

SASHI SIVRAMKRISHNA HARSHO MOHAN CHATTORAJ



A JOURNEY INTO THE FURNACE OF HISTORY

THE DYING EMBERS OF ANCIENT IRON-SMELTING IN INDIA

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POINT OF VIEW

VISUAL NARRATIVES & DOCUMENTATION

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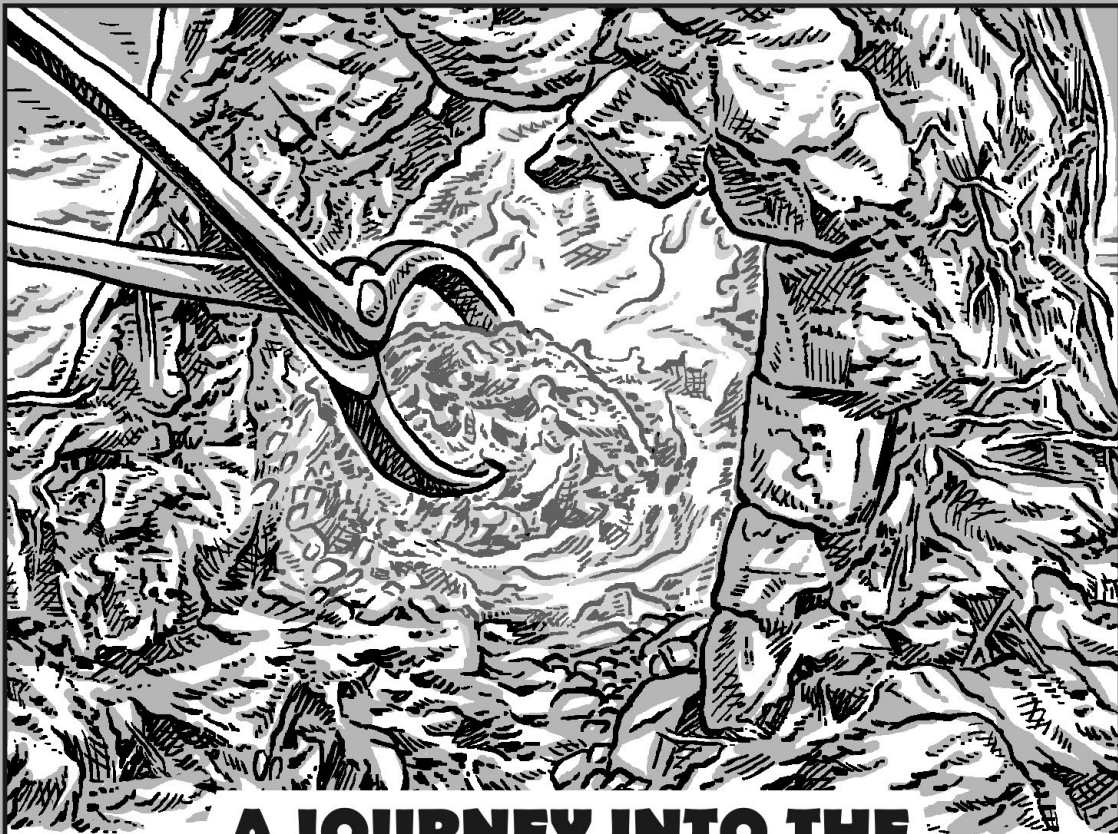
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A JOURNEY INTO THE FURNACE OF HISTORY

**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.

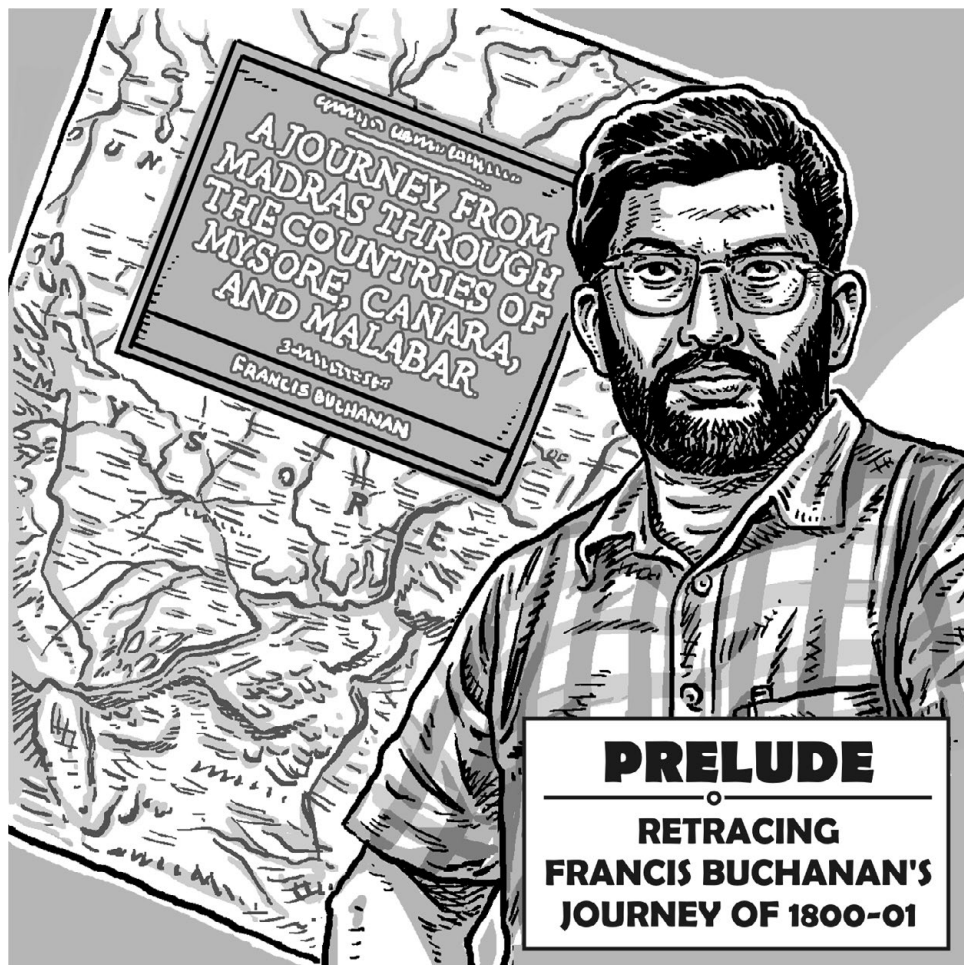
WHILE MOST OF THE CONTENTS HAVE TRIED TO RECORD ACTUAL EVENTS DURING OUR FIELD WORK, SOME OF THE MATERIAL IS IMAGINATIVE, OR FROM RECORDINGS AND INFORMATION OBTAINED IN EXTERNAL SOURCES.

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.

