

SASHI SIVRAMKRISHNA

HARSHO MOHAN CHATTORAJ

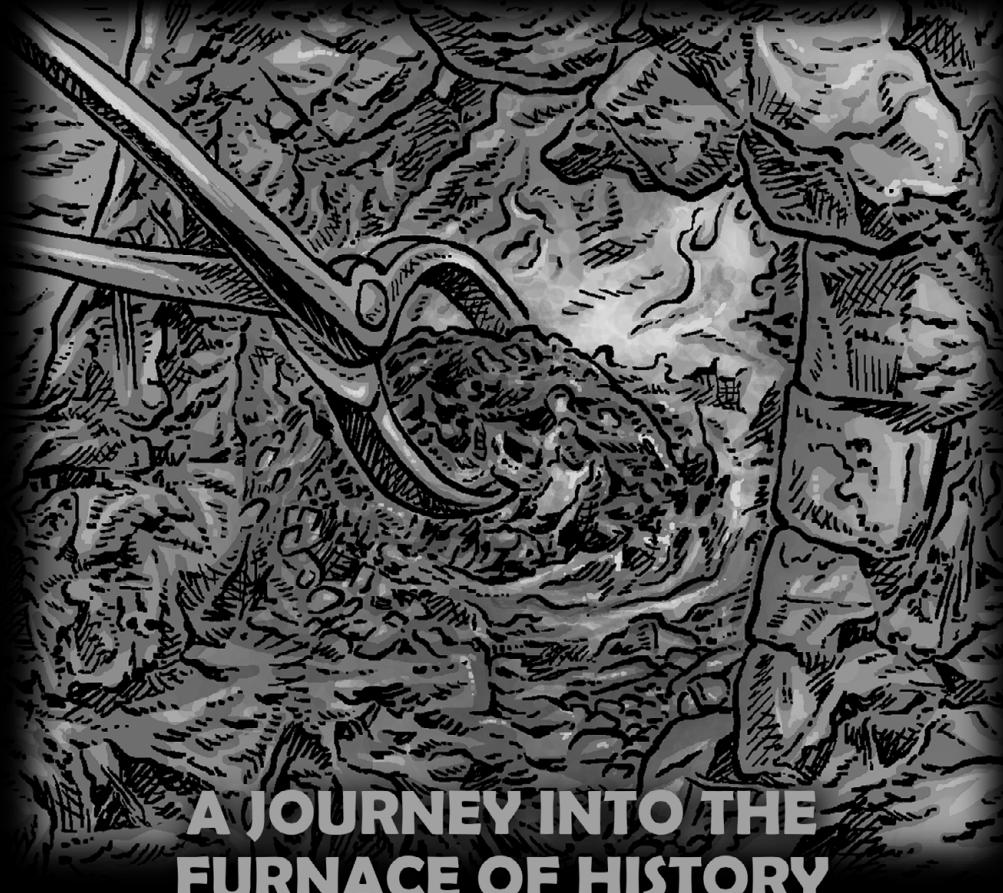


A hand holding a metal hook over a glowing furnace of molten iron.

A JOURNEY INTO THE FURNACE OF HISTORY

THE DYING EMBERS OF ANCIENT IRON-SMELTING IN INDIA

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A JOURNEY INTO THE FURNACE OF HISTORY

THE DYING EMBERS OF ANCIENT
IRON-SMELTING IN INDIA

SCRIPT: SASHI SIVRAMKRISHNA

ART: HARSHO MOHAN CHATTORAJ

INTRODUCTION

BEGINNING IN 2005, THE FOUNDATION TO AID INDUSTRIAL RECOVERY (FAIR) UNDERTOOK EXTENSIVE RESEARCH ON TRADITIONAL IRON AND STEEL SMELTING IN SOUTHERN INDIA. SASHI SIVRAMKRISHNA ALONG WITH SEVERAL OTHER RESEARCHERS AND ENTHUSIASTS INCLUDING MAHADEV NAYAK, AMALENDU JYOTISHI AND G.J. LINGARAJ VISITED SMELTING SITES RECORDED BY FRANCIS BUCHANAN IN HIS JOURNEY OF 1800-01 THROUGH PARTS OF ERSTWHILE MYSORE AND SOUTHERN INDIA. FROM THESE FINDINGS, A LARGER NARRATIVE ON IRON SMELTING EVOLVED.

UNFORTUNATELY, INDIAN ENVIRONMENTAL HISTORY HAS MISSED THE SCALE AND IMPORTANCE OF PROTO-INDUSTRIAL DEVELOPMENT IN SOUTHERN INDIA, AND HAS INSTEAD VIEWED MEDIEVAL ECONOMIES AS ESSENTIALLY AGRARIAN, CONSISTING OF SELF-SUFFICIENT VILLAGES. THE CENTRALITY OF A WAR ECONOMY IN THE FEUDAL PERIOD AND THE NEED FOR ARMS AND AMMUNITION WAS TOO LARGE TO BE BRUSHED ASIDE. WHEN TAKEN INTO ACCOUNT, WE ARGUED THAT IT WAS TIME FOR A REVISIONIST ENVIRONMENTAL HISTORY, INTEGRATING MILITARY AND METALLURGICAL HISTORY WITH ELEMENTS OF ANTHROPOLOGY, ECONOMICS AND SOCIOLOGY.

OUR RESEARCH HAS SINCE THEN BEEN PUBLISHED IN ACADEMIC JOURNALS INCLUDING ENVIRONMENT & HISTORY AND ECONOMIC & POLITICAL WEEKLY. HOWEVER, BEING AN ARDENT LOVER OF COMICS AND GRAPHIC NOVELS, SASHI SIVRAMKRISHNA WAS KEEN TO EXPLORE THE GRAPHIC NOVEL AS A MEDIUM TO SHARE THE STORY OF IRON AND STEEL SMELTING WITH A LARGER AND MORE GENERAL AUDIENCE, IN ADDITION TO PROFESSIONAL HISTORIANS.

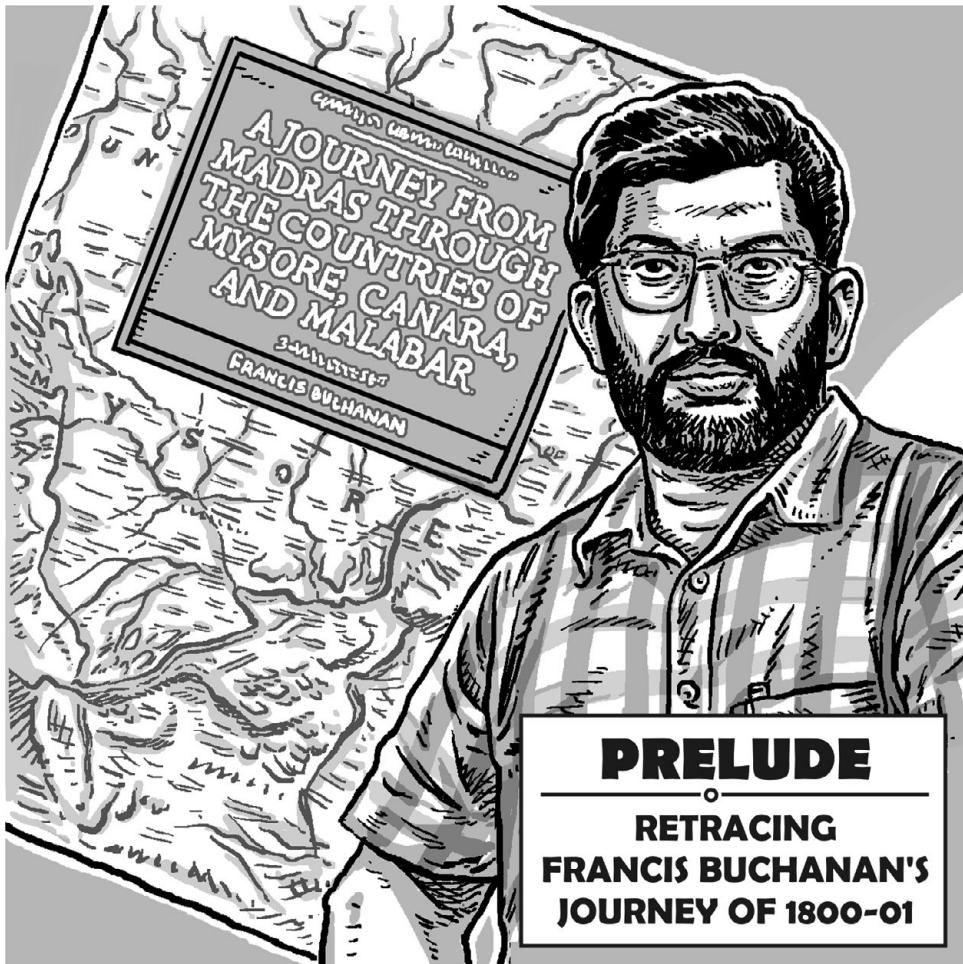
WHILE MOST OF THE CONTENTS HAVE TRIED TO RECORD ACTUAL EVENTS DURING OUR FIELD WORK, SOME OF THE MATERIAL IS IMAGINATIVE, OR FROM RECORDINGS AND INFORMATION OBTAINED IN EXTERNAL SOURCES.

ACADEMIC RESEARCH MOST OFTEN REMAINS IN THE REALM OF PUBLICATIONS AND THE WRITTEN WORD. FAIR HAS ATTEMPTED TO BRING ITS RESEARCH FINDINGS TO REACH A WIDER AUDIENCE THROUGH VISUAL MEDIA INCLUDING DOCUMENTARY REPORTS AND FILMS, PHOTO ESSAYS AND VISUAL HISTORIES. THE VISUAL STORYTELLING ASPECT HELPS TO BREAK DOWN BARRIERS, MAKING DIFFICULT SUBJECTS MORE APPROACHABLE AND ENGAGING FOR READERS OF ALL AGES AND BACKGROUNDS.

GRAPHIC NOVELS HAVE EMERGED AS A POWERFUL MEDIUM TO ENGAGE A WIDER AUDIENCE ON SERIOUS SUBJECTS. BY COMBINING COMPELLING NARRATIVES WITH STRIKING VISUALS, THEY CAN CONVEY COMPLEX THEMES IN AN ACCESSIBLE AND EMOTIONALLY RESONANT WAY. THIS FORMAT ALLOWS FOR THE EXPLORATION OF TOPICS SUCH AS HISTORICAL EVENTS AND PERSONAL NARRATIVES WITH A DEPTH AND NUANCE THAT TRADITIONAL TEXT ALONE MIGHT STRUGGLE TO ACHIEVE. THIS BOOK IS AN ENDEAVOUR TO NARRATE THE STORY OF OUR RESEARCH ON TRADITIONAL IRON AND STEEL SMELTING THROUGH A GRAPHIC NOVEL.

A GRAPHIC NOVEL IS MORE THAN THE WRITTEN WORD. THE ROLE OF THE ARTIST IS EQUALLY IMPORTANT. HARSHO MOHAN CHATTERAJ, AN ACCOMPLISHED ARTIST WITH THE EXPERIENCE OF HAVING DONE SEVERAL GRAPHIC NOVELS AND COMICS, WAS ABLE TO BRING THE IDEAS OF THE AUTHOR TO LIFE THROUGH HIS DEDICATED AND PAINSTAKING ART WORK, PANEL BY PANEL.

WE HOPE THIS GRAPHIC NOVEL IS ABLE TO (RE)IGNITE THE FURNACE OF INTEREST IN IRON AND STEEL SMELTING; AN OVERLOOKED BUT INDISPENSABLE FACET OF INDIAN ENVIRONMENTAL HISTORY.

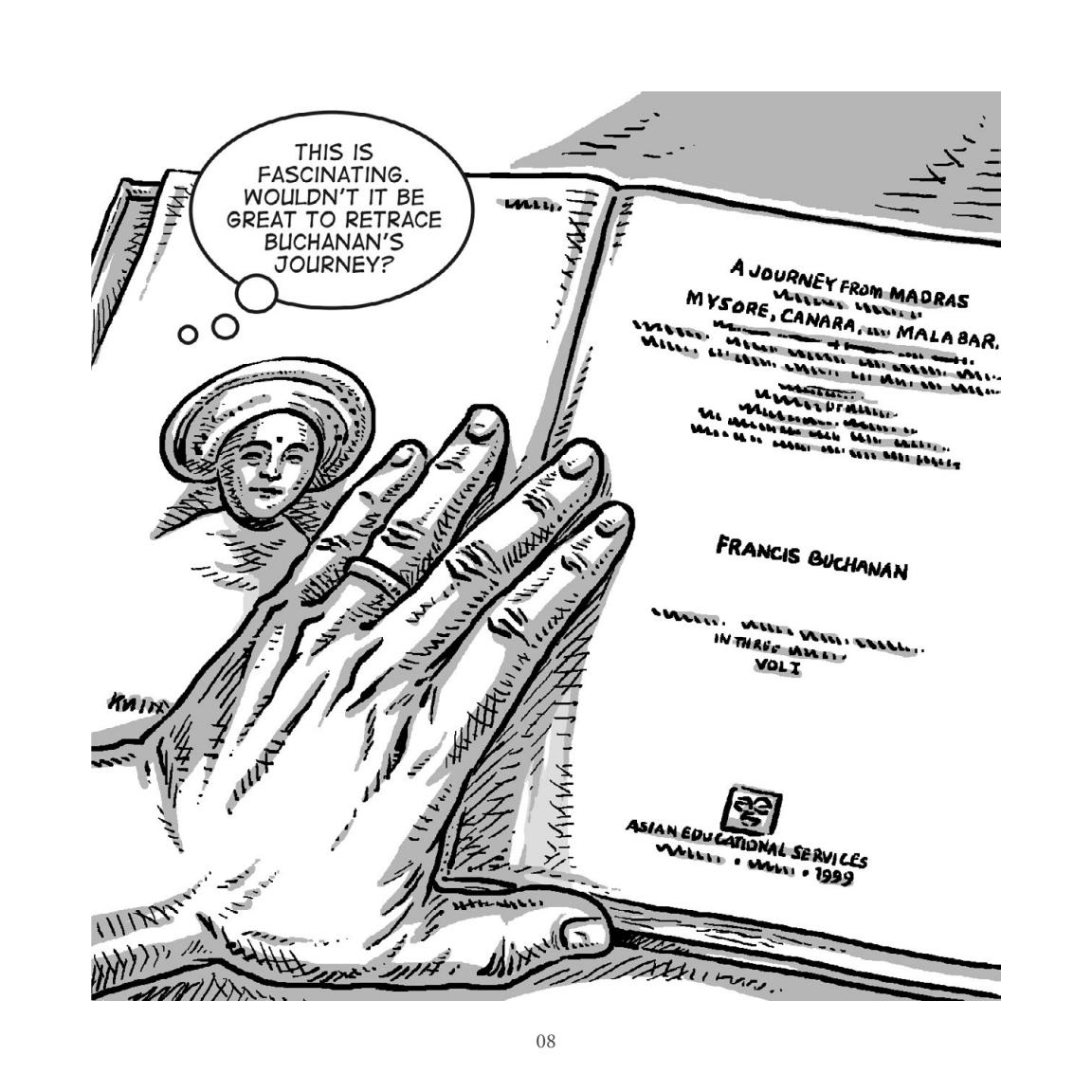


PRELUDE
RETRACING
FRANCIS BUCHANAN'S
JOURNEY OF 1800-01





... WHEN THE
INTERNET WAS
STILL NOT SO
WIDELY USED.



THIS IS
FASCINATING.
WOULDN'T IT BE
GREAT TO RETRACE
BUCHANAN'S
JOURNEY?

A JOURNEY FROM MADRAS
MYSORE, CANARA, MALAR,
VOL 1

FRANCIS BUCHANAN

IN THREE VOLUMES
VOL I

225
ASIAN EDUCATIONAL SERVICES
MADRAS • MUMBAI • 1999



SO MANY
OCCUPATIONS
DESCRIBED HERE!
CHARCOAL-MAKING FROM
COCONUT SHELLS, COARSE
BLANKET WEAVING, IRON
AND STEEL SMELTING,
LIMESTONE MAKING...

