604	18,62,293	2,18,307	16,38,174	4,06,306	51,75,239	6,41,483	1,02,45,838
<b>MICA—</b>								
Nellore .. .. .	8,318 cwt.	3,82,056	7,932 cwt.	3,97,462	9,114 cwt.	3,67,642	9,452 cwt.	3,87,378
India .. .. .	32,713 cwt.	14,35,401	41,075 cwt.	16,82,045	55,706 cwt.	20,76,599	65,430 cwt.	25,52,612
<b>STEATITE—</b>								
Anantapur .. .. .	..	..	..	..	..	..	260	2,150
Nellore .. .. .	41	1,909	30	1,650	26	390	25	238
Total .. .. .	..	..	..	..	..	..	285	2,388
India .. .. .	6,512	1,29,490	17,048	1,82,964	9,375	1,70,239	12,596	1,91,663
<b>ASBESTOS—</b>								
Cuddapah .. .. .	..	..	..	..	..	..	33.9	30,000
India .. .. .	56.5	3,107	100.45	6,022	88.7	4,482	262.3	41,948
<b>BARYTES—</b>								
Cuddapah .. .. .	4,609	11,762	15,405	1,46,720	7,732	26,252	7,899	49,453
Kurnool .. .. .	314	2,324	130	1,150	200	1,800	716	6,444
Total .. .. .	4,923	14,086	15,535	1,47,870	7,932	28,052	8,615	55,897
India .. .. .	5,114	16,049	15,689	1,49,260	8,075	29,312	9,255	60,842
<b>KYANITE—</b>								
Nellore .. .. .	..	..	..	..	..	..	7	33
India .. .. .	..	..	..	..	..	..	13,964	2,89,526
<b>MANGANESE-ORE—</b>								
Kurnool .. .. .	..	..	200	5,626	..	..	..	..
Visakhapatnam .. .. .	15,258	1,61,502	20,509	6,00,096	31,809	10,30,581	34,640	5,11,840
Total .. .. .	..	..	20,709	6,05,722	..	..	..	..
India .. .. .	813,442	1,49,88,545	10,51,594	4,30,49,955	967,929	3,98,42,264	844,663	1,82,59,154
<b>MICA—</b>								
Nellore .. .. .	13,609 cwt.	4,99,290	15,647 cwt.	6,48,075	22,201 cwt.	5,81,921	22,429 cwt.	8,83,488
India .. .. .	99,143 cwt.	32,52,350	1,33,440 cwt.	39,50,281	1,60,144 cwt.	42,04,633	1,54,685 cwt.	51,80,934
<b>STEATITE—</b>								
Anantapur .. .. .	40	600	13	195	..	..	..	..
Guntur .. .. .	..	..	..	..	7,128	4,755	7,985	19,775
Nellore .. .. .	74	2,612	27	1,080	32	1,280	70	1,120
Total .. .. .	114	3,212	40	1,275	7,160	6,035	8,055	20,895
India .. .. .	9,968	1,56,983	13,040	1,55,221	18,590	1,68,580	22,259	2,03,841
<b>ASBESTOS—</b>								
Cuddapah .. .. .	31.25	28,000	29	25,084	60	96,060	33	50,325
India .. .. .	291.70	41,794	365.85	45,329	506.55	1,16,757	894.55	68,966
<b>BARYTES—</b>								
Anantapur .. .. .	5,302	(j) 42,416	7,635	(j) 30,540	4,184	(j) 32,472	5,422	69,263
Cuddapah .. .. .	9,507	66,549	13,060	(j) 59,424	4,665	36,062	2,472	24,666
Kurnool .. .. .	2,931	26,379	1,450	(j) 13,050	1,155	11,550	..	..
Total .. .. .	17,740	1,35,344	22,145	1,03,014	10,004	80,084	7,894	93,929
India .. .. .	18,778	1,43,449	23,467	1,13,405	11,156	90,144	8,860	1,15,889

TABLE 8.—contd.

Comparative statement showing quantity and value of minerals produced in the former Andhra State and their respective figures for the whole of India—contd.