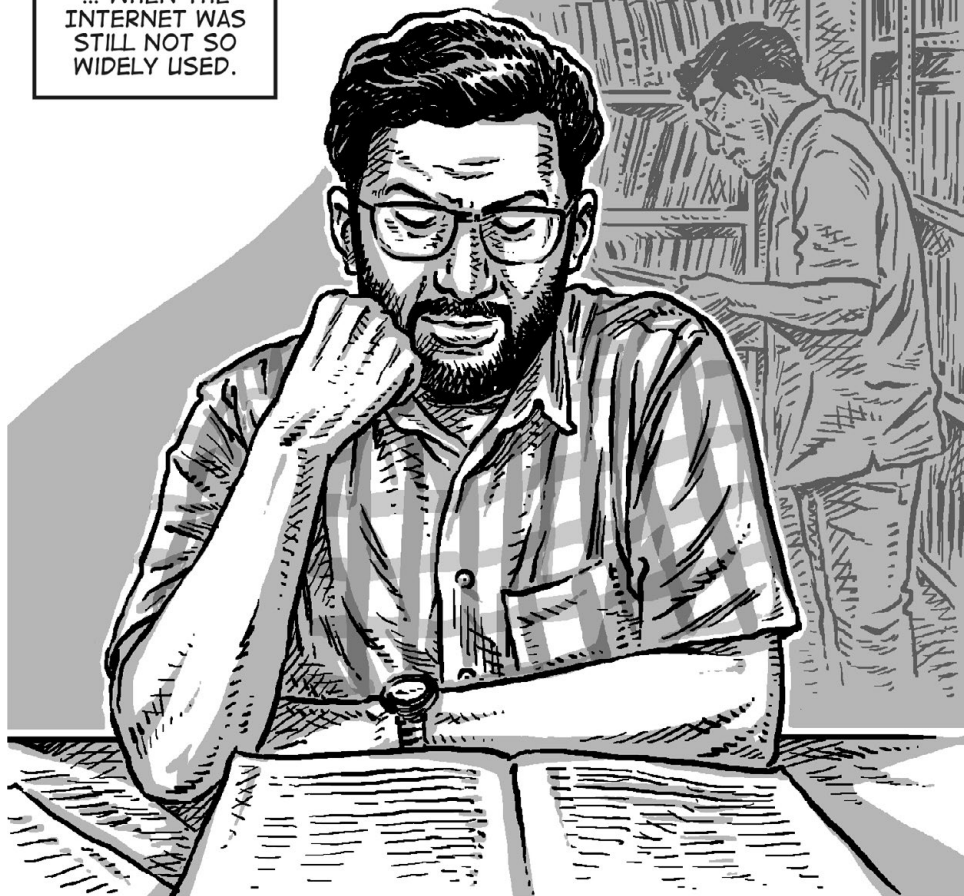
A GRAPHIC NOVEL IS MORE THAN THE WRITTEN WORD. THE ROLE OF THE ARTIST IS EQUALLY IMPORTANT. HARSHO MOHAN CHATTORAJ, AN ACCOMPLISHED ARTIST WITH THE EXPERIENCE OF HAVING DONE SEVERAL GRAPHIC NOVELS AND COMICS, WAS ABLE TO BRING THE IDEAS OF THE AUTHOR TO LIFE THROUGH HIS DEDICATED AND PAINSTAKING ART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





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





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!

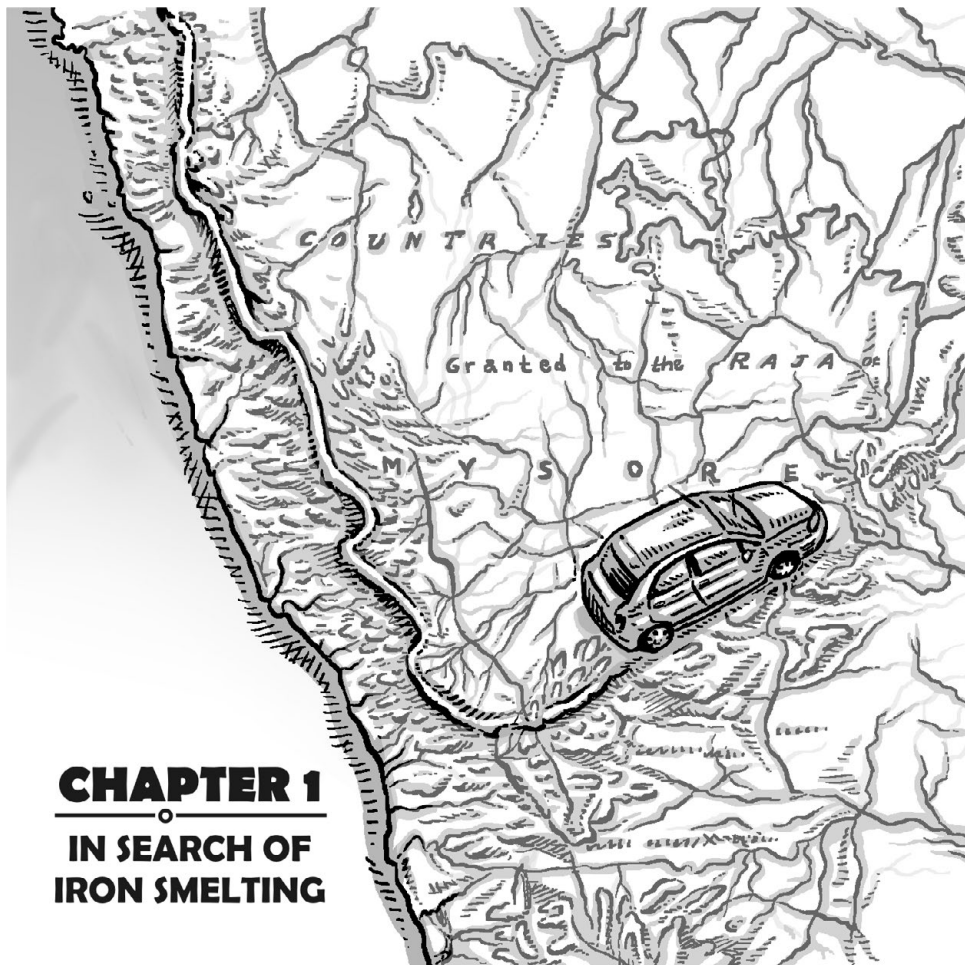


AND THUS WE STARTED ON OUR
OWN EXPLORATION, RETRACING
FRANCIS BUCHANAN'S JOURNEY
THROUGH SOUTHERN INDIA ...