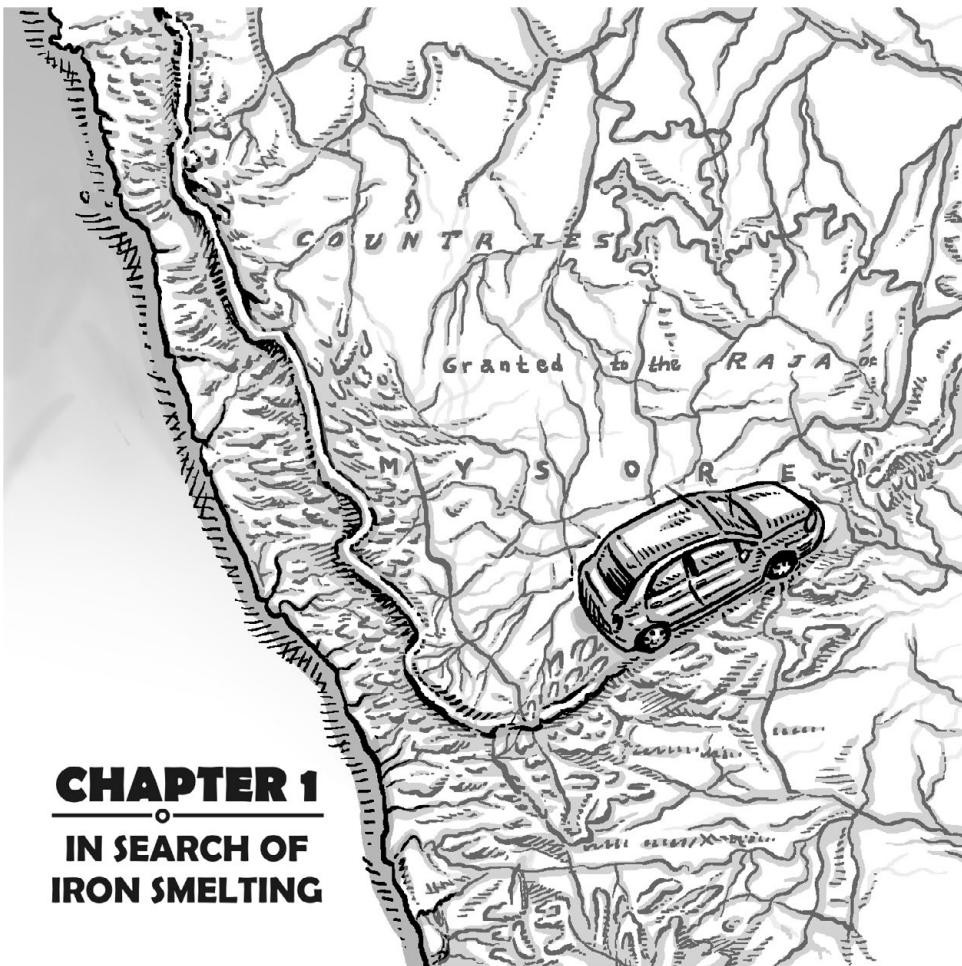
I WONDER
IF THESE STILL
EXIST TODAY!

AND THUS WE STARTED ON OUR OWN EXPLORATION, RETRACING FRANCIS BUCHANAN'S JOURNEY THROUGH SOUTHERN INDIA ...



CHAPTER 1

IN SEARCH OF IRON SMELTING



ALL SET, READY TO GO...



LOOKING FOR REMNANTS FROM 200 YEARS AGO.





SO MUCH HAS CHANGED SINCE
BUCHANAN'S JOURNEY...

YET SO MUCH HASN'T...













HE IS
ABSOLUTELY RIGHT.
IRON SMELTING WAS
CARRIED OUT HERE
EXTENSIVELY FOR
HUNDREDS OF
YEARS.

I STILL
WORK WITH IRON.
WOULD YOU LIKE
TO SEE SOME
OLD SITES?

OF
COURSE!

YES,
PLEASE!



FIRST,
HAVE SOME
COCONUT WATER.
IT'S A VERY
HOT DAY.



REFRESHING, BUT NOT ENOUGH
TO QUENCH OUR EXCITEMENT TO
SEE THOSE SMELTING SITES.











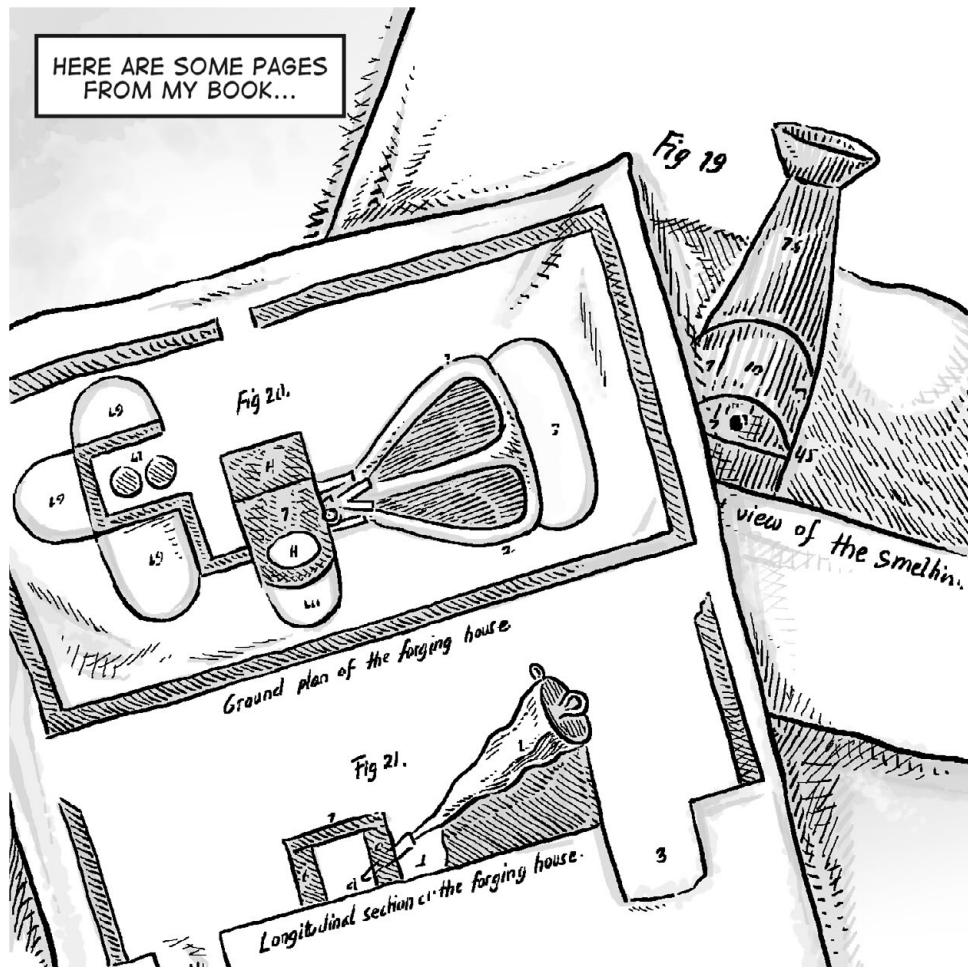


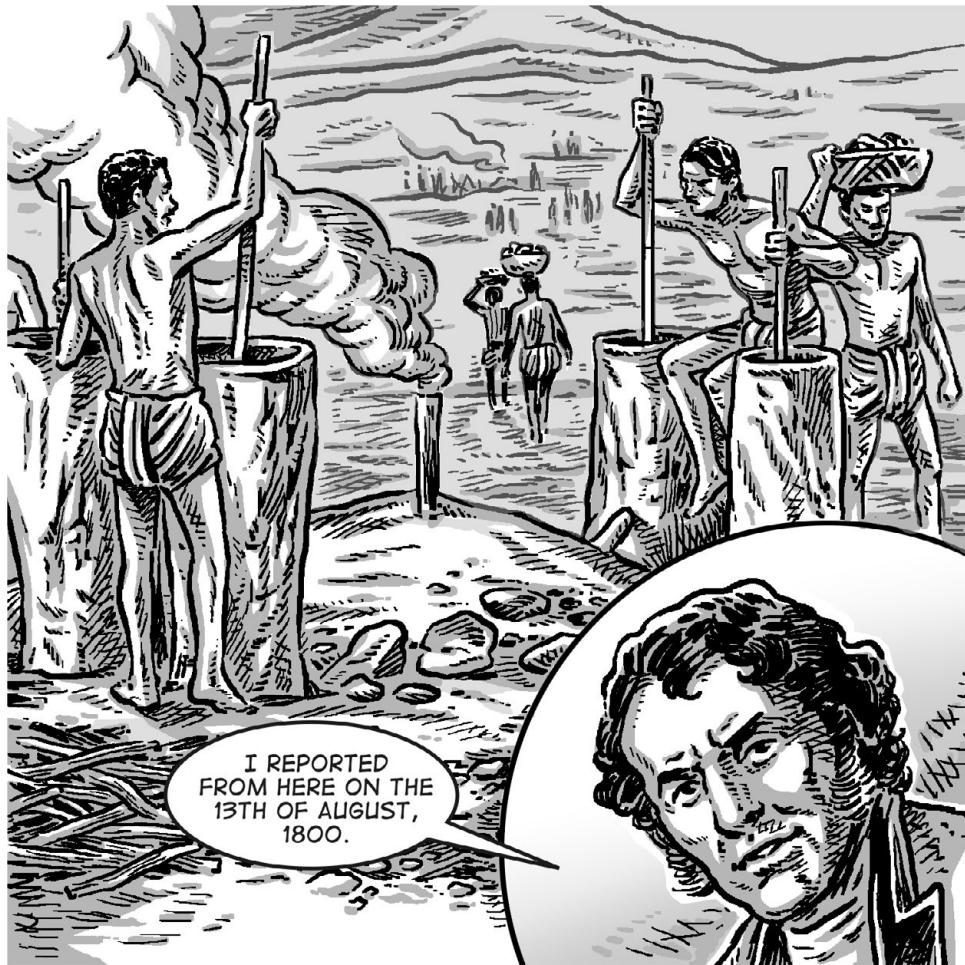
OH YES! I
AM RIGHT HERE.
BUCHANAN,
FRANCIS
BUCHANAN.

I STUDIED
MEDICINE AT THE
UNIVERSITY OF EDINBURGH
AND WAS ASSIGNED TO
SURVEY THE STATE OF
MYSORE BY THE EAST
INDIA COMPANY IN 1799,
IMMEDIATELY AFTER
THE FALL OF TIPU
SULTAN.

YOUR IDEA
TO RETRACE MY
JOURNEY OF 1800-01
DOES BRING BACK
MEMORIES OF TIMES
GONE BY.

HERE ARE SOME PAGES
FROM MY BOOK...

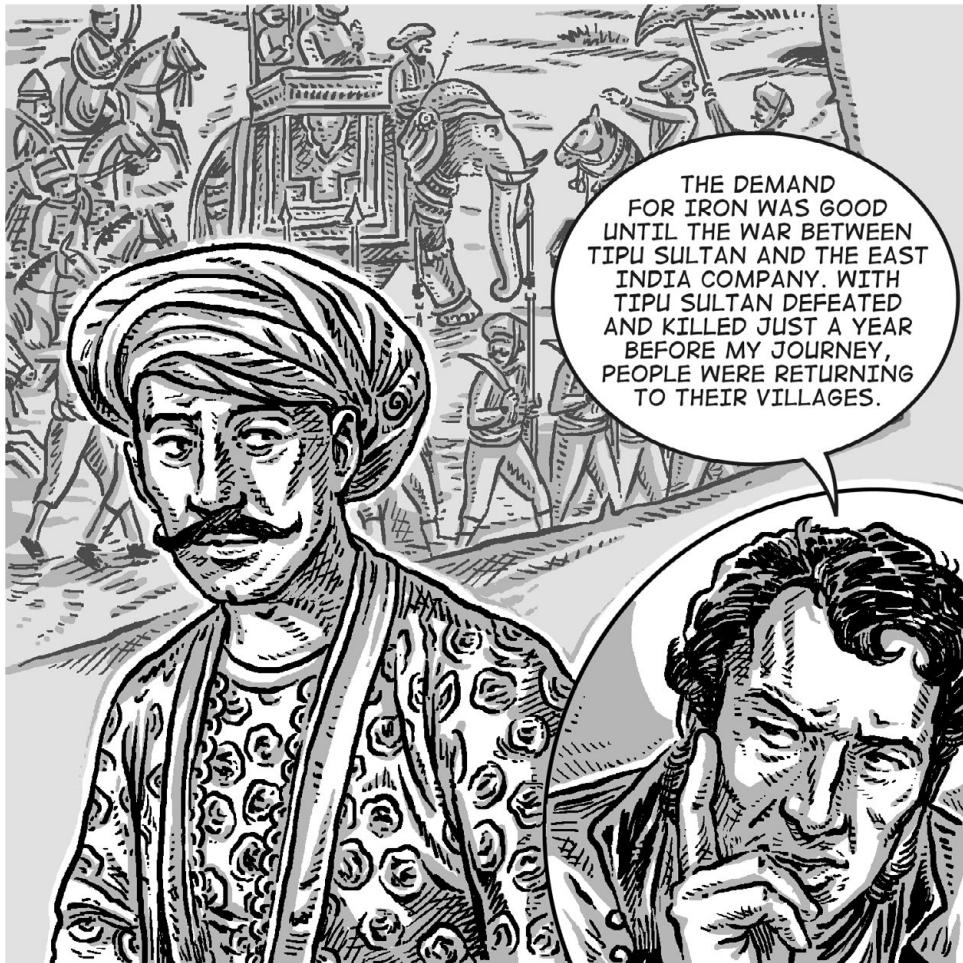






THERE WAS STILL
SOME SMELTING
HAPPENING
HERE AT THAT
TIME.

I REMEMBER THE
SOUND OF PLUMPING
BELLOWS, THE HEAT
AND SMOKE THAT FILLED
THE AIR, THE MOVEMENT
OF PEOPLE CARRYING
LOADS OF ORE AND
CHARCOAL.



THE DEMAND
FOR IRON WAS GOOD
UNTIL THE WAR BETWEEN
TIPU SULTAN AND THE EAST
INDIA COMPANY. WITH
TIPU SULTAN DEFEATED
AND KILLED JUST A YEAR
BEFORE MY JOURNEY,
PEOPLE WERE RETURNING
TO THEIR VILLAGES.







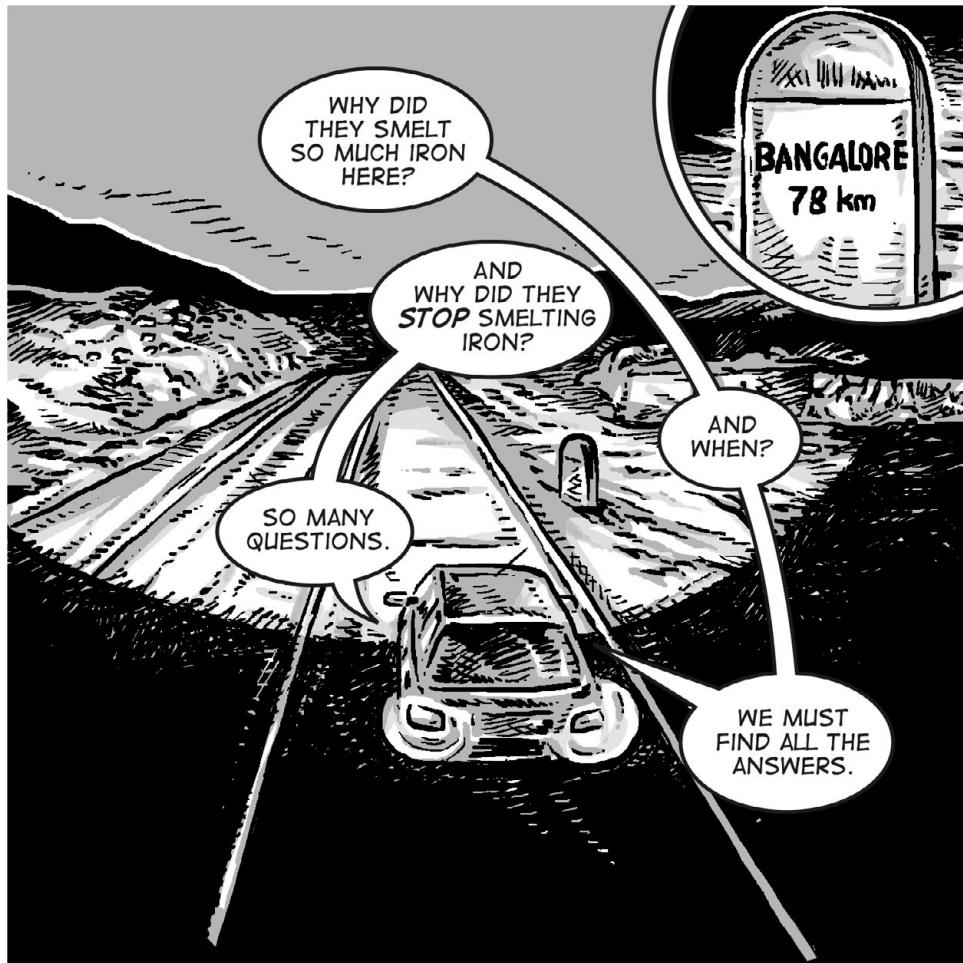
THEY
HAVE COME FROM
BANGALORE. THEY
ARE LOOKING FOR
OLD IRON SMELTING
SITES.