Minerals	1940—contd.		1941—contd.		1942—contd.		1943—contd.	
	Quantity	Value	Quantity	Value	Quantity	Value	Quantity	Value
	(Tons)	(Rs.)	(Tons)	(Rs.)	(Tons)	(Rs.)	(Tons)	(Rs.)
	(1)	(2)	(1)	(2)	(1)	(2)	(1)	(2)
<b>CHROMITE—</b>								
Krishna .. .. .			170	3,400	525	10,500	500	10,000
India .. .. .			11,935	3,32,871	14,415	4,10,004	10,227	2,97,126
<b>COPPER—</b>								
Nellore .. .. .							26	392
India .. .. .							3,59,789	61,80,492
<b>GYP SUM—</b>								
Nellore .. .. .							193	3,910
India .. .. .							82,267	2,72,650
<b>MANGANESE-ORE—</b>								
Visakhapatnam .. .. .	29,536	(a)	14,565	(a)	3,065	(a)	7,704	(a)
India .. .. .	8,68,918	(a)	7,91,141	(a)	7,57,269	(a)	5,95,366	(a)
<b>MICA—</b>								
Nellore .. .. .	26,688	(a)	15,121	(a)	18,344	(a)	20,271	(a)
	cwt. (u)		cwt. (u)		cwt. (u)		cwt. (u)	
India .. .. .	140,295	(a)	1,84,484	(a)	1,85,342	(a)	159,581	(a)
	cwt.		cwt.		cwt.		cwt.	
<b>STEATITE—</b>								
Anantapur .. .. .					365	9,125		
Guntur .. .. .	10,808	2,086						
Kurnool .. .. .					12,801	19,218		
Nellore .. .. .	9	144	107	1,407				
Total .. .. .	10,817	2,230			13,166	28,343		
India .. .. .	29,709	2,66,167	26,151	7,48,916	44,611	9,59,109	16,436	4,25,772
Minerals	1944		1945		1946		1947	
	Quantity	Value	Quantity	Value	Quantity	Value	Quantity	Value
	(Tons)	(Rs.)	(Tons)	(Rs.)	(Tons)	(Rs.)	(Tons)	(Rs.)
	(1)	(2)	(1)	(2)	(1)	(2)	(1)	(2)
<b>ASBESTOS—</b>								
Cuddapah .. .. .	58	85,759	38	4,717	18	20,044		
India .. .. .	583	1,21,805	820	78,383	307	48,040	160	15,394
<b>BARYTES—</b>								
Anantapur .. .. .	2,984	27,684	9,603	89,251	12,664	1,38,579	13,539	1,59,340
Cuddapah .. .. .	6,508	71,970	9,408	2,77,186	12,140	1,81,696	6,131	1,20,697
Kurnool .. .. .	4,075	45,599	3,692	42,948	4,070	44,055	4,555	47,820
Total .. .. .	13,567	1,45,253	22,703	4,09,385	28,874	3,64,330	24,225	3,27,857
India .. .. .	15,299	1,79,358	24,655	4,26,946	29,091	3,68,680	24,310	3,29,557
<b>CHROMITE—</b>								
Krishna .. .. .	500	10,000			274	6,850	153	6,380
India .. .. .	18,686	3,90,168	10,445	3,63,862	24,201	6,91,850	34,717	9,97,639
<b>MANGANESE-ORE—</b>								
Visakhapatnam .. .. .	3,203	(a)						
India .. .. .	7,71,471	(a)	3,70,980	(a)	2,52,916	55,21,081	4,51,034	96,40,563
<b>MICA—</b>								
Krishna .. .. .					54	3,941	186	14,487
					cwt.		cwt.	
Nellore .. .. .	11,929	(a)	17,316	(a)	14,124	6,85,294	13,604	6,83,262
	cwt. (u)		cwt. (u)		cwt.		cwt.	
Visakhapatnam .. .. .					3	(a)		
					cwt.			
Total .. .. .					14,181	6,89,235	13,790	6,97,749
					cwt.		cwt.	
India .. .. .	1,39,392	(a)	1,28,313	(a)	1,30,363	1,60,34,984	1,36,308	1,81,84,020
	cwt.		cwt.		cwt.		cwt.	
<b>OHRE—</b>								
Kurnool .. .. .					1,919	9,845	2,385	12,558
India .. .. .					8,701	1,72,437	11,397	2,00,153
<b>SLATE—</b>								
Kurnool .. .. .							477	9,540
India .. .. .							13,752	5,60,524
<b>STEATITE—</b>								
Anantapur .. .. .	202	6,060	148	5,760	69	4,200	284	8,135
Kurnool .. .. .	243	4,744	182	3,190	180	3,600	222	4,440
Nellore .. .. .	7	1,050	24	943			563	5,000
Total .. .. .	452	11,854	354	9,893	249	7,800	1,069	17,575
India .. .. .	21,392	4,61,489	22,511	5,61,577	22,369	6,94,227	20,652	10,02,819