CHAPTER 1

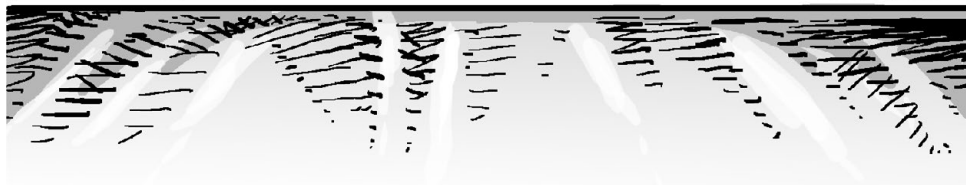
IN SEARCH OF IRON SMELTING



ALL SET, READY TO GO...



LOOKING FOR REMNANTS FROM 200 YEARS AGO.





YET SO MUCH HASN'T...





I THINK
THIS IS CHANNA-
RAYANADURGA.

YES, THAT
MUST BE THE
FORT.

THERE. A
BLACKSMITH'S
SHOP. LET'S
CHECK WITH
HIM.





WE ARE RETRACING
THE JOURNEY OF A
BRITISH SURVEYOR
WHO SPEAKS ABOUT
YOUR VILLAGE.

HE SAYS
THAT IRON WAS
SMELTED HERE
200 YEARS
AGO.



OUR VILLAGE,
REALLY? I CAN'T
READ THIS BUT IT'S
SURPRISING TO SEE
THIS OLD RECORD OF
**CHANNARAYANA-
DURGA!**

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

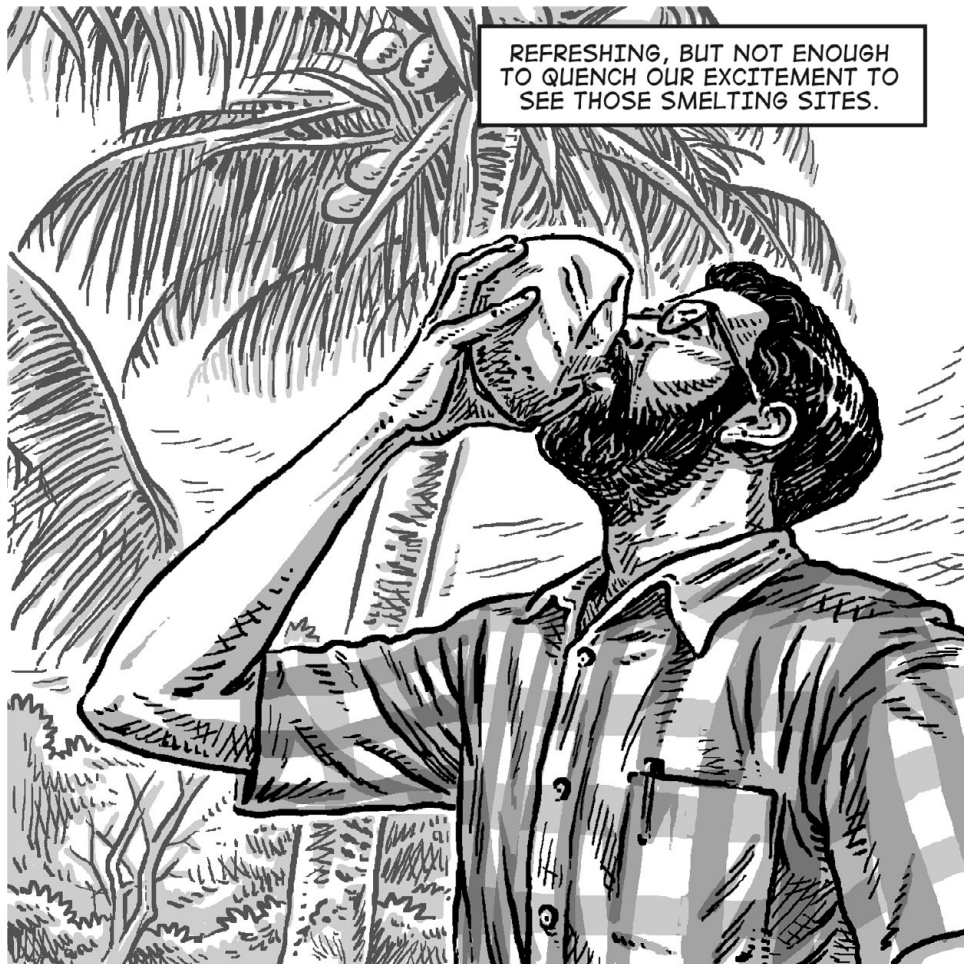
I STILL
WORK WITH IRON.
WOULD YOU LIKE
TO SEE SOME
OLD SITES?

OF
COURSE!

YES,
PLEASE!







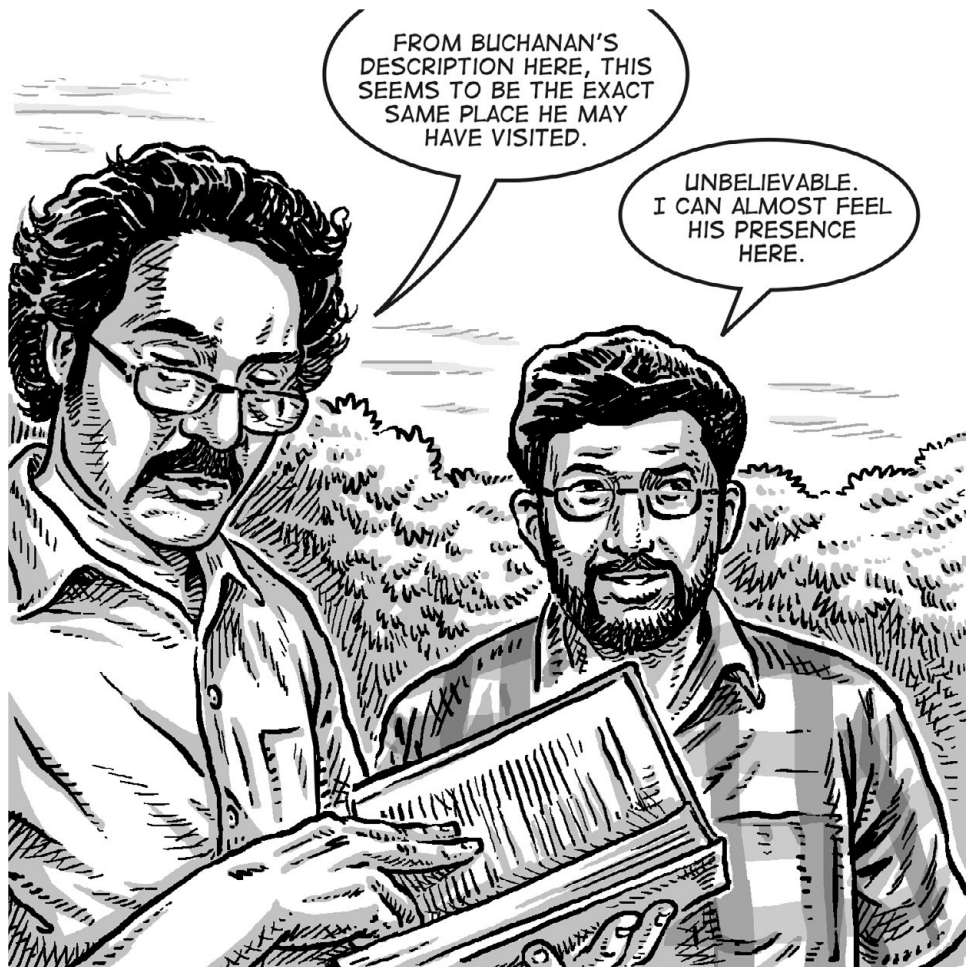
REFRESHING, BUT NOT ENOUGH
TO QUENCH OUR EXCITEMENT TO
SEE THOSE SMELTING SITES.