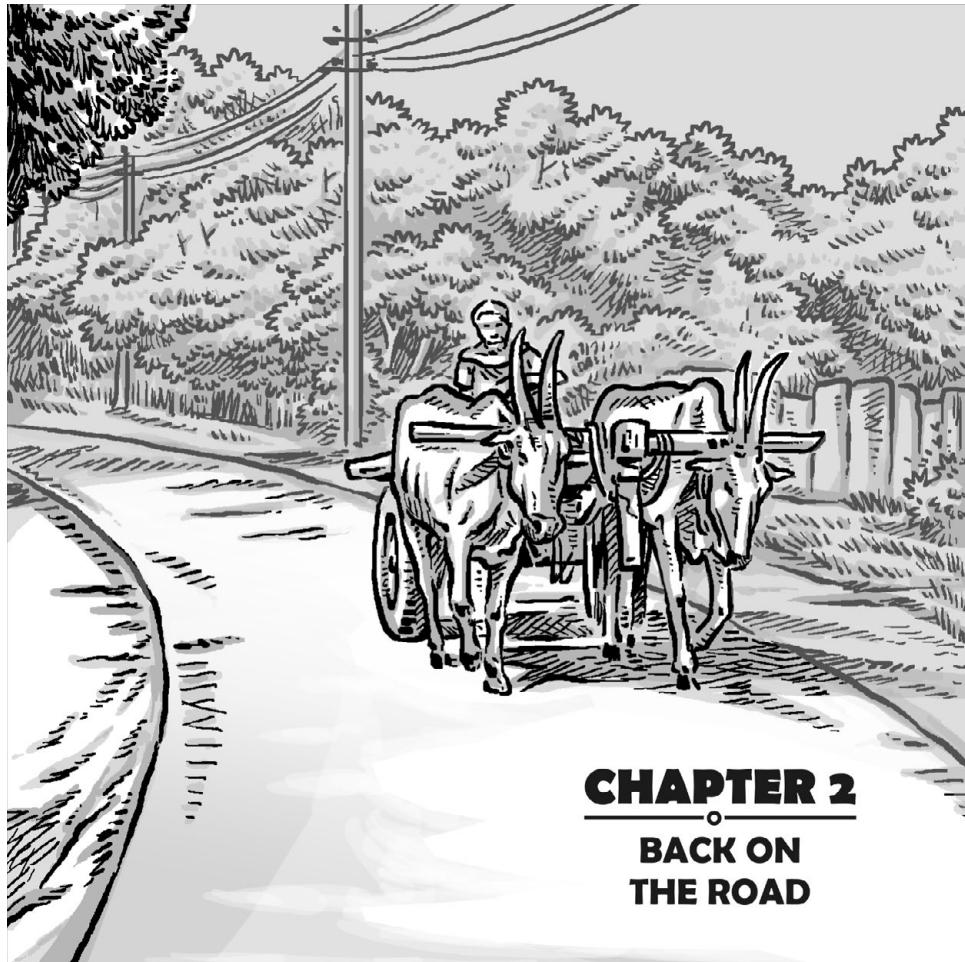












CHAPTER 2

BACK ON THE ROAD



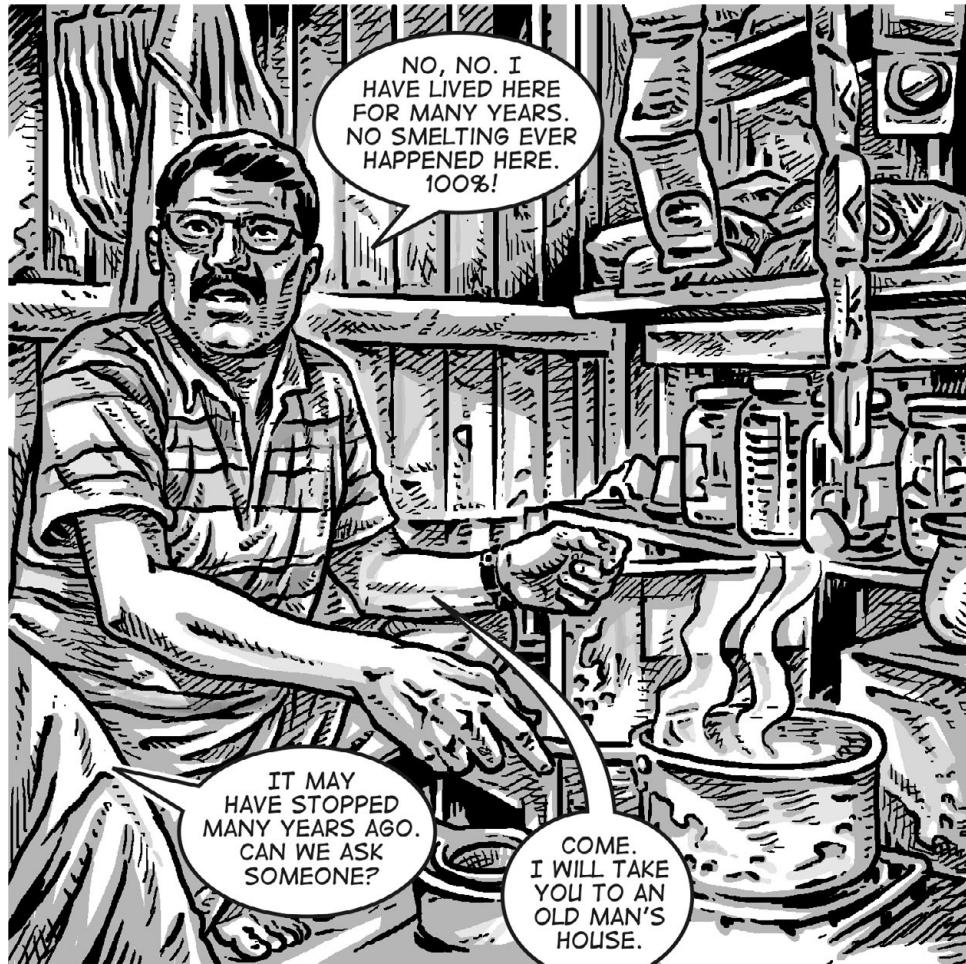


HEY, THERE
IS A CATTLE
FAIR HAPPENING
THERE.

INTERESTING.
BUT LET'S KEEP
THAT FOR ANOTHER
TIME.









OF COURSE,
I SAW IT
HAPPENING HERE.
YOU WILL FIND
OUT SOON.



















SO... HAVE
THINGS CHANGED
OR HAVE THEY
REMAINED QUITE
THE SAME?

NOW, THAT'S
A HARD ONE TO
ANSWER!

CHIKKANAYAKANAHALLI

WE WANT
TO KNOW ABOUT
IRON SMELTING IN
THIS VILLAGE.

ARE YOU
ASKING US TO
SELL ORE TO
YOU?

WHY?

DON'T
COME HERE
FOR IRON
ORE.



NO. WE
ARE STUDYING
HISTORY.

THIS IS AN
OLD BOOK WITH
THE RECORD OF
A BRITISH...

ABOUT
OUR VILLAGE?
IRON SMELTING 200
YEARS AGO? COME
WITH US.





WE WOULD USE
THIS ORE. NOW
IT IS ALL BEING
TAKEN AWAY TO
FACTORIES.



COME, WE
WILL SHOW YOU
WHAT WE COULD
MAKE WITH OUR
IRON AND
STEEL.



FEEL THE
WEIGHT OF THIS.
SEE HOW IT IS
CURVED. IT IS NOT
RUSTED... NOT
EVEN A LITTLE.

TELLS YOU
THE QUALITY OF
THE STEEL WE
MADE.



IT WAS
MADE IN OUR
VILLAGE, WE
ARE SURE.

LEAVES
WERE USED TO
CONVERT IRON
INTO CARBON
STEEL.



THEY MADE SOME
OF THE BEST STEEL IN
THE WORLD IN THESE
VILLAGES.

THEY
CALLED IT *UKKU* ...
WE CALLED IT
WOOTZ.

WE ARE CONVINCED OF BUCHANAN'S RECORDS... AND THE
EXTENT OF IRON SMELTING ON AN INDUSTRIAL SCALE.





ON A DIFFERENT
NOTE - BUCHANAN
MENTIONS THE LOCAL
PEOPLE HAVE A VERY
STRANGE CONCEPTION
OF DISTANCE.

LET US PUT
BUCHANAN TO
THE TEST.



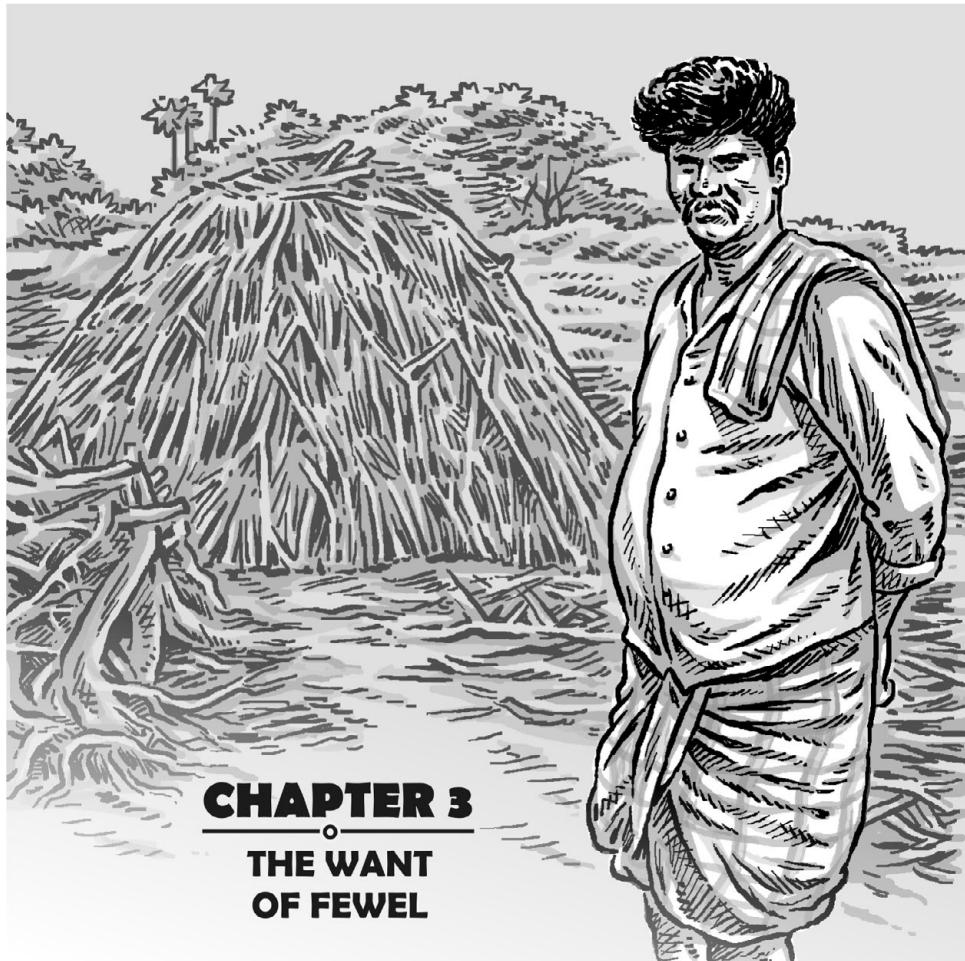






THE BUS FARE!
THAT CERTAINLY
IS AN INTERESTING
WAY TO MEASURE
DISTANCE.

AND
BUCHANAN
THOUGHT OF MAKING A
NOTE OF HOW PEOPLE
PERCEIVE DISTANCE
IN DIFFERENT
WAYS!



CHAPTER 3

THE WANT OF FEWEL



DISCOVERING
ALL THOSE SMELTING
SITES EXACTLY WHERE
BUCHANAN HAD
RECORDED THEM.

IT REALLY
FELT LIKE INDIANA
JONES FINDING
THE LOST ARK.







CHARCOAL!! THERE
MUST HAVE BEEN A
SHORTAGE OF CHARCOAL
IN THESE DISTRICTS
AROUND 1800.

TCRRR

CHARCOAL??





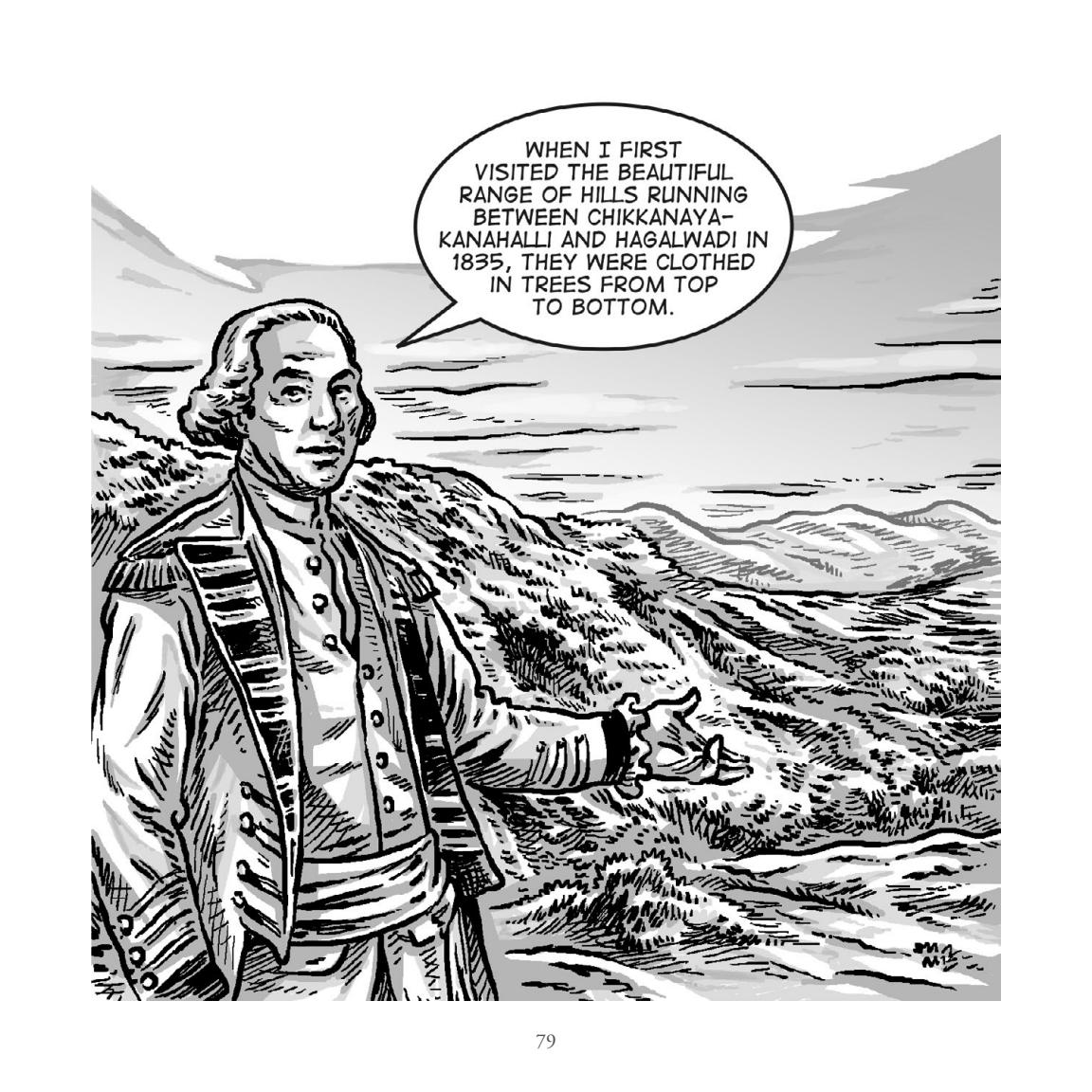


1854

GENERAL
DOBBS, YOU
CALLED FOR
ME?

YES.





WHEN I FIRST
VISITED THE BEAUTIFUL
RANGE OF HILLS RUNNING
BETWEEN CHIKKANAYA-
KANAHALLI AND HAGALWADI IN
1835, THEY WERE CLOTHED
IN TREES FROM TOP
TO BOTTOM.







NO ONE
WHO HAS NOT WITNESSED
THE PROCESS CAN CONCEIVE
THE DESTRUCTION MADE BY
THESE FORGES.

SO, THE
DEFORESTATION
HAPPENED BECAUSE
WOOD WAS REQUIRED
FOR CHARCOAL.

THE FUEL
FOR IRON
SMEILING.