TABLE 8.—*contd.*

Comparative statement showing quantity and value of minerals produced in the former Andhra State and their respective figures for the whole of India—*contd.*

Minerals	1948		1949		1950		1951	
	Quantity	Value	Quantity	Value	Quantity	Value	Quantity	Value
	(Tons)	(Rs.)	(Tons)	(Rs.)	(Tons)	(Rs.)	(Tons)	(Rs.)
	(1)	(2)	(1)	(2)	(1)	(2)	(1)	(2)
<b>ASBESTOS—</b>								
Cuddapah	..	..	76	75,575	119	1,53,700	136	1,78,634
India	..	..	146	89,825	208	1,80,802	518	2,38,762
<b>BARYTES—</b>								
Anantapur	..	..	10,882	1,16,897	9,739	86,933	3,194	29,971
Cuddapah	..	..	10,775	2,19,866	8,745	1,44,589	6,152	1,73,303
Kurnool	..	..	1,486	23,166	2,612	57,737	2,602	37,875
Total	..	..	23,043	3,49,829	21,096	2,89,259	11,948	2,41,149
India	..	..	23,143	3,59,929	21,118	2,90,579	11,963	2,41,749
<b>CALCITE—</b>								
Anantapur	..	..	..	..	..	..	595	3,455
India	..	..	..	..	..	..	1,380	24,550
<b>CHROMITE—</b>								
Krishna	..	..	1,727	1,03,640	5,142	2,07,320	3,961	1,43,785
India	..	..	22,555	7,05,963	19,416	6,25,306	16,729	5,69,095
<b>GRAPHITE—</b>								
East Godavari	..	..	..	..	..	..	..	..
India	..	..	..	..	..	..	..	..
<b>KYANITE—</b>								
Nellore	..	..	84	3,360	38	1,900	14	14,000
India	..	..	12,605	5,68,182	19,949	15,23,443	35,488	32,93,983
<b>MANGANESE-ORE—</b>								
Visakhapatnam	..	..	11,359	2,42,416	21,339	14,72,391	33,755	32,40,480
India	..	..	5,25,876	1,78,49,256	6,45,825	4,45,61,925	8,82,929	8,47,61,184
<b>MICA—</b>								
Krishna	..	..	106 cwt.	17,140	50 cwt.	12,476	..	..
Nellore	..	..	21,730 cwt.	10,58,914	16,944 cwt.	8,59,175	19,134 cwt.	26,92,165
Visakhapatnam	..	..	..	..	..	..	30 cwt.	(a)
Total	..	..	21,836 cwt.	10,76,054	16,994 cwt.	8,71,651	19,164 cwt.	..
India	..	..	1,51,273 cwt.	1,86,13,901	1,51,709 cwt.	1,85,48,525	1,62,447 cwt.	2,55,23,158
<b>OCHRE—</b>								
Kurnool	..	..	765	7,650	486	4,860	630	3,937
India	..	..	10,557	2,86,809	5,971	1,13,933	11,987	1,81,440
<b>SLATE—</b>								
Kurnool	..	..	..	..	2,593	8,680	..	..
India	..	..	..	..	20,323	9,76,320	..	..
<b>STEATITE—</b>								
Anantapur	..	..	244	6,110	555	10,181	164	4,574
Kurnool	..	..	..	..	..	..	50	1,250
Nellore	..	..	30	1,800	..	..	..	..
Total	..	..	274	7,910	..	..	214	5,824
India	..	..	18,096	12,05,582	21,195	10,91,411	25,485	5,48,381
<b>CHITTOOR—</b>								
India	..	..	..	..	..	..	105oz	23,780
	..	..	..	..	..	..	2,39,168.2	5,62,06,814