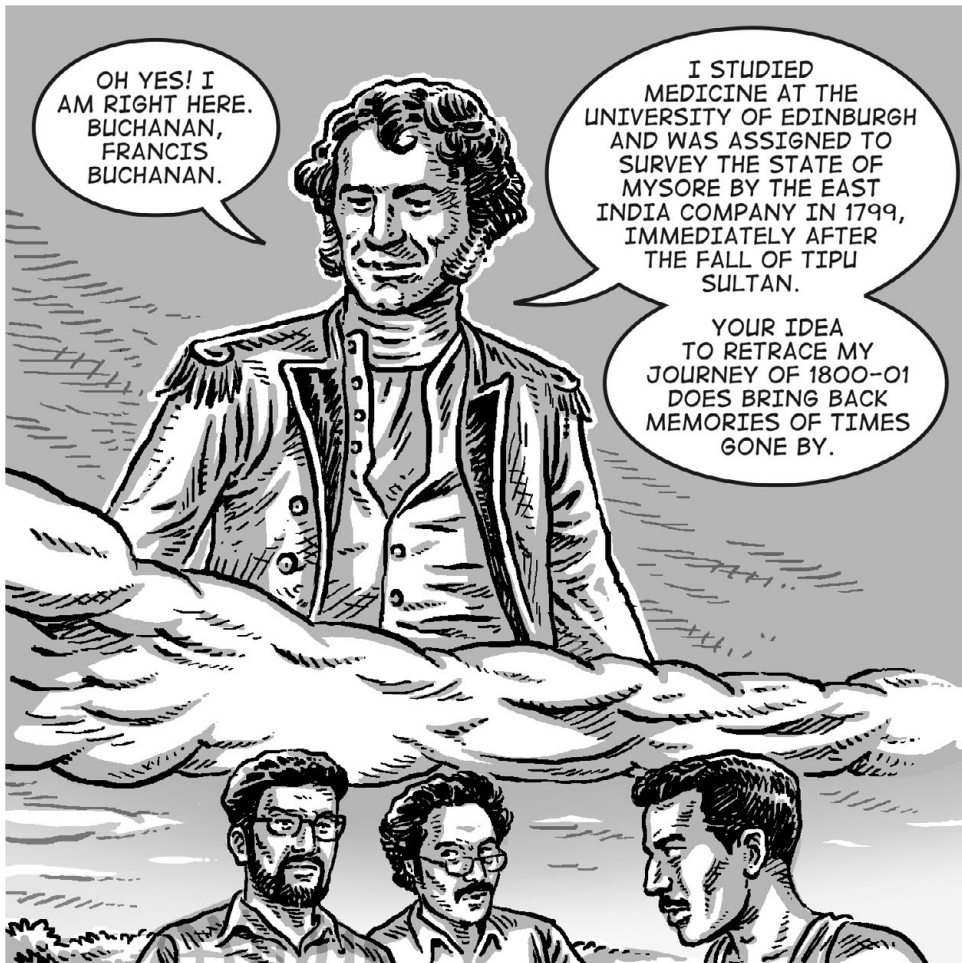






FROM BUCHANAN'S
DESCRIPTION HERE, THIS
SEEMS TO BE THE EXACT
SAME PLACE HE MAY
HAVE VISITED.

UNBELIEVABLE.
I CAN ALMOST FEEL
HIS PRESENCE
HERE.