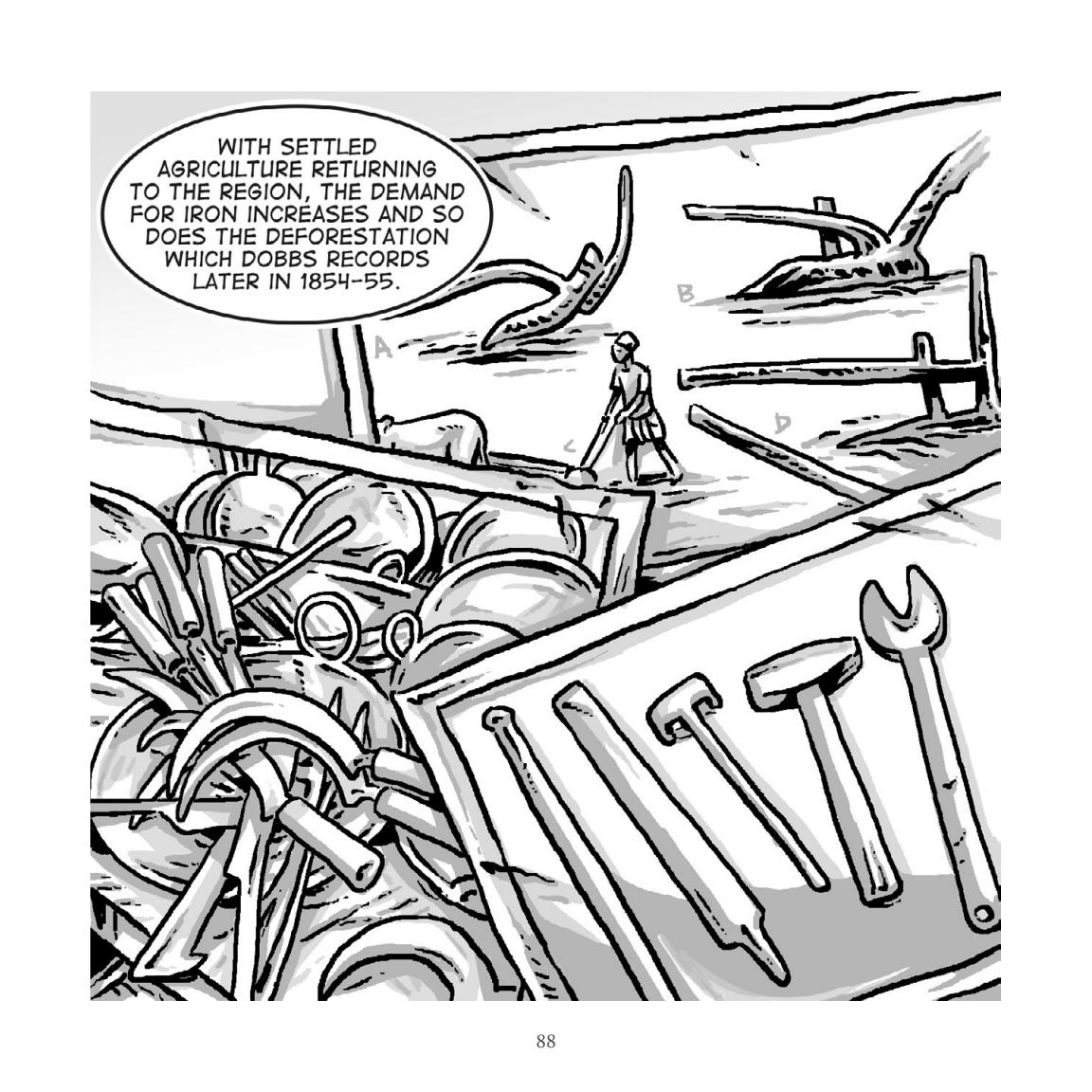


AFTER THE
FALL OF TIPU IN
1799, THE WARS
STOP AND IRON
SMEILING
TOO.

THE
FORESTS
REGENERATE
WHEN DOBBS FIRST
SEES THEM
IN 1835.







WITH SETTLED
AGRICULTURE RETURNING
TO THE REGION, THE DEMAND
FOR IRON INCREASES AND SO
DOES THE DEFORESTATION
WHICH DOBBS RECORDS
LATER IN 1854-55.



* COOKING OVENS

** PEOPLE WHO IRON CLOTHES



WE COLLECT
THE WOOD BY
EXTRACTING THIS
'TREE', RATHER A
WEED - **JALLI***, WHICH
FARMERS WANT
REMOVED FROM
THE FIELDS.

* PROSOPIS JULIFLORA









THE MOUND IS
SET ALIGHT WITH
HOT CHARCOAL.



AFTER
30 DAYS THE
CHARCOAL IS
READY.

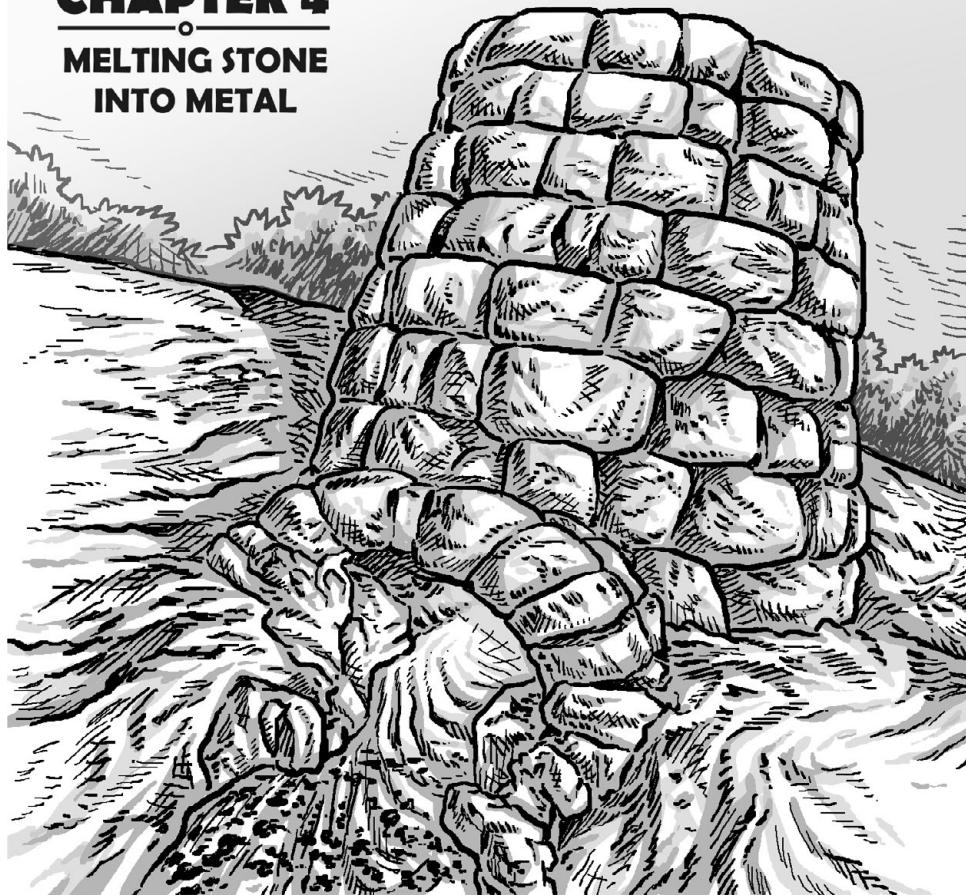


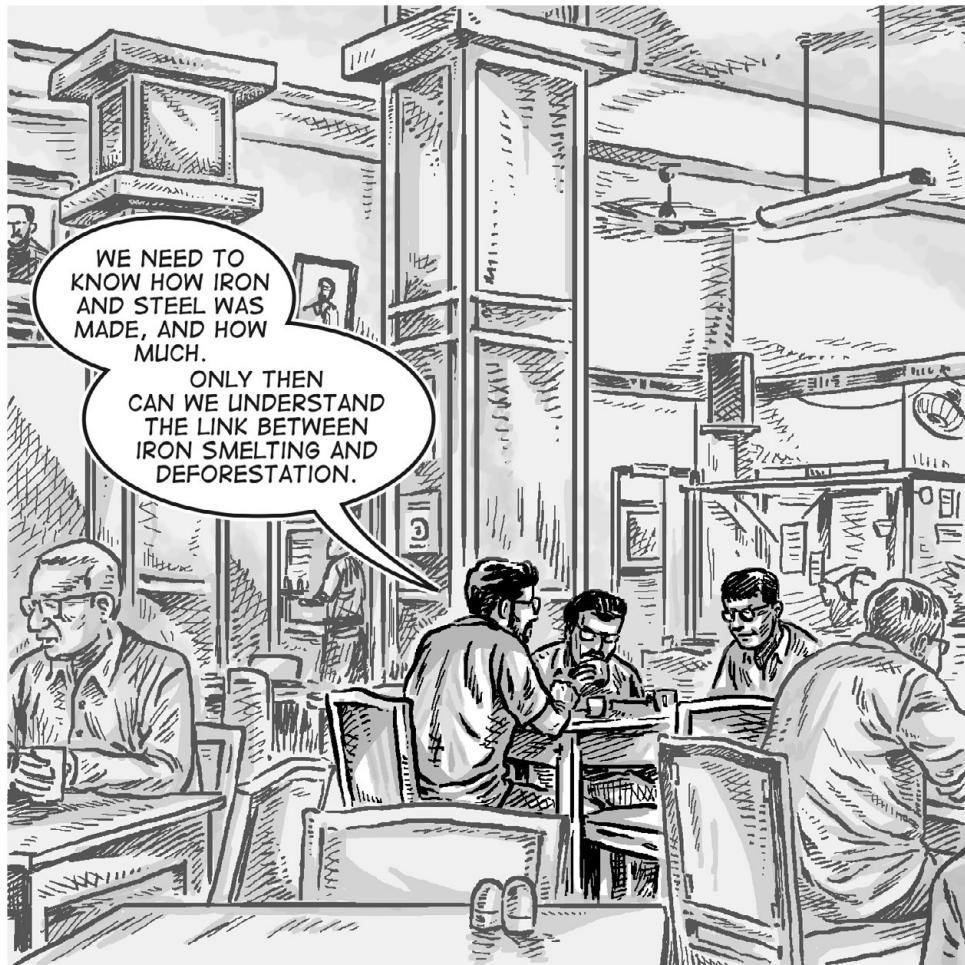




CHAPTER 4

MELTING STONE INTO METAL











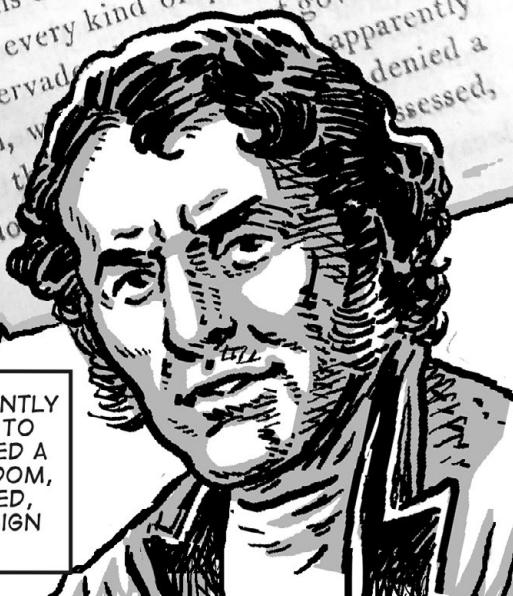






of the various
after the iron mines: but
tent, that, nobody having wrought
tuation was not now known. After a long search
ad found a few stones, which they sent, believing that they
be iron-ore. I then sent for the man who had given me the
mation; and on the following day,
th June,—I took him along with me to Ghettipura, where I not
y found the ore in several places, but also the pits, from which
e people were then actually taking it to supply their furnaces.
am at some loss to account for this desire of concealment relative
o minerals, which also extends to every kind of quarry throughout
the country, and which equally pervades
and the other inhabitants. Men, w
correct information relative to the
knowledge of the fossile kingdom

June 17



"MEN, WHO HAVE GIVEN ME APPARENTLY
CORRECT INFORMATION RELATIVE TO
THEIR FARMS, HAVE EAGERLY DENIED A
KNOWLEDGE OF THE FOSSILE KINGDOM,
WHICH THEY NO DOUBT POSSESSED,
AND FOR WHICH DENIAL I CAN ASSIGN
NO PLAUSIBLE MOTIVE."

SOME
THINGS NEVER
CHANGE.

WAIT, LET'S
TRY OUR OLD
TRICK.







WILL THIS
BE OUR LUCKY
DAY!

CAN WE
SEE SOME OLD
FURNACES?





I AM SORRY.
THE FURNACES HAVE
GONE. THEY SHOULD
BE BELOW THIS
BOUNDARY WALL.

BUT THIS
IS WHERE THE
SMELTING WOULD
HAPPEN.



I DON'T
THINK WE CAN
FIND REMNANTS
OF FURNACES.





BUT THIS
CERTAINLY SEEMS
TO BE THE LOCATION
BUCHANAN SPEAKS OF.
I WONDER WHAT IT
WAS LIKE THEN.



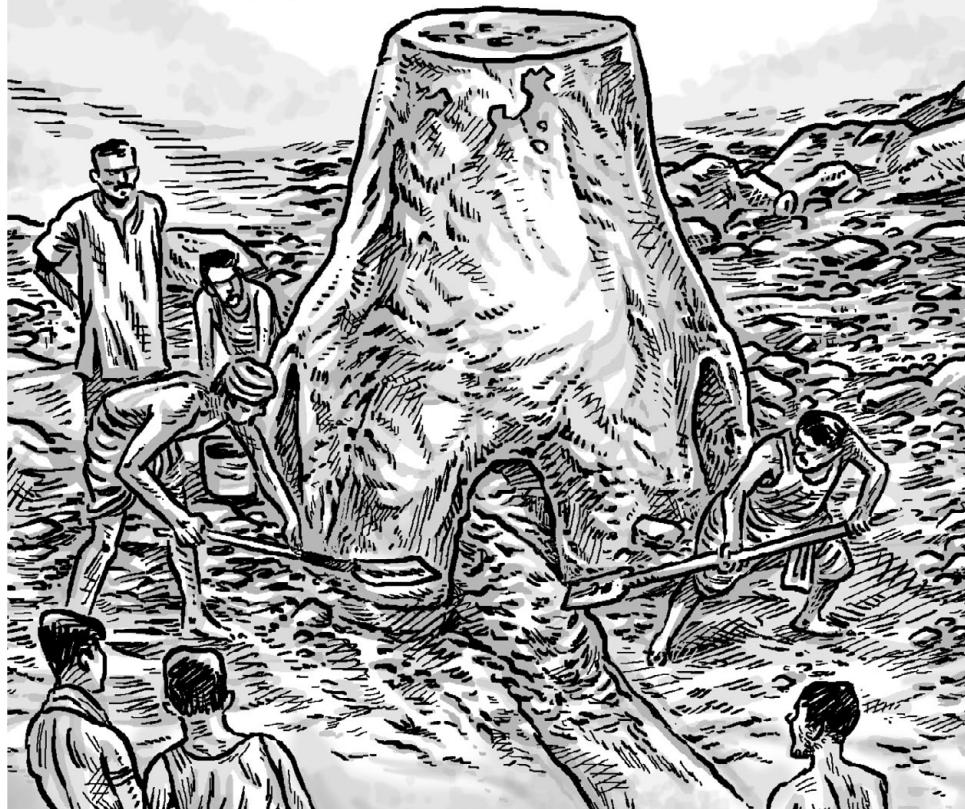




DURING THE 4 MONTHS OF
HEAVY RAIN, MEN WOULD
COLLECT THE ORE RUNNING
DOWN THE HILL AND WASH
IT TO REMOVE THE QUARTZ.



IN THE REMAINING 8 MONTHS OF THE YEAR, IRON IS SMCLETED IN FURNACES, SOME 5 FEET HIGH.

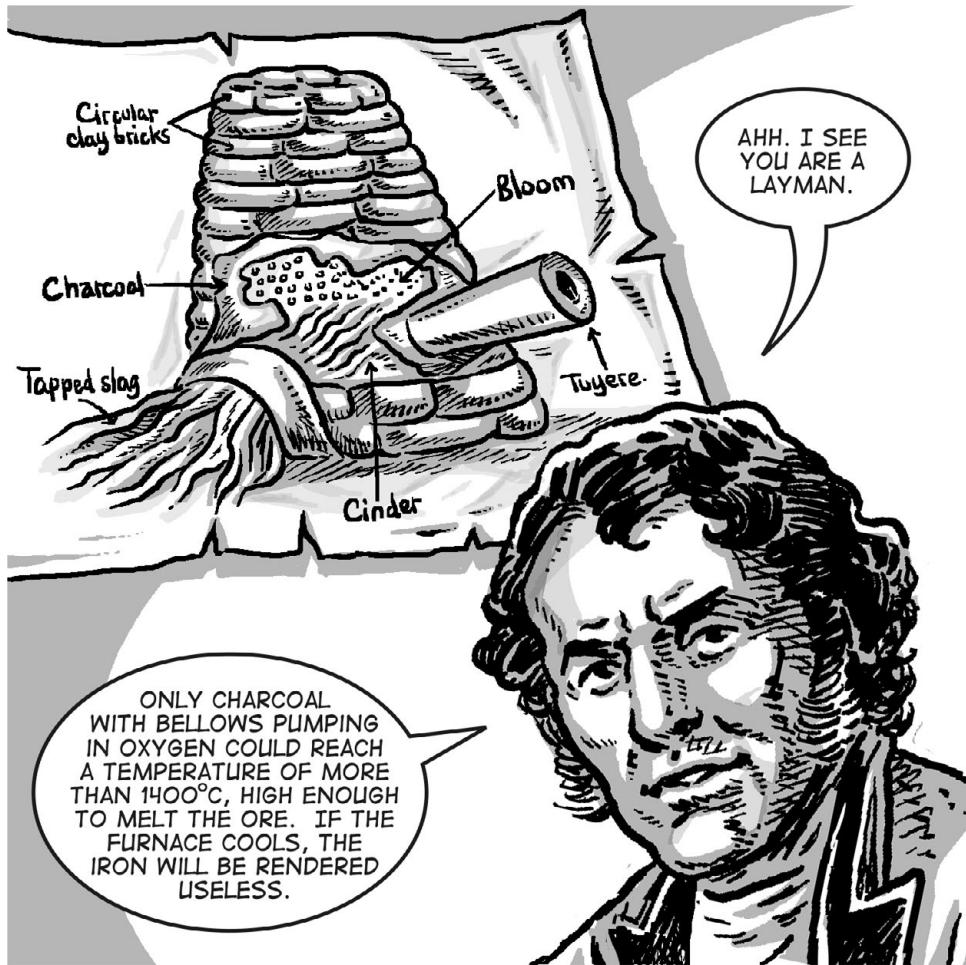




IT TOOK 6 AND 1/2 HOURS TO SMELT A BATCH OF IRON FROM THE ORE.