Minerals	1952		1953		1954	
	Quantity	Value	Quantity	Value	Quantity	Value
	(Tons)	(Rs.)	(Tons)	(Rs.)	(Tons)	(Rs.)
	(1)	(2)	(1)	(2)	(1)	(2)
<b>ASBESTOS—</b>						
Cuddapah	..	..	241	4,12,066	258.11	5,04,735
India	..	..	865	4,93,429	718.14	5,55,233
<b>BARYTES—</b>						
Anantapur	..	..	292	2,508	1,418	13,729
Cuddapah	..	..	6,744	2,51,542	7,094	89,630
Kurnool	..	..	2,994	52,620	888	22,211
Total	..	..	10,030	3,06,670	9,400	1,25,570
India	..	..	..	..	..	..
<b>CALCITE—</b>						
Anantapur	..	..	1,160	5,500	1,599	12,216
India	..	..	3,582	42,903	2,587	38,120
<b>CHINA CLAY—</b>						
Andhra	..	..	(a)	(a)	2,213	11,065
India	..	..	..	..	94,422	19,82,190
<b>CHROMITE—</b>						
Krishna	..	..	1,218	58,343	1,385	44,718
India	..	..	35,187	18,36,753	64,770	25,29,782
<b>GOLD—</b>						
Chittoor	..	..	..	..	..	..
India	..	..	..	..	..	..



TABLE 8.—*contd.*

Comparative statement showing quantity and value of minerals produced in the former Andhra State and their respective figures for the whole of India—*contd.*

Minerals.	1952— <i>contd.</i>		1953— <i>contd.</i>		1954— <i>contd.</i>	
	Quantity	Value	Quantity	Value	Quantity	Value
	(Tons)	(Rs.)	(Tons)	(Rs.)	(Tons)	(Rs.)
	(1)	(2)	(1)	(2)	(1)	(2)
<b>GRAPHITE—</b>						
West Godavari .. .. .	157	15,700	70	7,000	100	10,000
Visakhapatnam .. .. .	..	..	..	..	100	10,000
Total .. .. .	..	..	..	..	200	20,000
India .. .. .	2,881	3,13,498	767	69,092	1,479	1,36,561
<b>IRON-ORE</b>						
Chittoor .. .. .	2,962	11,850	28,742	2,40,678	20,036	80,144
Cuddapah .. .. .	5,791	78,178	15,267	2,22,705	6,625	67,797
Krishna .. .. .	..	..	..	..	1,67,173	11,44,205
Kurnool .. .. .	7,560	37,800	32,535	1,12,520	54,838	1,75,718
Total .. .. .	16,313	1,27,828	76,544	5,75,903	2,48,672	14,67,864
India .. .. .	39,25,511	2,68,33,315	38,54,865	2,80,90,695	43,08,273	2,89,36,036
<b>KYANITE—</b>						
Nellore .. .. .	1,729	86,475	1,525	78,386	32	1,625
India .. .. .	26,882	63,16,876	15,374	23,66,004	42,330	87,80,362
<b>MANGANESE-ORE—</b>						
Srikakulam † .. .. .	1,15,617	1,77,47,209	2,16,837	3,36,09,735	58,494	81,30,666
Visakhapatnam .. .. .	..	..	2,187	3,38,985	..	..
Total .. .. .	..	..	2,19,024	3,39,48,720	..	..
India .. .. .	14,62,264	22,44,57,524	19,02,238	29,48,46,890	14,13,847	19,54,17,452
<b>MICA—</b>						
Nellore .. .. .	12,966	21,59,319	13,993	22,08,000	11,496	23,01,406
India .. .. .	(cwt.) 1,52,209	2,20,60,906	(cwt.) 1,28,492	1,76,84,370	1,03,381	1,55,91,884
<b>OCHRE—</b>						
Kurnool .. .. .	5,011	27,749	44,490	90,031	54,367	2,26,836
India .. .. .	17,600	3,04,929	59,631	2,80,756	75,506	5,47,139
<b>SALT—</b>						
Andhra .. .. .	(a)	(a)	2,88,860	47,36,751	1,62,867	26,30,000
India .. .. .	..	..	31,65,037	5,83,02,092	25,16,725 <sup>a</sup>	4,25,64,000
<b>STEATITE—</b>						
Anantapur .. .. .	298	10,740	90	4,000	128	4,810
Kurnool .. .. .	289	15,545	180	3,594	594	11,978
Nellore .. .. .	14	1,740	..	..	..	..
Total .. .. .	601	28,025	270	7,594	722	16,788
India .. .. .	20,772	7,64,224	29,135	16,78,277	42,326	13,28,191