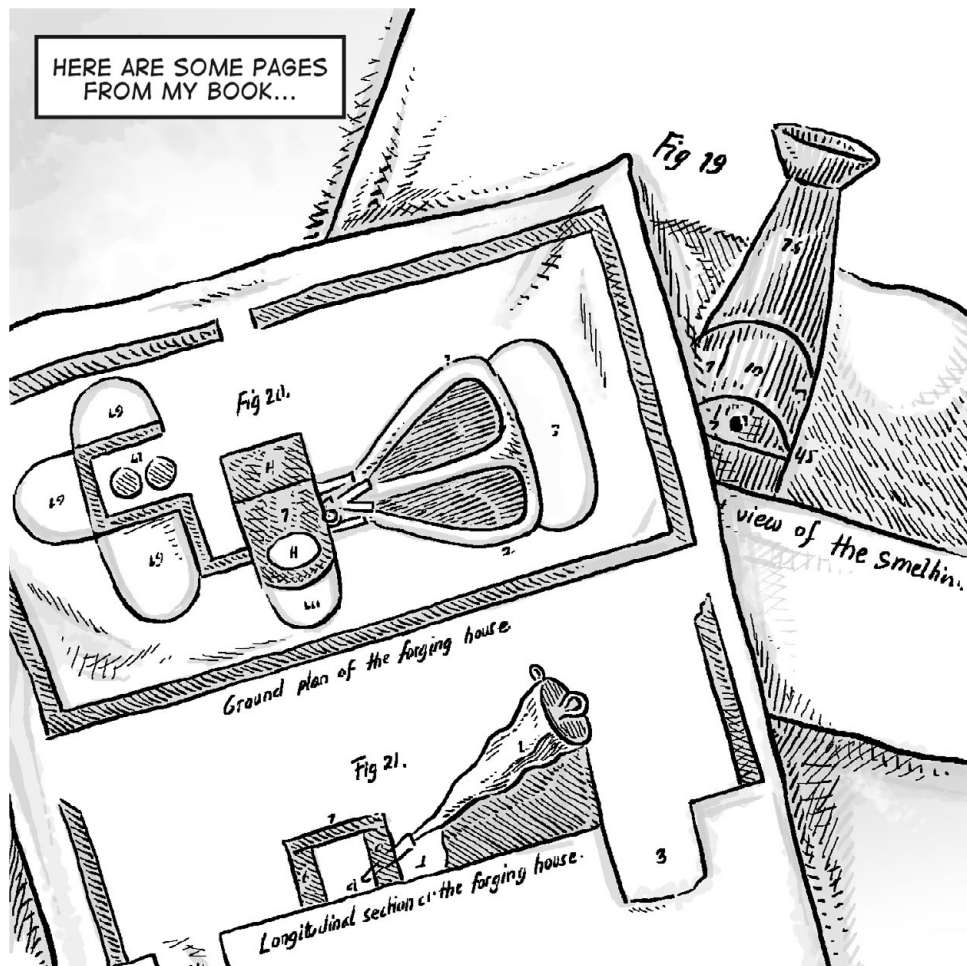


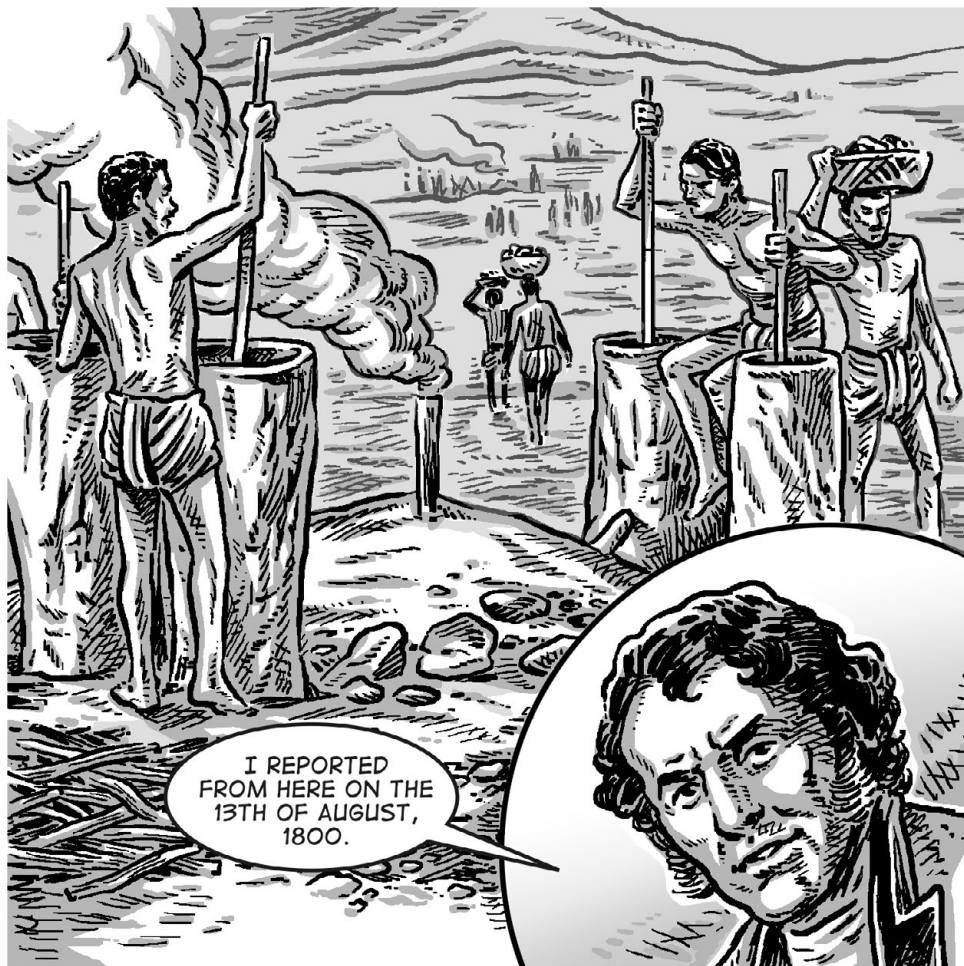
OH YES! I
AM RIGHT HERE.
BUCHANAN,
FRANCIS
BUCHANAN.

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...

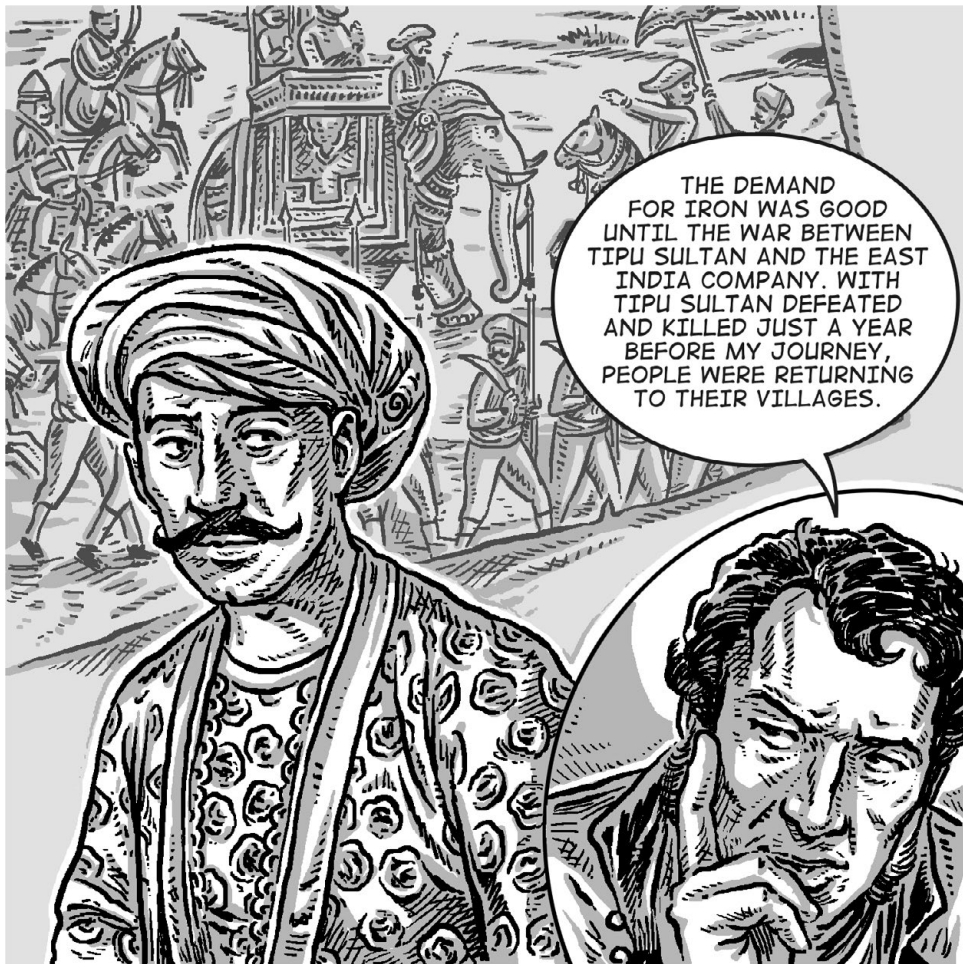




THERE WAS STILL
SOME SMELTING
HAPPENING
HERE AT THAT
TIME.

I REMEMBER THE
SOUND OF PUMPING
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.



HOW
LARGE WAS
THIS SMELTING
SITE?