THE BELLows WOULD HAVE TO BE WORKED THROUGHOUT THE PROCESS.



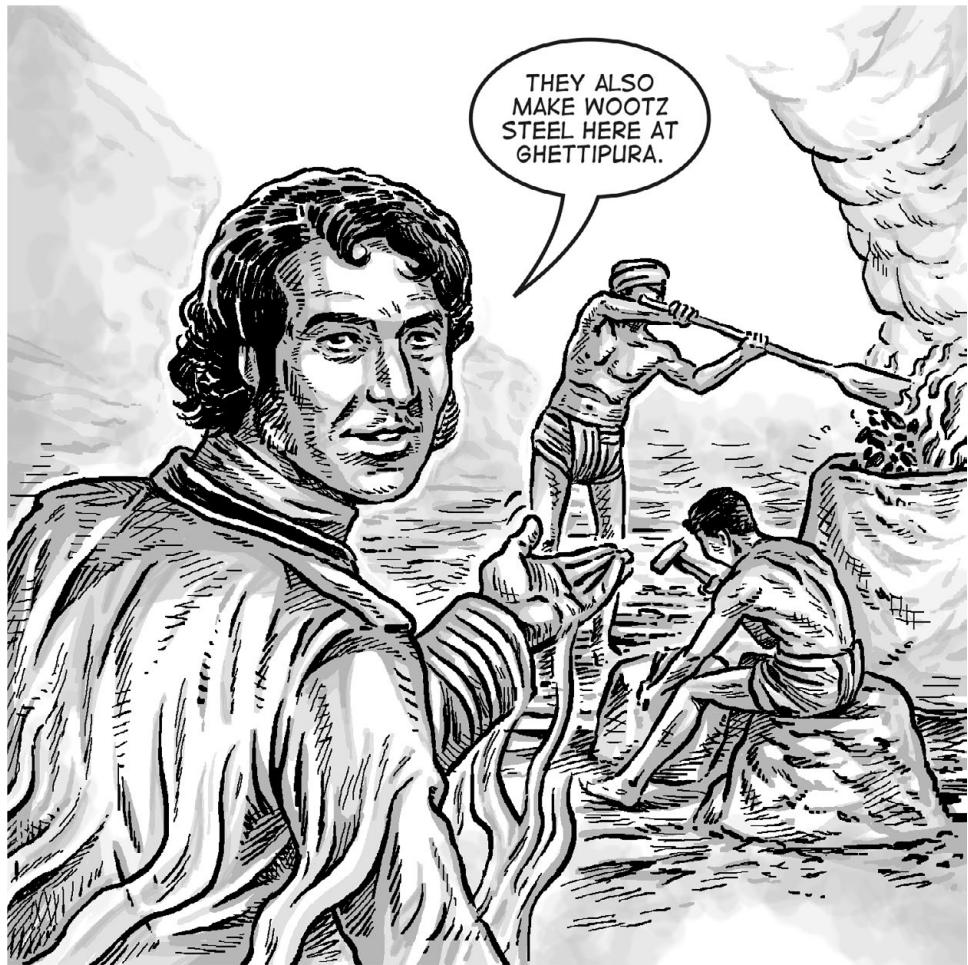




AT THE BOTTOM
ARE 2 BLOCKS OF IRON,
EACH WEIGHING MORE
THAN 12 POUNDS*.

* 5 KILOS







IRON IS MIXED WITH CHARCOAL AND PUT IN SMALL CLAY POTS OR CRUCIBLES.

LEAVES AND SHRUBS ARE ADDED TO FURNISH CARBON TO THE IRON.

THEY ARE HEATED
FOR SIX HOURS
IN A FURNACE.





THE CRUCIBLES
ARE COOLED AND THEN
OPENED. SMALL INGOTS
OF PURE STEEL ARE
SEPARATED OUT FROM
THE IMPURITIES.



THE EAST INDIA COMPANY IS
VERY INTERESTED IN HOW WOOTZ
STEEL IS MADE. I HAVE ASKED
MY ARTISTS TO RECORD
THEM CAREFULLY.



THERE WERE
SO MANY FURNACES
AROUND... IRON AND
STEEL WERE PRODUCED
HERE ON A MASSIVE
SCALE.



I WONDER
WHO BOUGHT ALL
THIS IRON AND
STEEL?



AFTER TIPLU'S
DEATH, BLACKSMITHS
MAKING AGRICULTURAL
IMPLEMENT BUGHT IT.

BUT IN EARLIER
TIMES, THE IRON AND
STEEL WERE USED TO
MAKE WEAPONS.





DAMASCUS STEEL WAS FORGED IN SYRIA FROM WOOTZ INGOTS BETWEEN 900 AD AND 1750 AD. IT WAS HARD, FLEXIBLE, AND HAD A 'WATER' PATTERN.

ITS GRAIN
STRUCTURE MADE
IT THE IDEAL STEEL
FOR SWORDS.





LINGARAJ, I THINK
WE NEED TO WEAVE
TOGETHER IRON SMELTING
AND WEAPONS
MANUFACTURE.

INTERESTING...

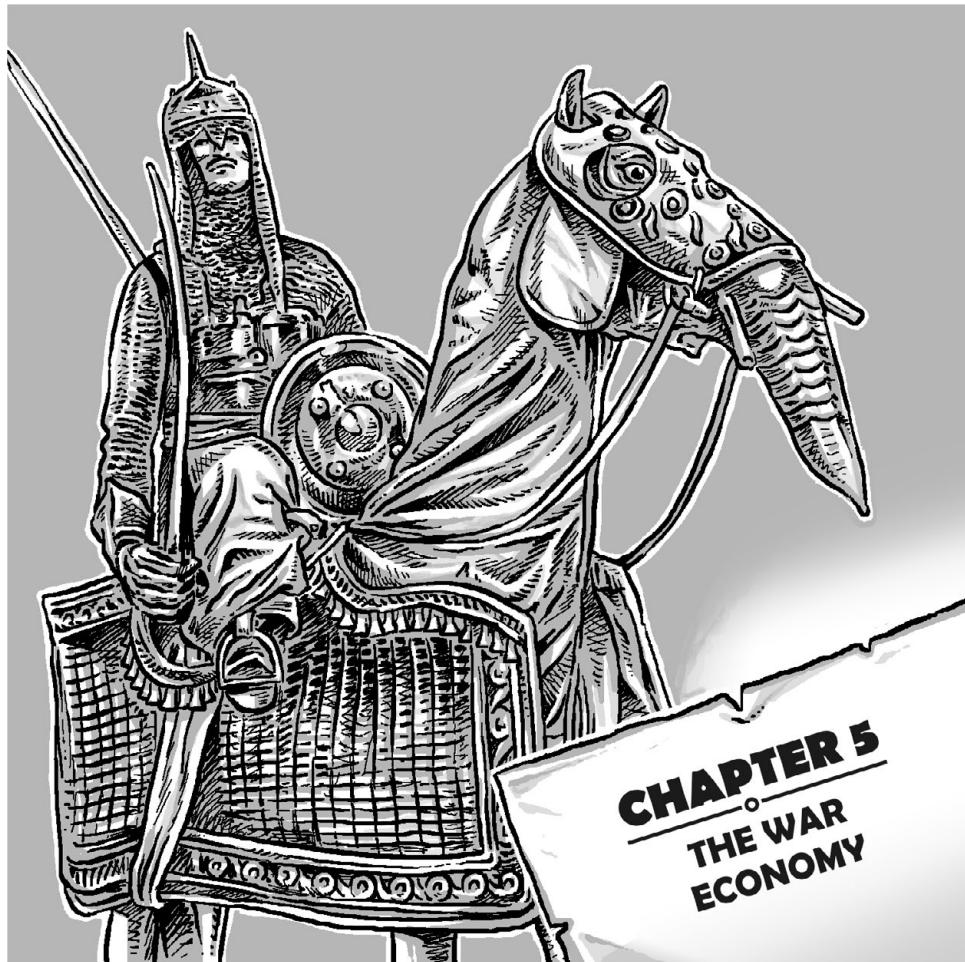


ONLY THEN CAN WE GET
A SENSE OF **HOW MUCH** IRON
AND STEEL WAS BEING PRODUCED
EVEN BEFORE COLONIAL
INTERVENTIONS.



TO GET
A SENSE OF
THE CHARCOAL
REQUIRED AND
ITS IMPACT ON
THE FOREST...

YES, METALLURGICAL,
MILITARY AND ENVIRONMENT
HISTORY... WE NEED TO
STUDY THEM TOGETHER.





ANCIENT AND
MEDIEVAL INDIA WAS
A WAR ECONOMY. TO
THINK INDIA WAS JUST
AGRICULTURAL IS NAIVE.
INDUSTRIAL ACTIVITY
WAS SUBSTANTIAL.



YES, SOME
ENVIRONMENTAL
HISTORIANS SEE THE
BEGINNING OF FOREST
DESTRUCTION ONLY
AFTER THE ADVENT OF
THE RAILWAYS.



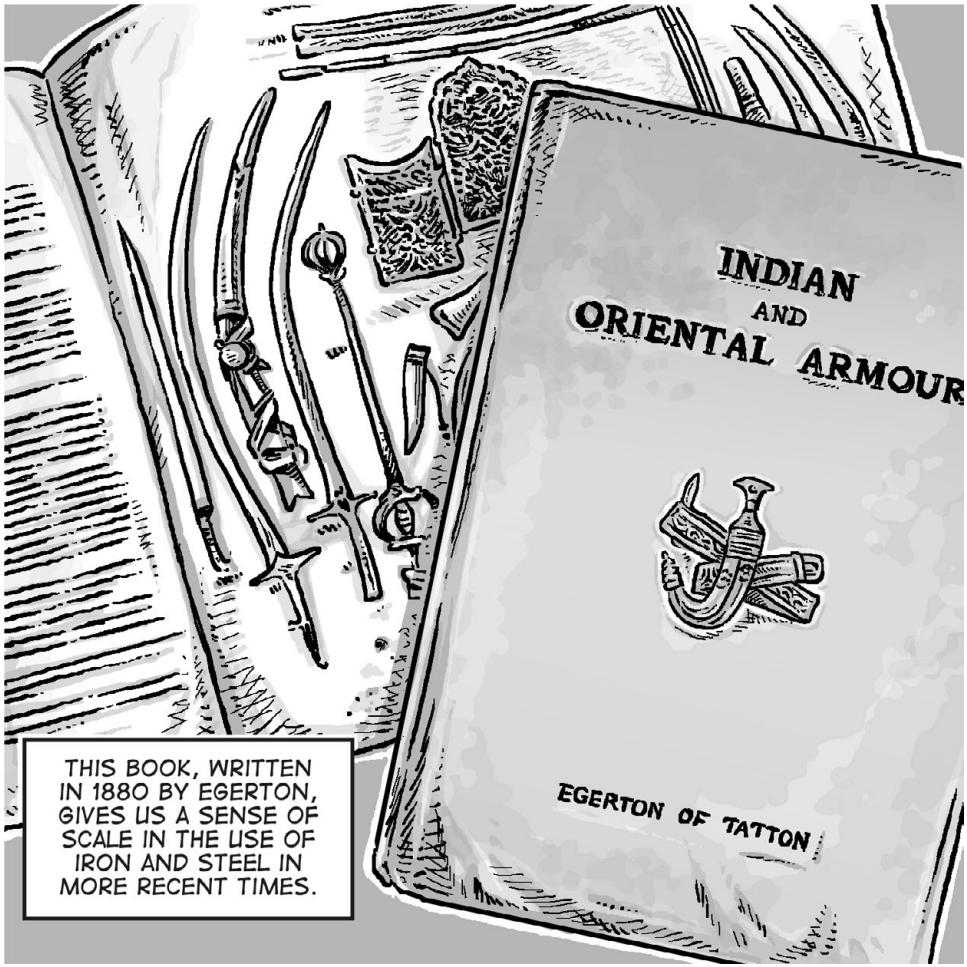
INDIAN EPICS LIKE
THE RAMAYANA AND
MAHABHARATA SPEAK OF
GREAT BATTLES WITH
INTRIGUING WEAPONS.



WHEN ALEXANDER INVADED INDIA IN 327 BCE, THE ARMY OF HIS INDIAN OPPONENT, PORUS, CONSISTED OF 85 ELEPHANTS, 300 CHARIOTS, 30,000 SOLDIERS ON FOOT AND 4,000 HORSES.



APPARENTLY, PORUS GIFTED ALEXANDER WITH 30 POUNDS OF WOOTZ STEEL. SURELY MUST HAVE BEEN SOMETHING SPECIAL AND WORTHY OF A GIFT TO ALEXANDER.



INDIAN
AND
ORIENTAL ARMOUR



EGERTON OF TATTON

THIS BOOK, WRITTEN
IN 1880 BY EGERTON,
GIVES US A SENSE OF
SCALE IN THE USE OF
IRON AND STEEL IN
MORE RECENT TIMES.



THE MUGHAL ARMIES HAD HUNDREDS OF THOUSANDS OF SOLDIERS AND HUNDREDS OF ELEPHANTS CLOTHED IN STEEL ARMOUR.

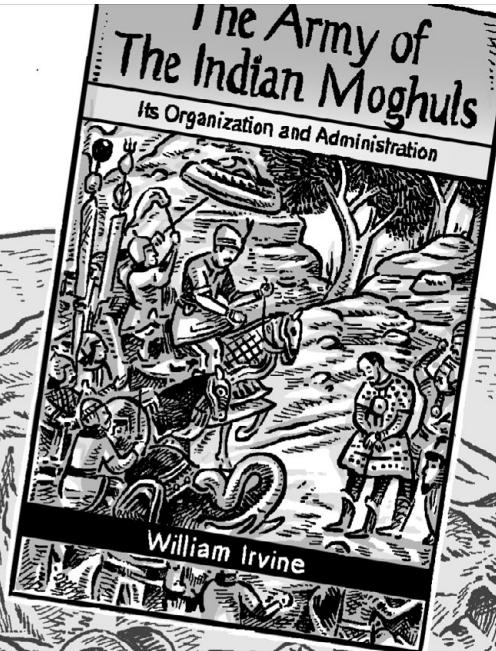


THERE IS AN ACCOUNT
BY WILLIAM IRVINE WHICH
SAYS THAT IT TOOK 500
OXEN AND 4 ELEPHANTS TO
MOVE JUST THE ARTILLERY
OF THE MUGHAL ARMY.

The Army of The Indian Moghuls

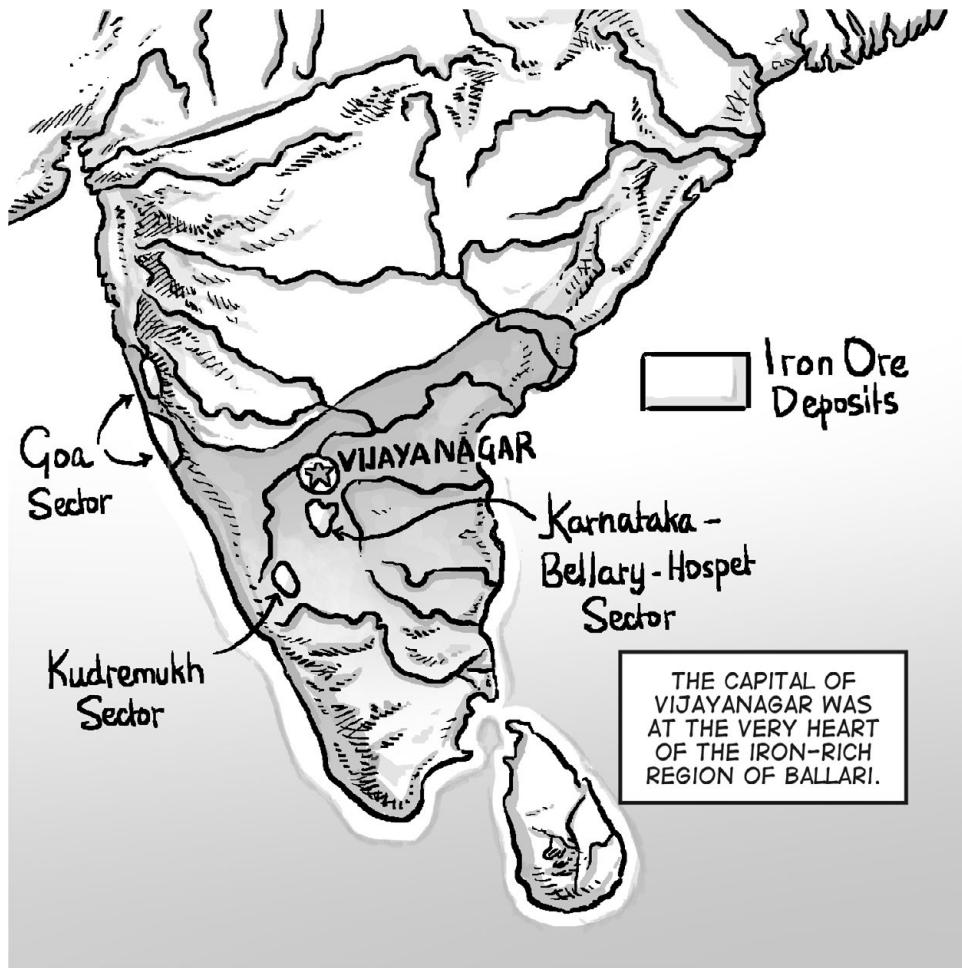
Its Organization and Administration

William Irvine



A PORTUGUESE RECORD MENTIONS THAT THE ARMY OF THE VIJAYANAGAR EMPIRE IN SOUTH INDIA HAD 35,000 HORSES, 733,000 FOOT SOLDIERS, 586 ELEPHANTS AND 400 GREAT CANNONS, BESIDES THE SMALL ARMS AND AMMUNITION.