(a) Information not available.

(b) Approximate at Rs. 6.8 per ton.

(c) Export figures.

(d) Approximate at Rs. 9.1 per ton.

(e) Approximate at Rs. 9.8 per ton.

(f) Approximate at Rs. 11.5 per ton.

(g) Approximate at Rs. 11.6 per ton.

(s) At £ 4.27 per ton.

(t) At £ 4.80 per ton.

(u) Including small quantities produced in the districts of Madras State.

<sup>1</sup> Value of 509 tons not available.

<sup>2</sup> Including 36,435 tons of white clay.

<sup>3</sup> Including 3,193 tons of white clay.

<sup>4</sup> Excluding 2,00,551 tons produced by small-scale unlicensed producers.

† The northern part of the Visakhapatnam district was constituted into the Srikakulam district. The manganese-ore production in the Visakhapatnam district till 1951 was from this northern part.

(h) At £ 5.44 per ton.

(i) At Rs. 10-7-0 per ton.

(j) Estimated.

(k) At £ 6.09 per ton.

(v) At £ 4.94 per ton.

(w) At £ 4.56 per ton.

(y) At £ 4.77 per ton.

(z) At £ 4.43 per ton.

(l) At £ 5.00 per ton.

(m) At £ 5.16 per ton.

(n) At £ 5.05 per ton.

(o) At £ 3.97 per ton.

(x) Value of 2.5 carats in 1910 and 5.75 carats in 1911 recovered at Banganapalle, not returned.

(p) At £ 4.95 per ton.

(q) At £ 4.32 per ton.

(r) At £ 5.86 per ton.

TABLE 9.

Summarised comparative statement showing quantity and value of minerals produced in the former Andhra State and their respective figures for the whole of India.\*