ONE ACRE,
MAYBE. BUT
SOME ARE EVEN
AS MUCH AS 8
ACRES.

WOULD
YOU LIKE TO
SEE ANOTHER
ONE?

YES.



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

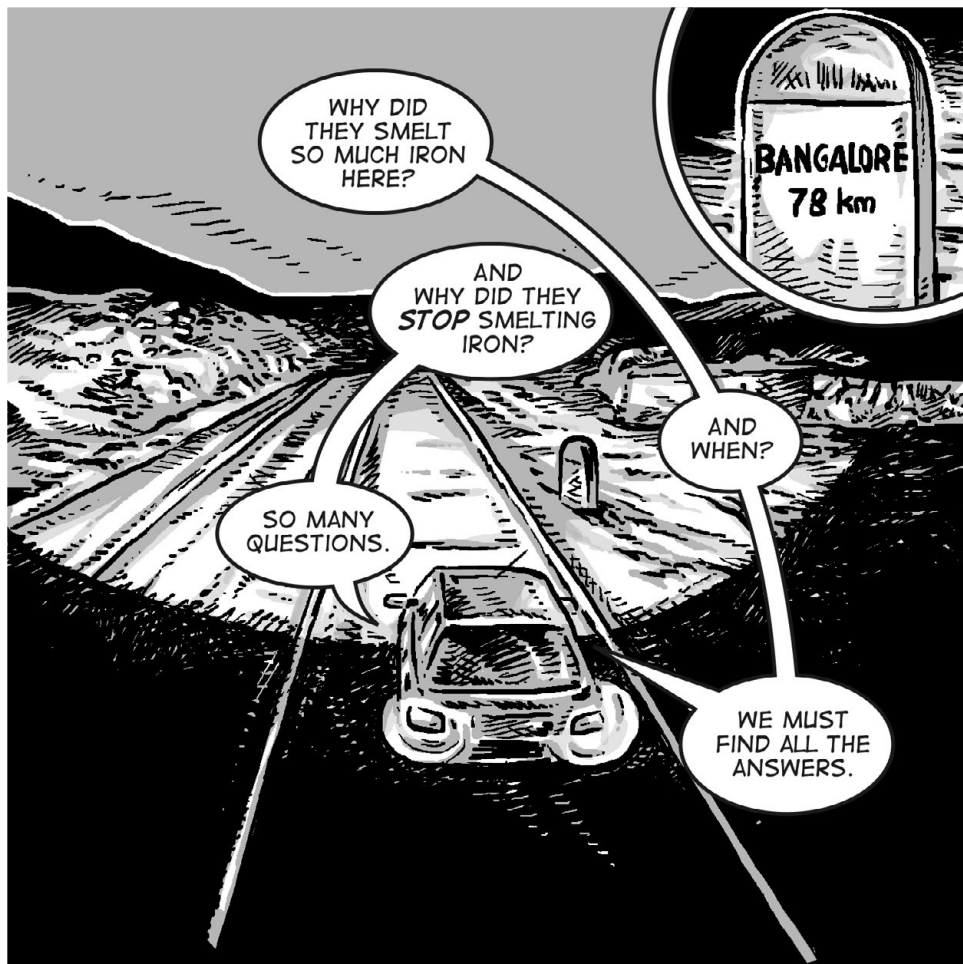


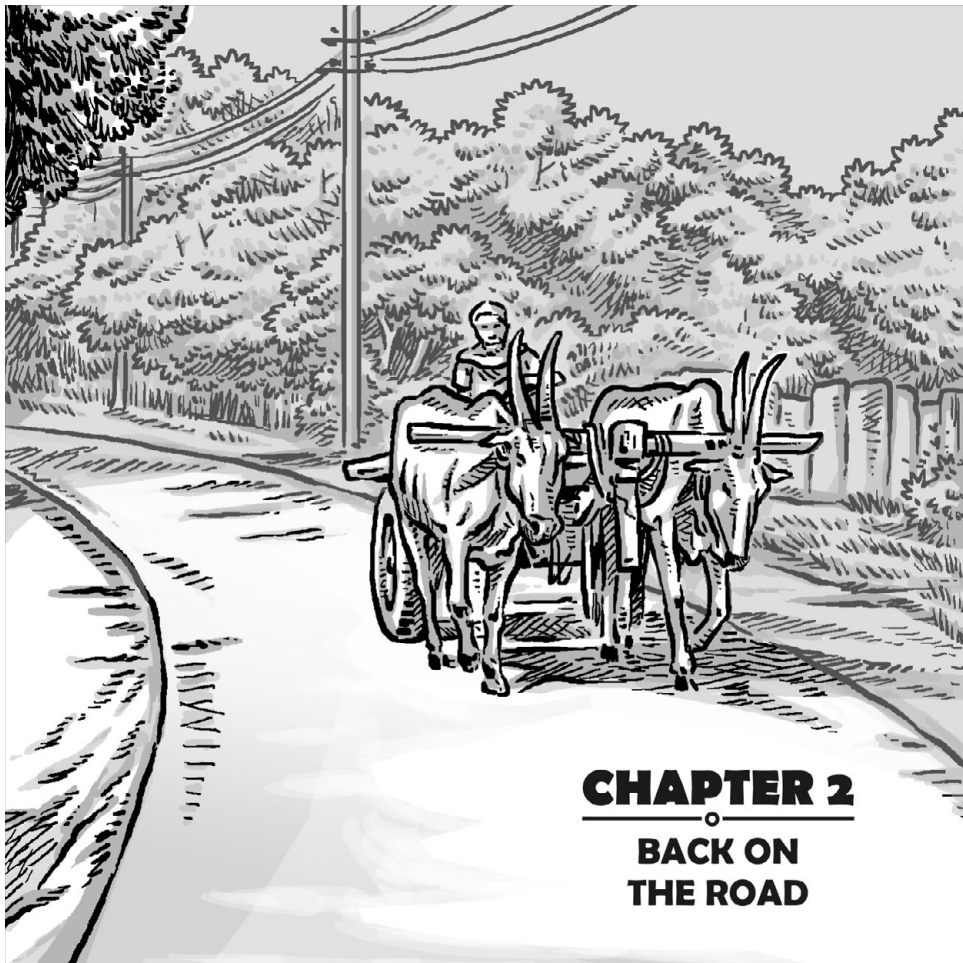












CHAPTER 2

BACK ON THE ROAD



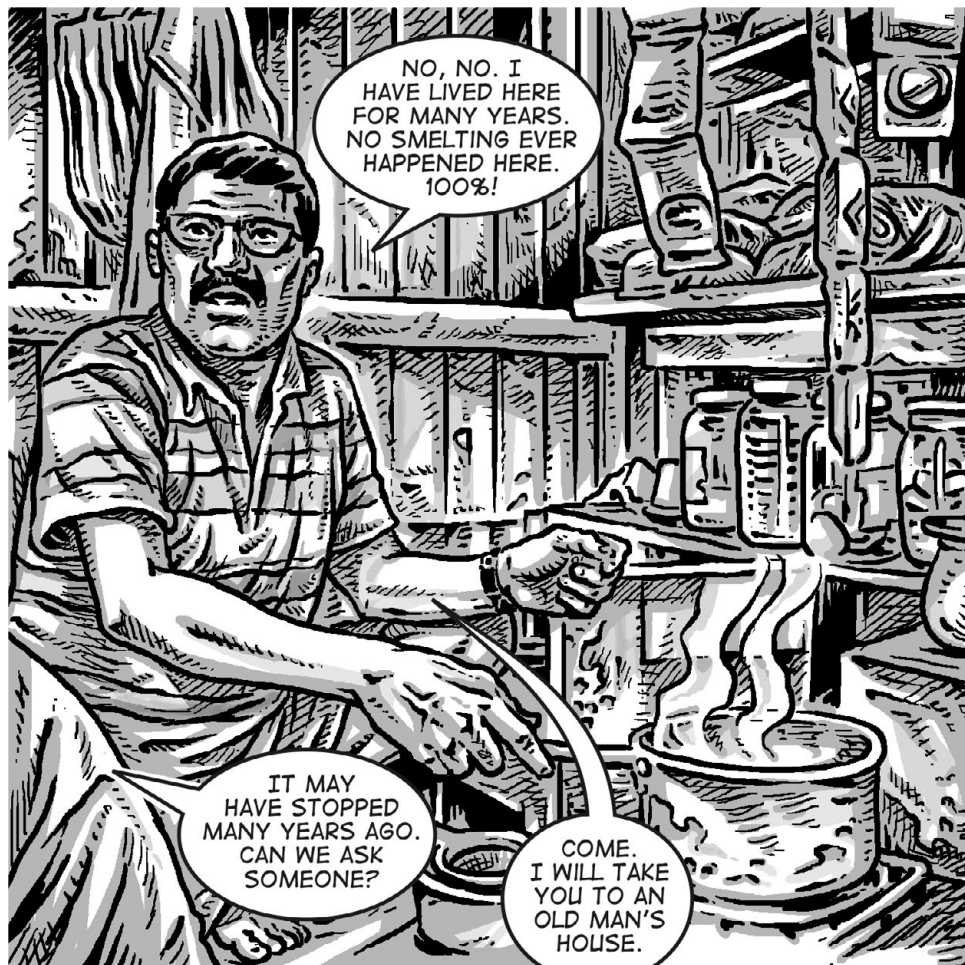


HEY, THERE
IS A CATTLE
FAIR HAPPENING
THERE.

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











YOU ARE RIGHT.
EVERYBODY
HAS FORGOTTEN