YOU ALSO HAD MASSIVE CANNONS LIKE THE ONES FOUND IN THE FORTS OF RAJASTHAN, DAULATABAD AND THAJAVUR, EACH WEIGHING 40-50 TONS.





A SMALL CANNON OF 10-15 TONS WOULD REQUIRE 1000-1500 TONS OF WOOD!!

MAKING 100 CANONS WOULD REQUIRE 1,50,000 TONS OF WET WOOD.

A SINGLE LARGE CANNON WOULD HAVE REQUIRED 5000 TONS OF WET WOOD!!



MANY KINGS ALSO
EMPLOYED EUROPEAN
ENGINEERS TO DESIGN
AND MANAGE
ORDNANCE FACTORIES.

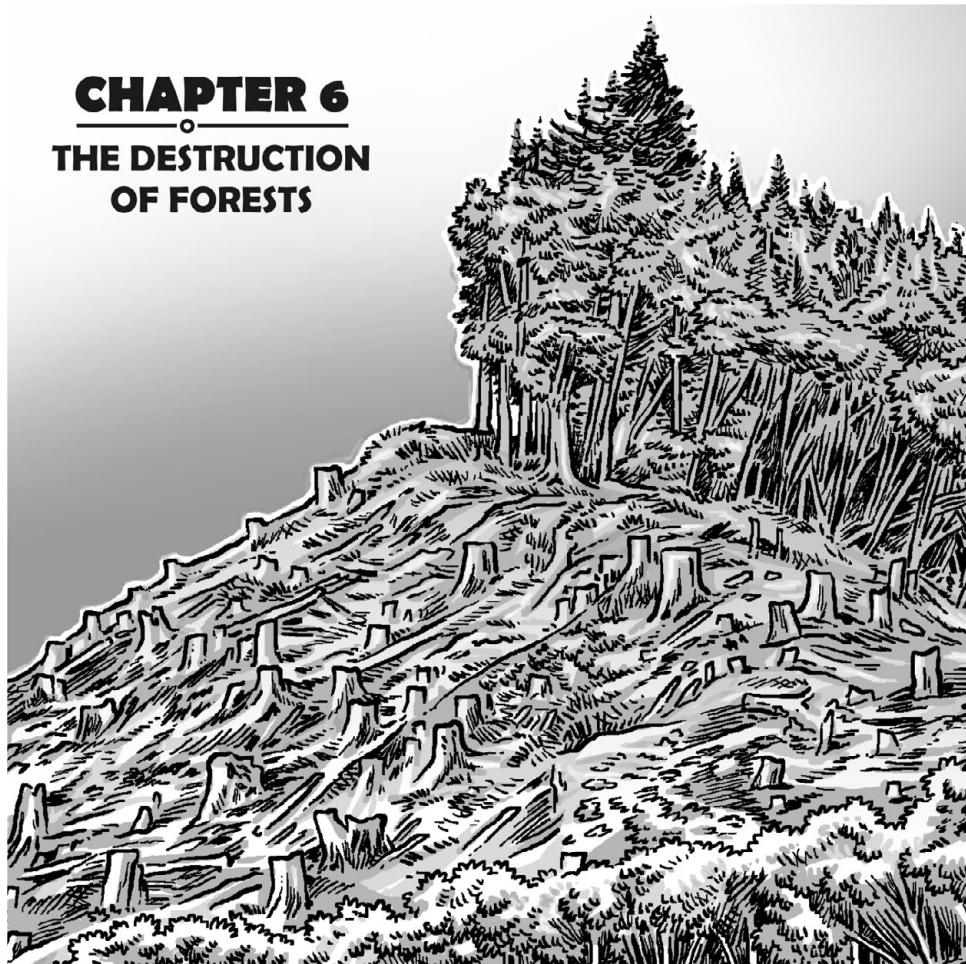


NOW IT'S
CLEAR WHY TIPLI'S
WARS COULD HAVE
LED TO MASSIVE
DEFORESTATION
ACROSS ERSTWHILE
MYSORE.



CHAPTER 6

THE DESTRUCTION OF FORESTS







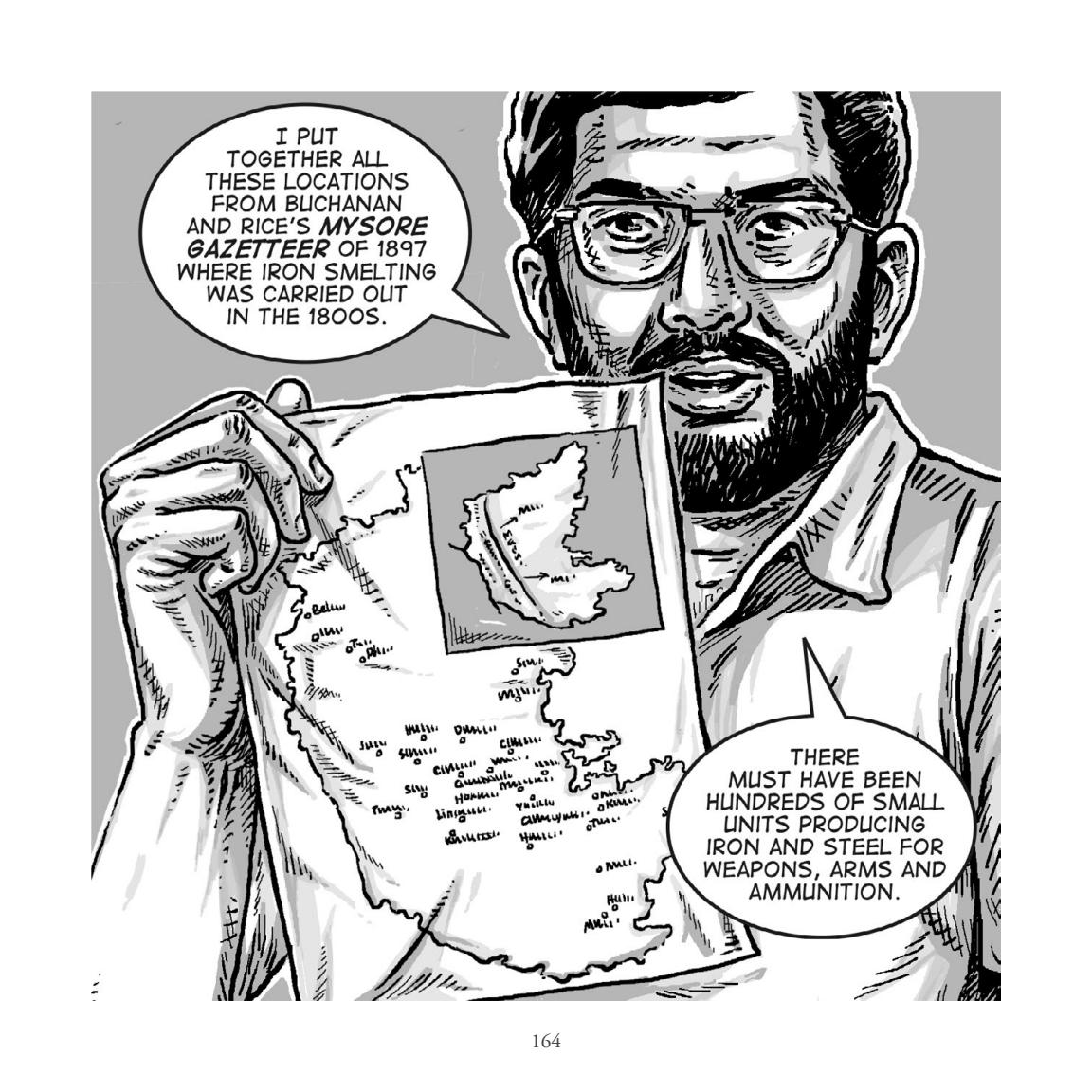






I ALWAYS
THOUGHT IT WAS
MODERN INDUSTRY
AND THE RAILWAYS
THAT DESTROYED
FORESTS.





I PUT
TOGETHER ALL
THESE LOCATIONS
FROM BUCHANAN
AND RICE'S *MYSORE
GAZETTEER* OF 1897
WHERE IRON SMELTING
WAS CARRIED OUT
IN THE 1800S.

THERE
MUST HAVE BEEN
HUNDREDS OF SMALL
UNITS PRODUCING
IRON AND STEEL FOR
WEAPONS, ARMS AND
AMMUNITION.



I HAVE ALSO
LISTED BRITISH
RECORDS THAT REPORT
IRON SMELTING AND
DESTRUCTION OF
FORESTS ACROSS
INDIA.

tracts of the Indus, Ganges and Brahmaputra,
Central Provinces, Assam and the Naga Hills.
Kashmir, Ahmedabad, Kathiawar and Kachchh,
Bengal, Bihar.

Tendukera on the Narmada
Kappatgud hills in Dharwar, Belgaum,
Ratnagiri, Rewa Kantha, Kaira.
Nellore, North Arcot, Madura, Salem,
Tiruchirappalli, Mysore State and
the Deccan plateau.
Canara, Bypore in the Malabar.

PAPERS ON
THE IMPACT OF IRON
SMEILING ON FORESTS
ACROSS THE WORLD.

ENGLAND,
IRELAND, RUSSIA,
AFRICA, AMERICA,
SWEDEN...

Advances in Historical Studies > Vol.3 No.2, March 2014

Historic Charcoal Production in the US and Forest Depletion: Development of Production Parameters

Thomas J. Straka

Dark ages and dark areas:
global deforestation
in the deep past

Iron is iron 'til it is rust: Trade
and Ecology in the Decline
of West African Iron-Smelting*

Did the charcoal-based iron
industry really
drive the forest cover decline in the
Northern Pyrenees?

Léonel Fauquédu
andrée Parrot, with Sylvestre, Métais





PERHAPS SHIFTING
CULTIVATORS WERE
CHARCOAL-MAKERS AND
IRON SMELTERS.



CHOP THE TREES FOR CHARCOAL, CULTIVATE
SOME GRAINS WHILE THEY MANUFACTURE
IRON. THEN MOVE ON TO A FRESH SITE.



MAKES SENSE NOW.
BECAUSE THESE WERE AND
ARE THE MOST IRON-RICH
AND FORESTED REGIONS
OF INDIA.

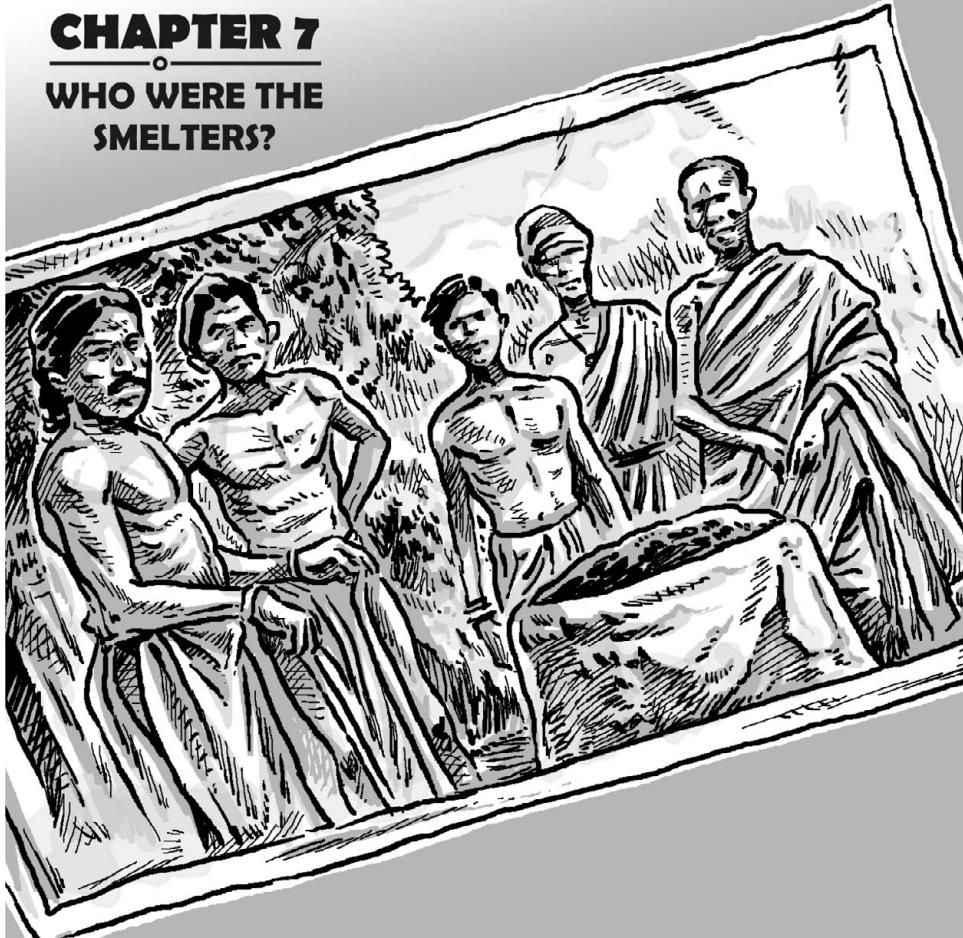
AND INHABITED BY TRIBES WHO
WERE THE GREATEST IRON
SMELTERS IN ANCIENT INDIA.





CHAPTER 7

WHO WERE THE SMELTERS?





CHHATTISGARH, INDIA

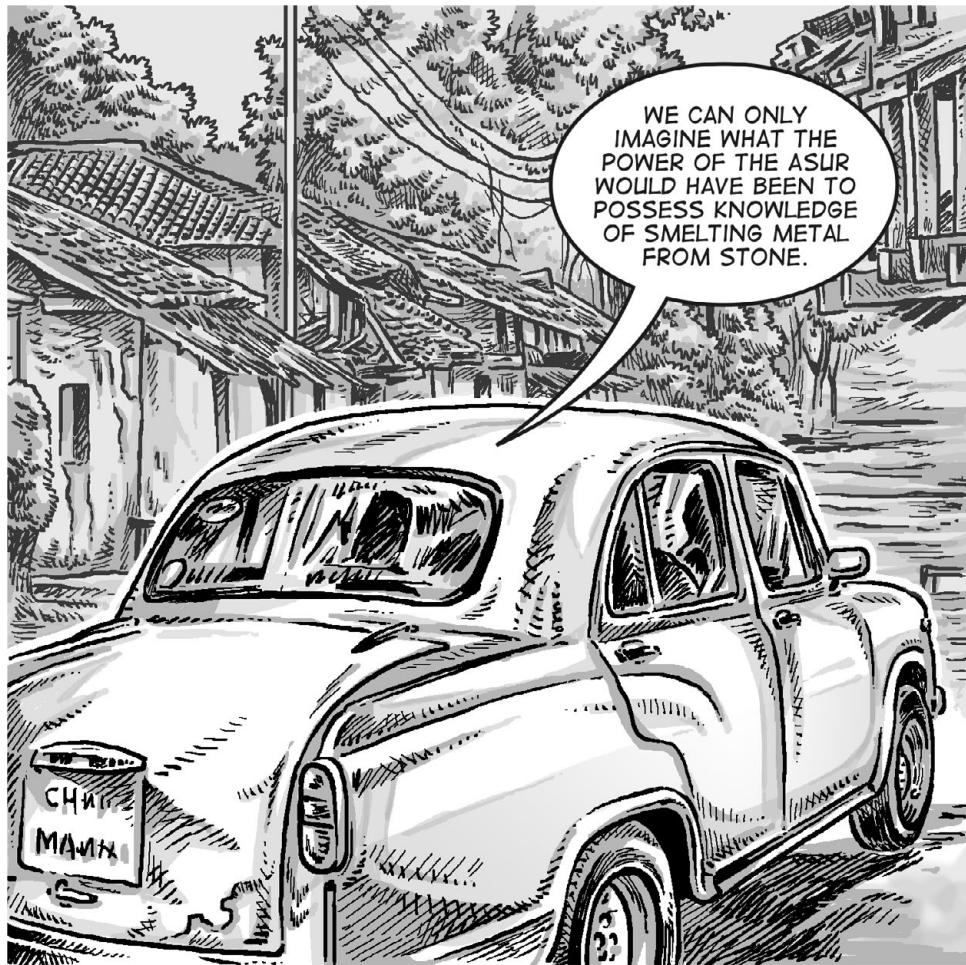
IT'S GREAT,
TRAVELING IN AN
AMBASSADOR!

TO MEET THE
ASUR AND AGARIA
WHO TAUGHT THE
WORLD HOW TO
SMELT IRON.



VERRIER ELWIN, THE
RENNED ANTHROPOLOGIST,
CLAIMS THAT THE ASUR ARE
THE ASURA OF SANSKRIT
LITERATURE.

THE DEVAS
BELONGED TO
THE STONE AGE WHILE
THE ASUR WERE THE
BRINGERS OF THE
IRON AGE.