Minerals*	Total figures till 1954.		Average figures for 1946—54.	
	Output (tons) (2)	Value (Rs.) (3)	Output (tons) (4)	Value (Rs.) (5)
(1)				
ASBESTOS—				
Cuddapah .. .. .	1,460.75	18,83,551	107.72	1,70,307
India .. .. .	8,322.55	24,92,198	377	2,06,560
BARYTES—				
Anantapur .. .. .	85,325	8,08,631	6,131.7	64,652
Cuddapah .. .. .	173,681	25,44,261	8,515.1	1,80,757
Kurnool .. .. .	71,217	8,78,406	2,849.9	42,049
Total .. .. .	330,223	42,31,298	17,496.6	2,87,459
India .. .. .	354,454	44,51,322 (a)	17,590.9	2,88,344 (h)
CALCITE—				
Anantapur .. .. .	5,638	48,579	1,409.5(b)	12,145(b)
India .. .. .	12,578	1,47,301	3,144.5(b)	36,825(b)
CHINA CLAY—				
Andhra .. .. .	Over 5,459	Over 25,940	2,729.5(c)	12,970(c)
India .. .. .	240,566	45,02,274	120,283(c)	22,51,137(c)
CHROMITE—				
Krishna .. .. .	19,927	7,25,836	2,025.8	76,882
India .. .. .	345,492	1,20,23,113	31,087.1	11,36,565
COPPER—				
Nellore .. .. .	405	7,852	..	..
DIAMONDS—				
Kurnool .. .. .	191.79 carats.	1,440	..	..
India .. .. .	421.49 cts.	66,885	..	..
GOLD—				
Anantapur .. .. .	182,315 oz.	1,13,37,251	..	..
Chittoor .. .. .	Over 2,959 oz.	2,07,845	..	..
Total .. .. .	185,274 oz.	1,15,45,096	105 oz. (f)	23,780(f)
India .. .. .	9,372,898.24 oz.	58,77,57,735	..	..
GRAPHITE—				
East Godavari .. .. .	367	32,700(d)	109(e)	10,900(e)
Visakhapatnam .. .. .	100	10,000	100(f)	10,000(f)
Total .. .. .	467	42,700(d)	..	..
India .. .. .	6,262	6,43,670	1,565.5(e)	1,60,918(e)
GYPSUM—				
Nellore .. .. .	193	3,910	..	..
IRON-ORE—				
Chittoor .. .. .	51,740	3,32,672	17,246.7(e)	1,10,891(e)
Cuddapah .. .. .	27,683	3,68,680	9,227.7(e)	1,22,893(e)
Krishna .. .. .	167,163	11,44,205	167,173(f)	11,44,205(f)
Kurnool .. .. .	94,933	3,26,038	31,644.3(e)	1,08,679(e)
Total .. .. .	341,529	21,71,595	113,843(e)	7,23,865(e)
India .. .. .	12,088,649	8,38,60,046	4,029,549.7(e)	2,79,53,349(e)
KYANITE—				
Nellore .. .. .	3,875	1,95,479	552.6(g)	27,921(g)
India .. .. .	209,093	2,89,95,002	27,875.6(g)	41,00,782(g)
MANGANESE-ORE—				
Kurnool .. .. .	946	19,887	..	..
Srikakulam .. .. .	2,351,198	10,32,05,064(h)	57,864	81,31,765
Visakhapatnam .. .. .	2,187	3,38,985	..	..
Total .. .. .	2,354,331	10,35,63,936(h)	..	..
India .. .. .	38,276,436	1,96,94,77,968(h)	981,033.8	11,72,67,069
MICA—				
Krishna .. .. .	487 cwt.	51,244	..	..
Nellore .. .. .	670,356.2 "	4,44,75,426 (h)	15,942.6 cwt.	17,61,461
Visakhapatnam .. .. .	33 "	(i)	..	..
Total .. .. .	670,876.2 "	4,45,26,670(h)	..	..
India .. .. .	4,278,226 "	35,15,48,486(h)	146,402.3 "	2,01,65,736
OCHRE—				
Kurnool .. .. .	Over 110,723	Over 3,87,478	12,302.6	43,053
India .. .. .	212,642	22,25,636	23,626.9	2,47,293
SAMARSKITE				
Nellore .. .. .	103.6 cwt.	4,668	..	..
SLATE—				
Kurnool .. .. .	3,512	19,015	..	..
STEATITE—				
Anantapur .. .. .	3,180	83,790	239.1	6,556
Guntur .. .. .	25,921	26,616	..	..
Kurnool .. .. .	16,232.85	1,97,490	224.4	7,685
Nellore .. .. .	2,300.6	1,02,623	69	1,260
Total .. .. .	47,634.45	4,10,519	532.5	15,501
India .. .. .	600,706.2	1,66,51,988	25,964.1	10,72,487

Total value 16,97,50,000 or Rs. 17 crores approximately.

\* The figures for India relate to the same period of production as for Andhra. These include also figures for the intervening short periods when there was no production in Andhra.

- (a) Value of 509 tons from Jaipur not available.  
 (b) Average for 4 years from 1951.  
 (c) Average for 2 years from 1953.  
 (d) Value of 40 tons not available  
 (e) Average for 3 years from 1952.  
 (f) Started production in 1954.  
 (g) Average for 7 years from 1948.  
 (h) Approximate.  
 (i) Information not available.

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