OUR HISTORY.

BEHIND ANAND'S
TEA SHOP, NEXT TO
THE TEMPLE, IRON WAS
SMELTED UNTIL 50
YEARS AGO.

NOW, IT
IS ALL GONE.
EVEN THE FURNACES
ARE GONE. THEY
WERE *SO* BIG.









IMAGINE, THIS
WAS AN INDUSTRIAL AREA
AND NOW AGRICULTURAL.
WE ALWAYS THINK
THE OTHER WAY,
DON'T WE?







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.



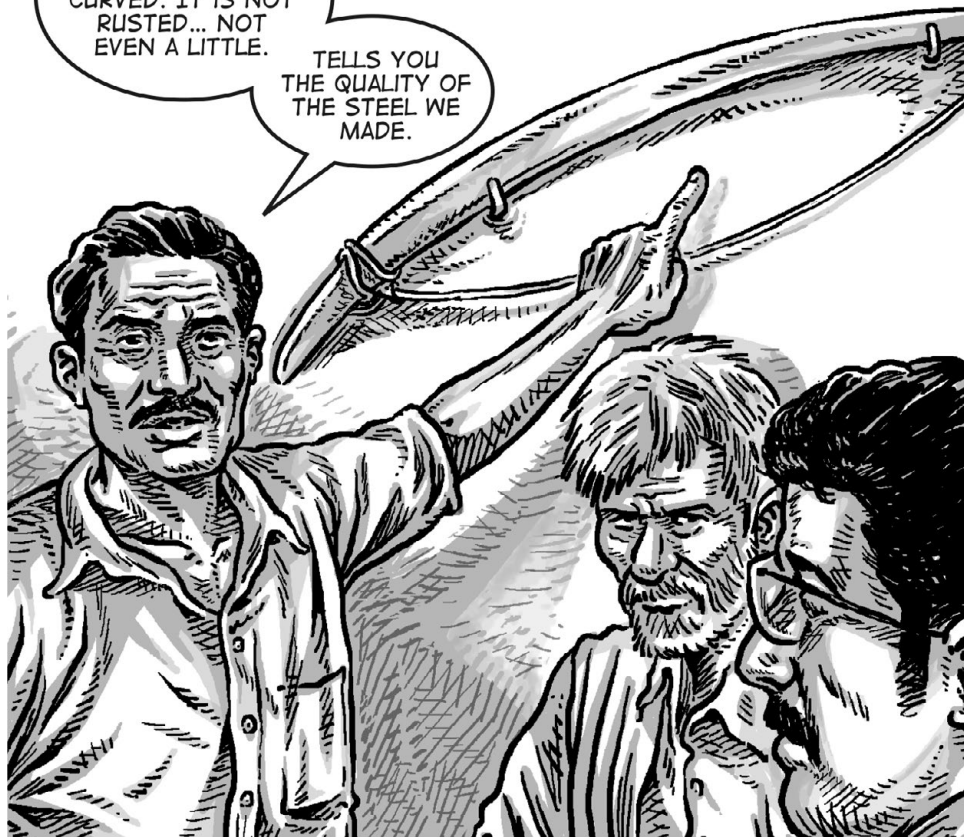






FEEL THE
WEIGHT OF THIS.
SEE HOW IT IS
CURVED. IT IS NOT
RUSTED... NOT
EVEN A LITTLE.