THE ASUR
AND AGARIA
WERE FEARED AND
REVERED. THEY FIND
MENTION IN THE
RIGVEDA AND
MAHABHARATA...

THEY WERE
THE MYTHICAL
ENEMIES OF
THE DEVAS OR
GODS.

THE AGARIA WOMEN CONSTRUCT
THE FURNACE USING CLAY COLLECTED
FROM THE RIVER BED AND DRIED HUSK.



THE SMELTERS SET OUT INTO THE HILLS TO COLLECT THE IRON ORE AVAILABLE IN CLOSE PROXIMITY TO THEIR VILLAGE.





THE IRON ORE IS
COLLECTED AND BROUGHT
TO THE SMELTING SITE.

SO, THE
TRIBES MAY
NOT HAVE BEEN
AS ISOLATED
FROM SOCIETY
AS IMAGINED.

PERHAPS
FROM THE
AGRICULTURAL
VILLAGES, BUT
NOT THE
STATE.



THE AGARIA
WERE COMPLETELY
ABSORBED IN THEIR CRAFT
AND THEIR MATERIAL; THEY
HAVE LITTLE LIFE APART
FROM THE ROAR OF THE
BELLOWS AND THE DANG
OF HAMMER UPON
IRON.

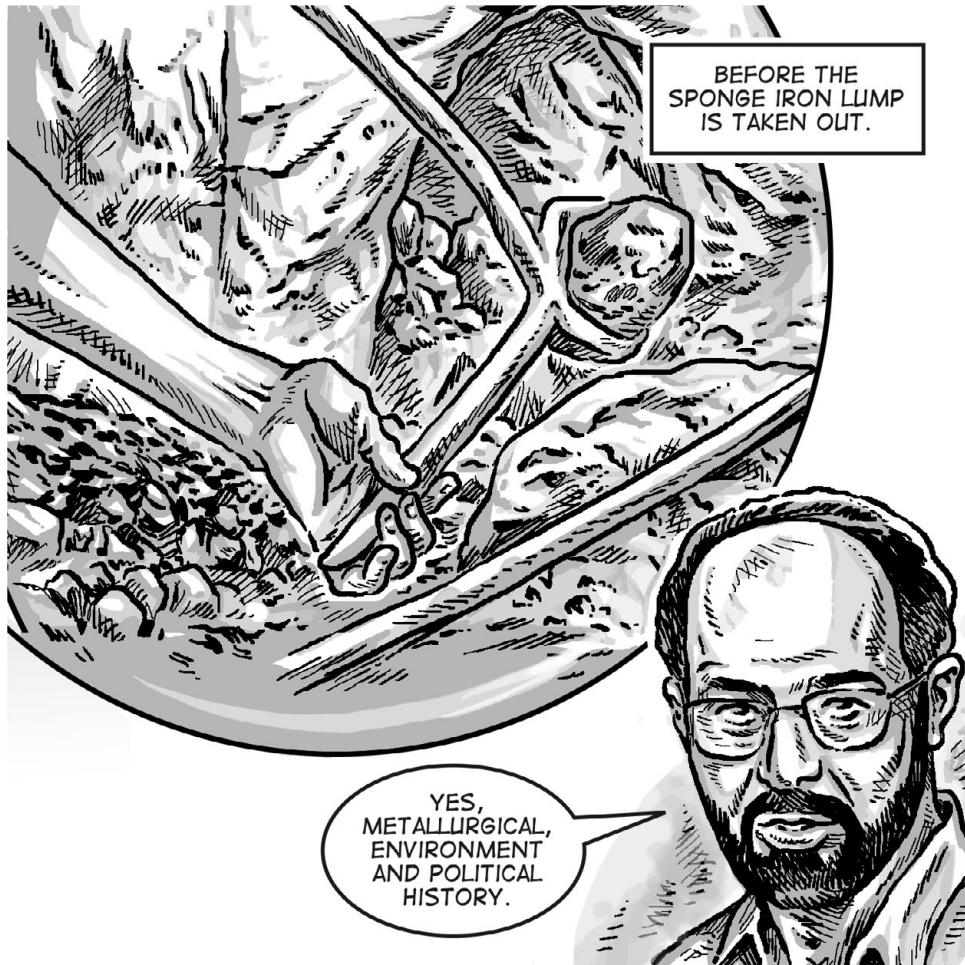
CHARCOAL AND IRON
ORE ARE POURED INTO
THE FURNACE IN THE
RATIO OF 16:15.





THE PROCESS CAN
TAKE SEVERAL HOURS.

IT ALL FITS
IN TOGETHER,
DOESN'T IT?





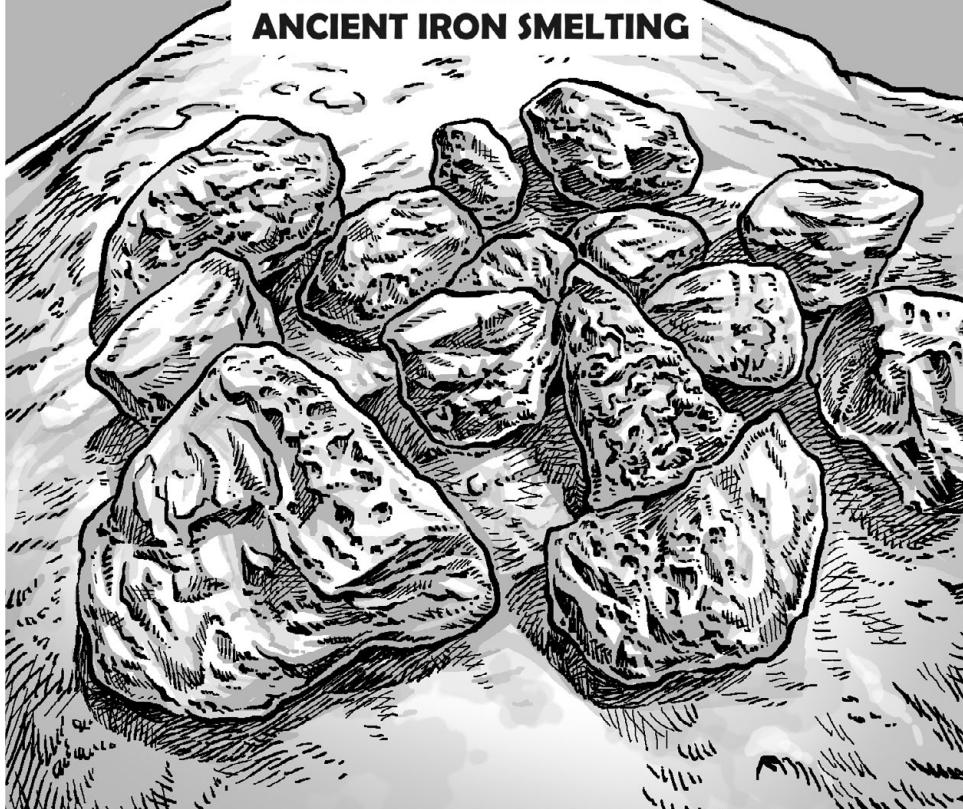
THE IRON IS SHAPED
THROUGH BEATING INTO
IMPLEMENT... PERHAPS
AGRICULTURE, BUT
AT SOME TIME,
ALSO FOR WAR.

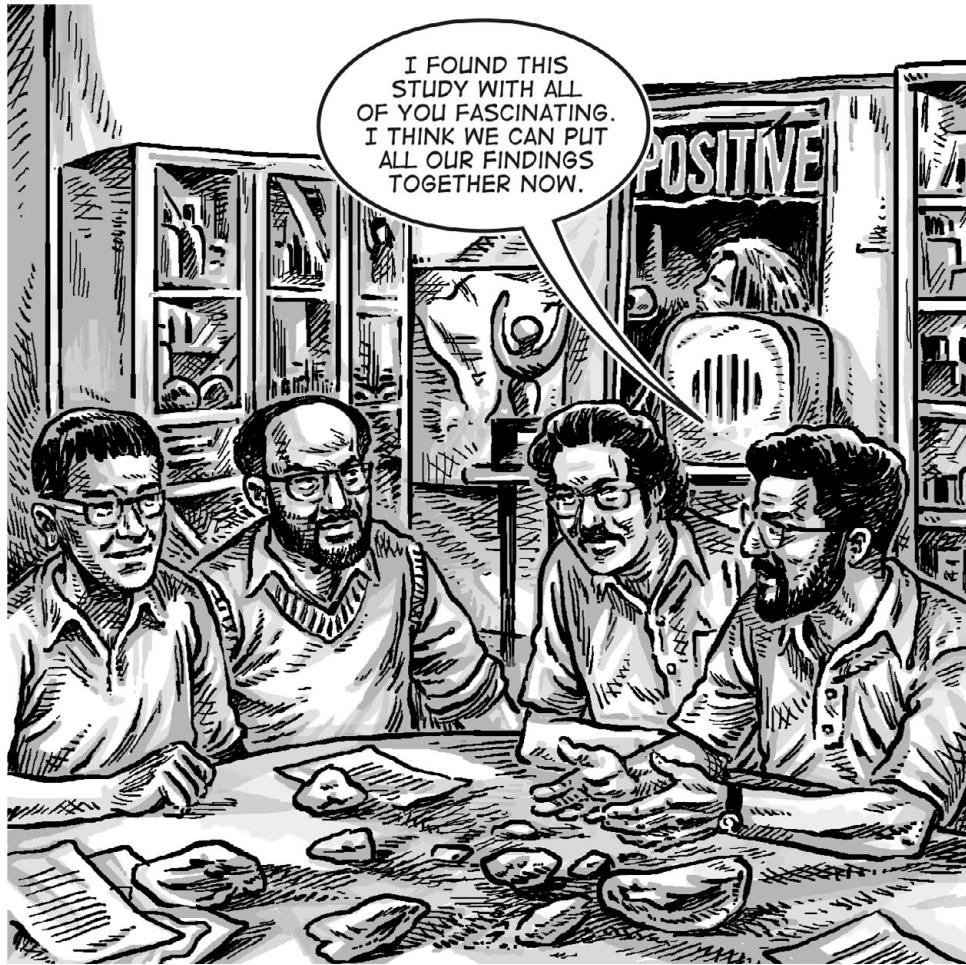




CHAPTER 8

THE DYING EMBERS OF ANCIENT IRON SMELTING







INDIA WAS A WAR ECONOMY
PRODUCING THOUSANDS - IF
NOT HUNDREDS OF THOUSANDS -
TONS OF IRON AND STEEL FOR
ARMS AND AGRICULTURE.



THE SMELTERS WERE TRIBES
LIKE THE ASUR AND AGARIA,
WHO WERE AT THE FOREFRONT
OF THIS TECHNOLOGY.

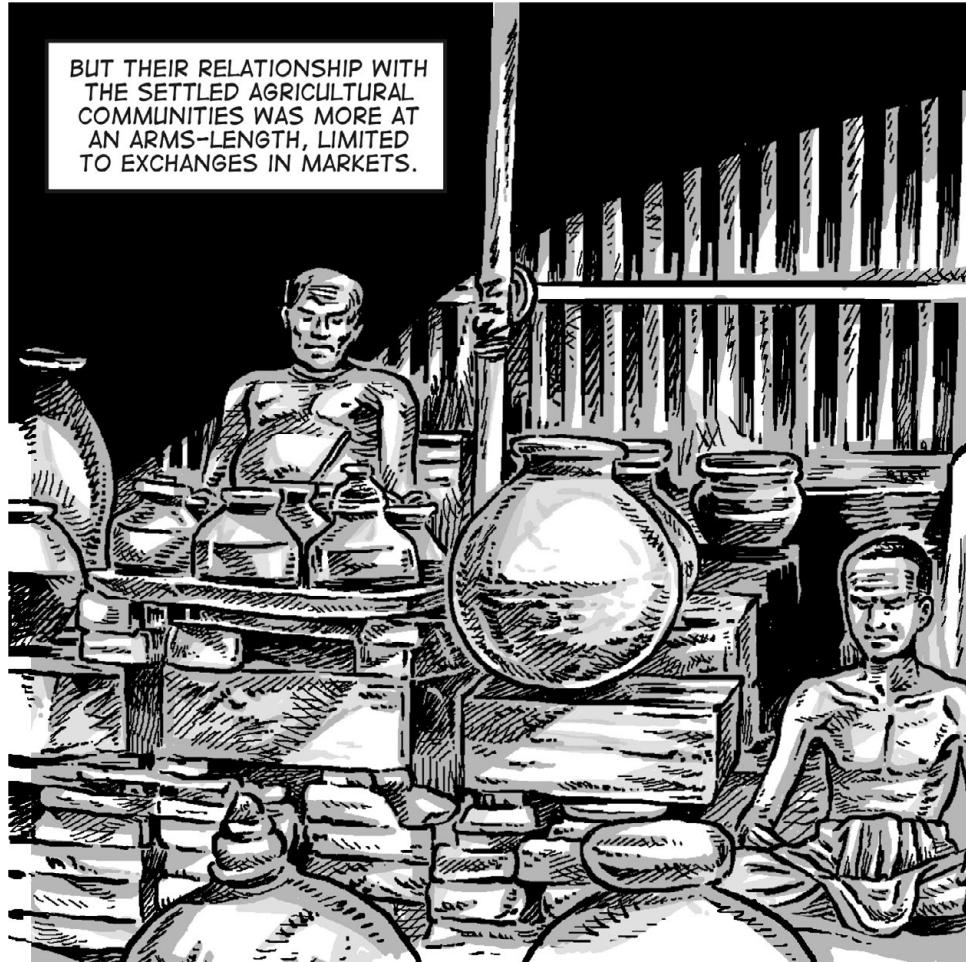
THEY MAY HAVE ALSO ENGAGED IN SHIFTING AGRICULTURE TO PRODUCE THE CHARCOAL FOR SMELTING.



THE SMELTERS HAD A CLOSE RELATION WITH THE STATE PROVIDING IRON AND STEEL INGOTS TO GOVERNMENT-RUN KARKHANAS OR FACTORIES.



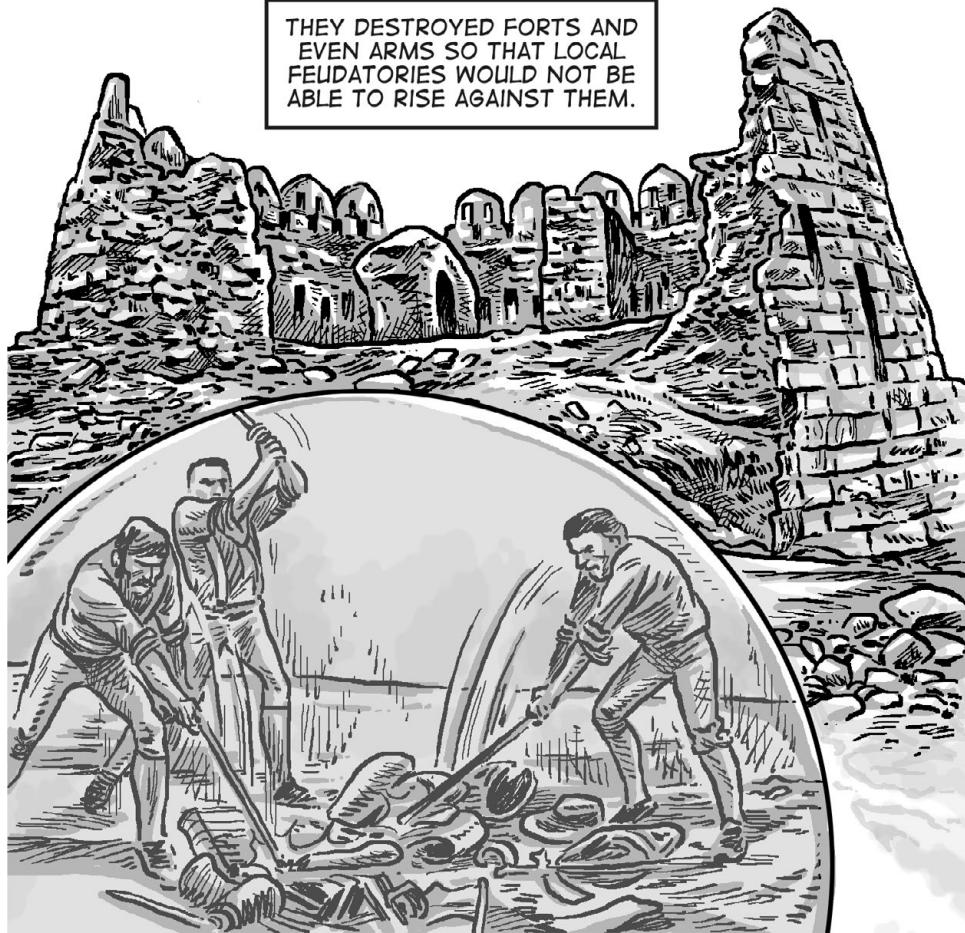
BUT THEIR RELATIONSHIP WITH THE SETTLED AGRICULTURAL COMMUNITIES WAS MORE AT AN ARMS-LENGTH, LIMITED TO EXCHANGES IN MARKETS.



ALL THIS WAS DISRUPTED BY THE
BRITISH, WHO ENDED THE WAR
ECONOMY AS THEY CONSOLIDATED
THEIR POWER AND RULE OVER INDIA.



THEY DESTROYED FORTS AND
EVEN ARMS SO THAT LOCAL
FEUDATORIES WOULD NOT BE
ABLE TO RISE AGAINST THEM.

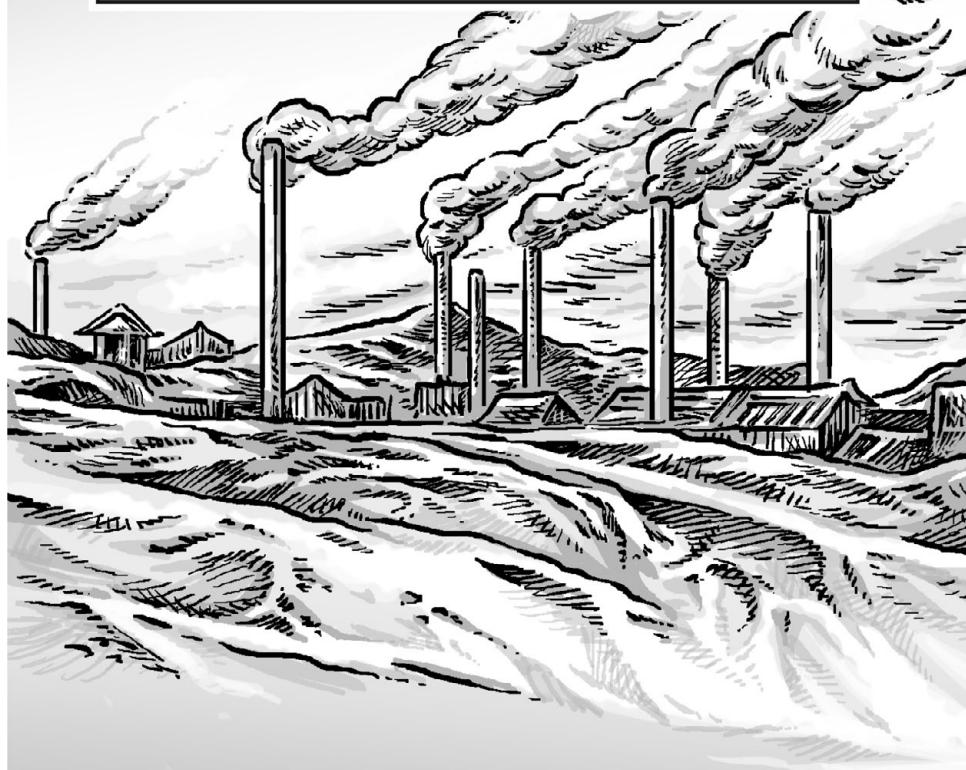




THE RELATIONSHIP BETWEEN TRIBES (SMELTERS) AND THE STATE WAS BROKEN. SOME TRIBES RECEDED INTO ISOLATION IN FORESTS AND SOME TRIED TO INTEGRATE INTO SETTLED AGRICULTURAL VILLAGE LIFE.



ALTHOUGH THE EAST INDIA COMPANY ARGUED THAT LOCAL SMELTERS WERE DESTROYING FORESTS, THEY ENCOURAGED THEIR OWN MODERN LARGE-SCALE FACTORIES TO PRODUCE IRON USING CHARCOAL AS FUEL BY GIVING THEM ACCESS TO FORESTS AT CONCESSIONAL TERMS.



THE LOCAL SMELTERS BEGIN SERVING
THE NEEDS OF AGRICULTURE WHILE THE
BRITISH FACTORIES WERE INTERESTED
IN EXPORTS TO BRITAIN AND FOR THE
RAILWAYS IN INDIA.



A FACTORY WAS SET UP BY JOSIAH MARSHALL HEATH IN 1830 IN PORTO NOVO (PARANGIPETTAI) NEAR PONDICHERRY.



HEATH ALSO STARTED PLANTS
IN BEYPORE AND PALLAPATTI.

Porto Nuvo

Beypore

Pallapatti

Ooty

Coimbatore

Kodaikanal

Kochi

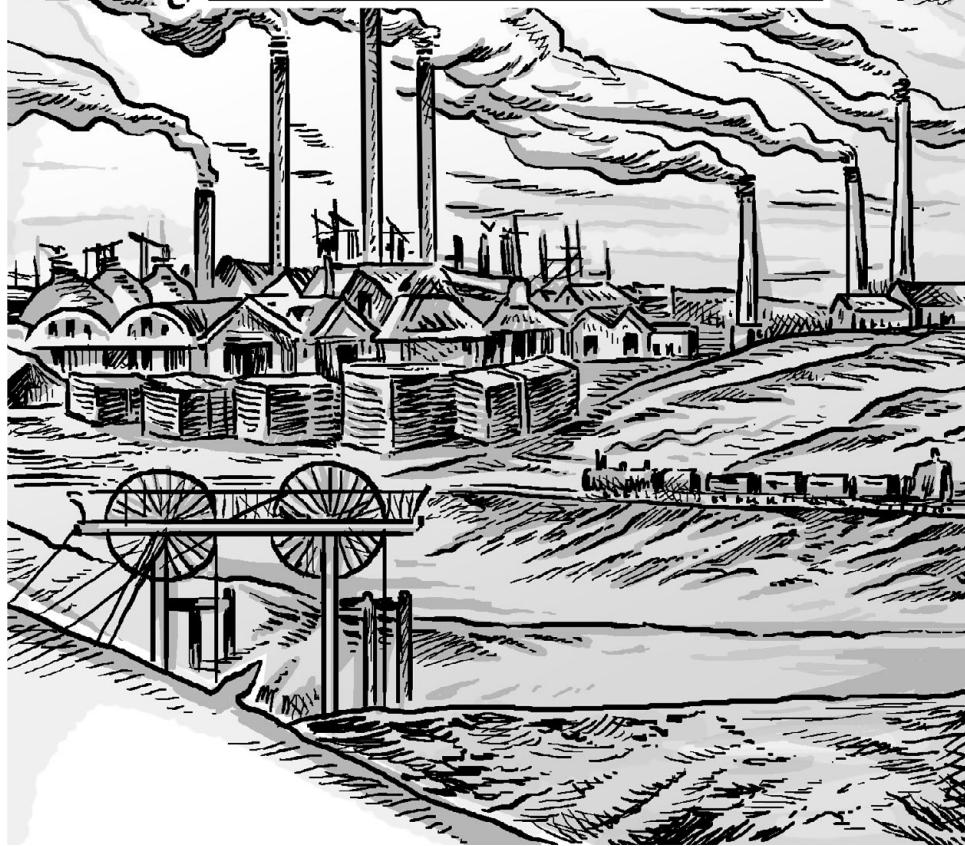
Madurai

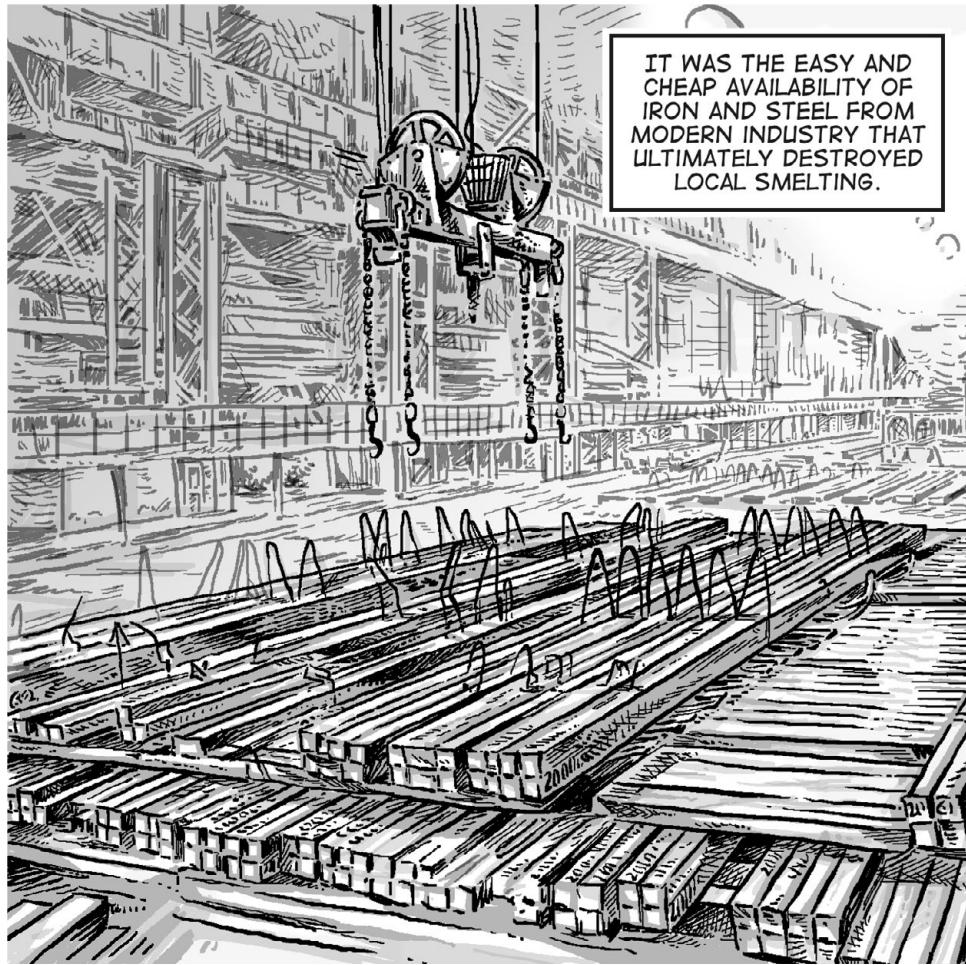
Thiruvananthapuram



ALL THREE FAILED BY THE 1860S DUE TO DIFFICULTY IN PROCUREMENT OF CHARCOAL AND CONSEQUENTLY, FINANCIAL DIFFICULTIES.

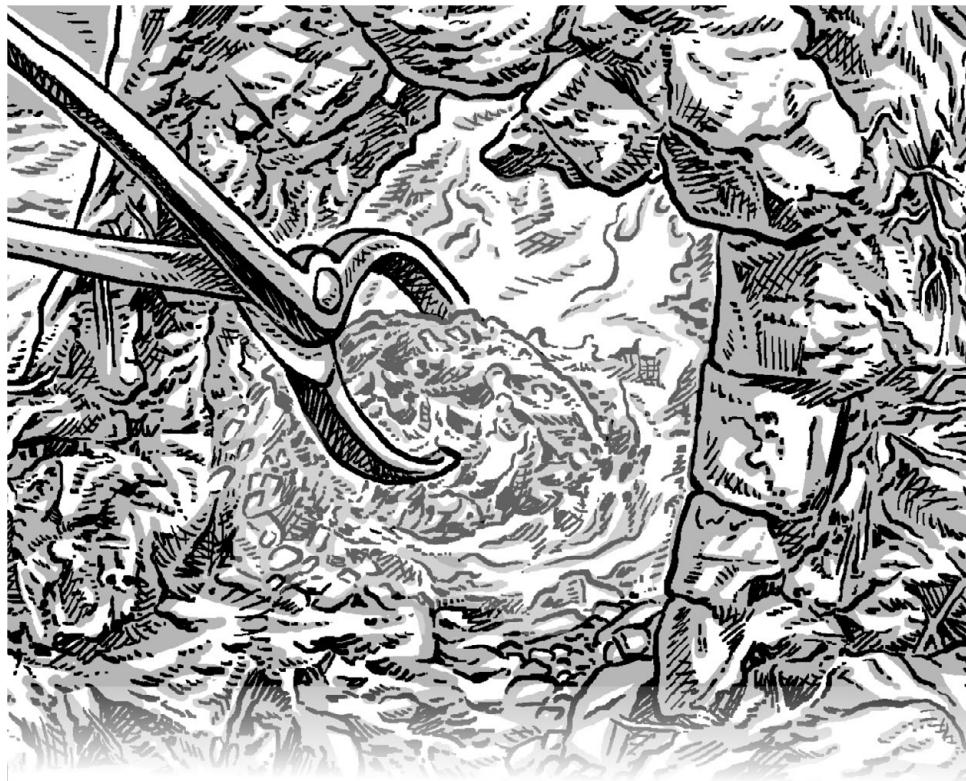
MEANWHILE, THE USE OF COAL TO SMELT IRON
REPLACED CHARCOAL BY THE MID-19TH CENTURY.





IT WAS THE EASY AND
CHEAP AVAILABILITY OF
IRON AND STEEL FROM
MODERN INDUSTRY THAT
ULTIMATELY DESTROYED
LOCAL SMELTING.





THE ASUR AND AGARIA ARE PERHAPS
THE LAST TO HOLD ON TO THE DYING
EMBERS OF ANCIENT IRON SMELTING.

THE END

THE TEAM



SASHI SIVRAMKRISHNA

A PH.D. IN ECONOMICS FROM CORNELL UNIVERSITY, SASHI IS HAS AN INTEREST IN MACROECONOMICS, ENVIRONMENTAL AND MONETARY HISTORY AS WELL AS DOCUMENTARY FILMMAKING. HE IS NOW CHAIRMAN AT FAIR.



HARSHO MOHAN CHATTERAJ

HARSHO MOHAN CHATTERAJ IS A RENOWNED GRAPHIC NOVELIST AND ILLUSTRATOR BASED IN KOLKATA, INDIA. HE HAS BEEN A PROMINENT FIGURE IN THE COMICS' MEDIUM SINCE THE EARLY 2000S. HIS PORTFOLIO INCLUDES A WIDE RANGE OF GRAPHIC NOVELS AND ILLUSTRATIONS FOR BOTH INDIAN AND INTERNATIONAL PUBLISHERS. THIS COMIC HAS COME TO FRUITION WITH HARSHO'S VIVID DRAWINGS AND METICULOUS ATTENTION TO DETAIL, BRINGING THE STORY TO LIFE WITH A UNIQUE BLEND OF HISTORICAL AND IMAGINED ELEMENTS.



MAHADEV NAIK

BEING A FIELD RESEARCHER AT FAIR IN THE EARLY 2000S, MAHADEV TRAVELED EXTENSIVELY WITH SASHI DURING THE INITIAL EXPEDITIONS TO IRON SMELTING SITES. HIS ABILITY TO ENGAGE WITH PEOPLE IN VILLAGES, GAVE US INTERESTING INSIGHTS INTO TRADITIONAL IRON AND STEEL SMELTING. MAHADEV HAS SINCE THEN MADE SEVERAL CORPORATE FILMS AND ALSO RUNS HIS OWN DIGITAL MARKETING COMPANY.



AMALENDU JYOTISHI

A PH.D. IN ECONOMICS FROM THE INSTITUTE FOR ECONOMIC & SOCIAL CHANGE (BANGALORE), AMALENDU IS PRESENTLY PROFESSOR AT AZIM PREMJI UNIVERSITY. AMALENDU PROVIDED HIS CRITICAL IDEAS AND THOUGHTS ON EXPANDING THE SCOPE OF OUR STUDY ON TRADITIONAL IRON SMELTING TO THE ESTABLISHMENT OF STATUTORY FOREST LAWS IN INDIA.



LINGARAJ JAYAPRAKASH

AN ENVIRONMENTAL SOCIAL SCIENTIST WITH A PH.D. FROM MCGILL UNIVERSITY (CANADA), LINGARAJ HAS ASSOCIATED WITH FAIR ON RESEARCH PROJECTS AND DOCUMENTARY FILMS.

HE IS CURRENTLY CONSULTING WITH THE DEVELOPMENT RESEARCH GROUP OF THE WORLD BANK AND WAS PREVIOUSLY ASSOCIATED WITH MCGILL UNIVERSITY IN CANADA, TERI (THE ENERGY AND RESOURCES INSTITUTE) AND UNESCO SOCIAL AND HUMAN SCIENCES DIVISION. HE HAS ALSO BEEN AN ADAPTATION FELLOW AT MIT CLIMATE CO-LABS.



SREEDHAR S.

AN M.A. IN ECONOMICS, SREEDHAR IS PROJECT FIELD INVESTIGATOR AT FAIR. HE HAS WORKED METICULOUSLY BEHIND THE SCENES TO ARCHIVE OUR RECORDS SYSTEMATICALLY AND GIVE FINAL SHAPE TO OUR RESEARCH. HIS KNOWLEDGE OF THE LOCAL HISTORY ACROSS KARNATAKA HELPED US TO ARTICULATE OUR IDEAS APPROPRIATELY.

This graphic novel is a visual journey into the research carried out at the Foundation to Aid Industrial Recovery (FAIR) on traditional iron and steel smelting in India. It repositions iron smelting and the smelter at the centre of a revised narrative of pre- and early-colonial environmental history. In a medieval war economy, the smelter shared a relationship of mutual interdependence with the feudal state as a provider of critical raw material for weapon manufacture. This, however, changed with the advent of the colonial state; interdependence giving way to competition over resources. It is through a multilayered perspective of environmental, military and political history intertwined with the anthropology of iron smelting that we propose a revisionist view of proto-industrial development in India.



POINT OF VIEW

VISUAL NARRATIVES & DOCUMENTATION



"From fire and anvil was wrought the iron that shaped empires and forged the future, but at the cost of forests laid low to feed the furnaces with charcoal, leaving scars upon the earth."