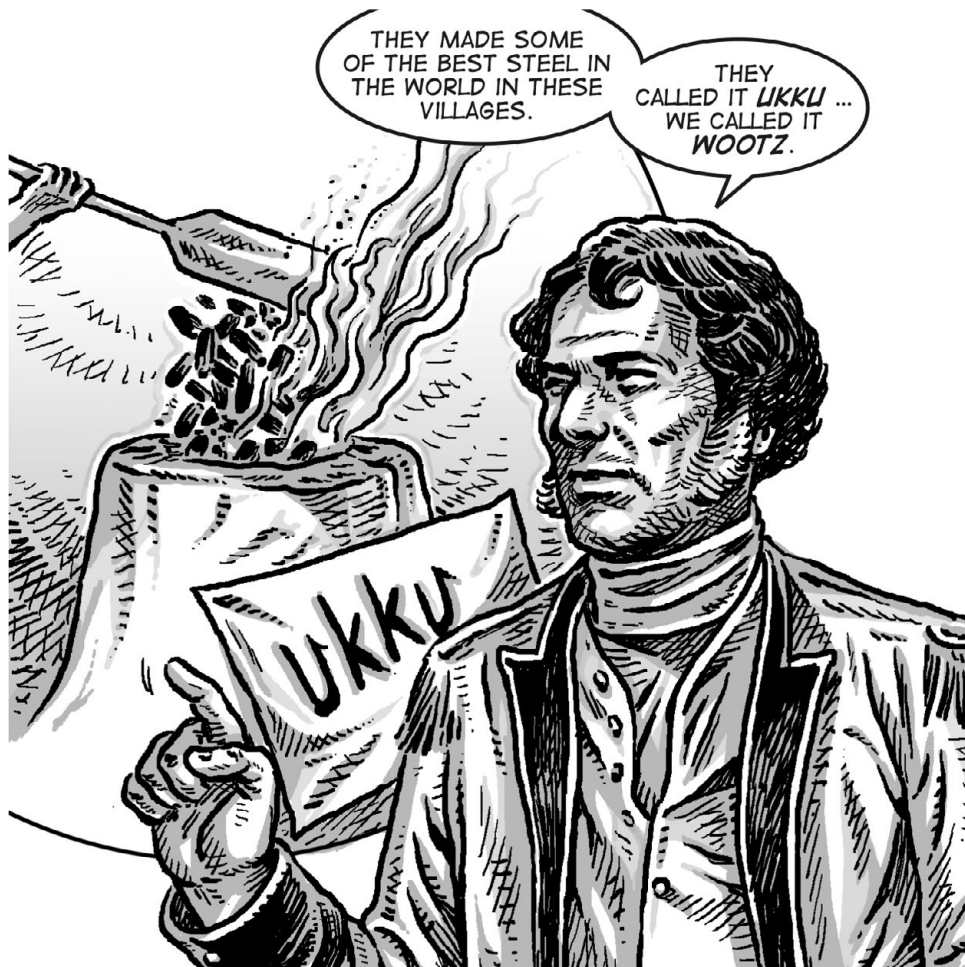
TELLS YOU
THE QUALITY OF
THE STEEL WE
MADE.



IT WAS
MADE IN OUR
VILLAGE, WE
ARE SURE.

LEAVES
WERE USED TO
CONVERT IRON
INTO CARBON
STEEL.





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







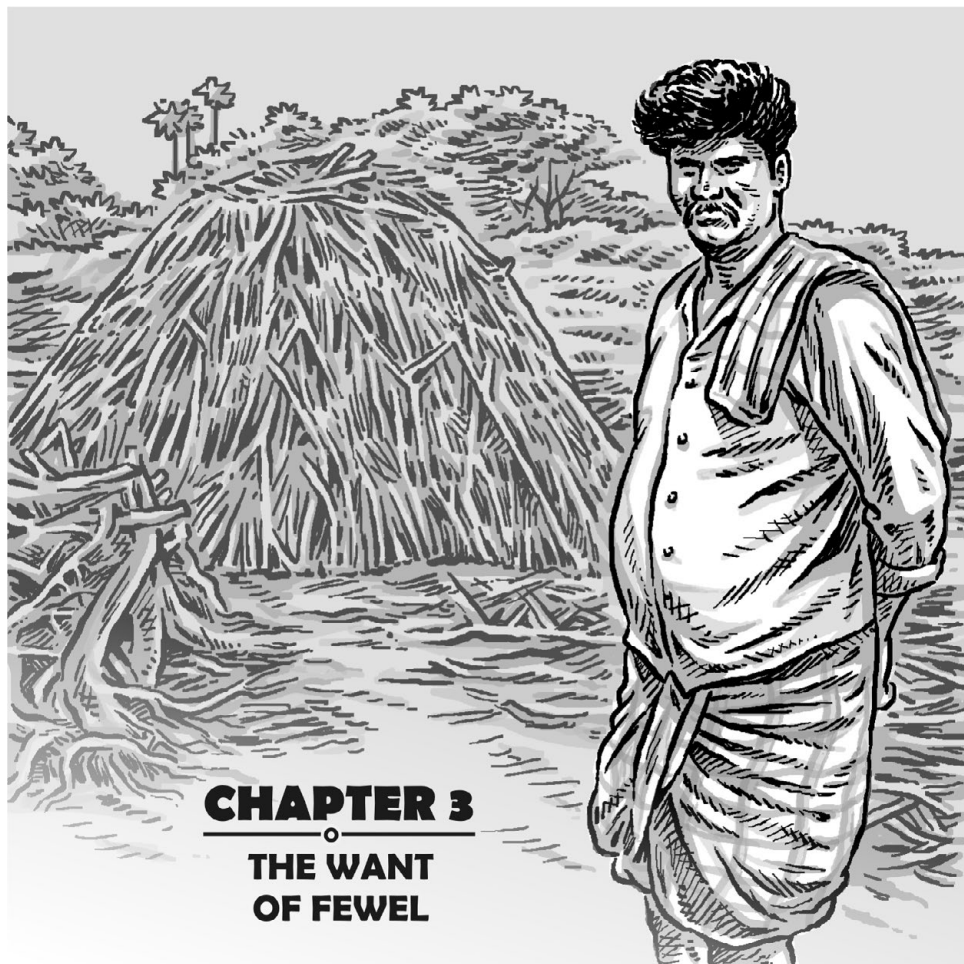






THE BUS FARE!
THAT CERTAINLY
IS AN INTERESTING
WAY TO MEASURE
DISTANCE.

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



CHAPTER 3
○
**THE WANT
OF FEWEL**





LOOK HERE!
HE MENTIONS
THE "WANT OF
FEWEL".

FUEL?
WHAT FUEL?

A JOURNAL FROM 1841

will be in gradual decay, and it would be useless to even end, when that which is purple. All that I saw, being near the sandstone, decay, and therefore useless; but that is the case with the best slate quarries in Scotland.

Iron was formerly smelted at Ellady-caray from black sand, which was brought from a hill about two miles to the westward. Much of the vitreous scoriae remains where the furnaces stood; but the work has been abandoned these sixty years: the want of fewel is indeed a sufficient reason.

Ellady-caray is a small fort with thirty houses. It has a plantation, co. palms; and a garden of reeds; but not a trace of vegetation coming from Herium.

of reeds; but not a trace of vegetation coming from Herium.










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.



THESE FORESTS
ARE DISAPPEARING
FAST UNDER THE AXE
OF THE IRON AND STEEL
MANUFACTURERS EVEN
THOUGH I HAD PROHIBITED
THIS ACTIVITY.







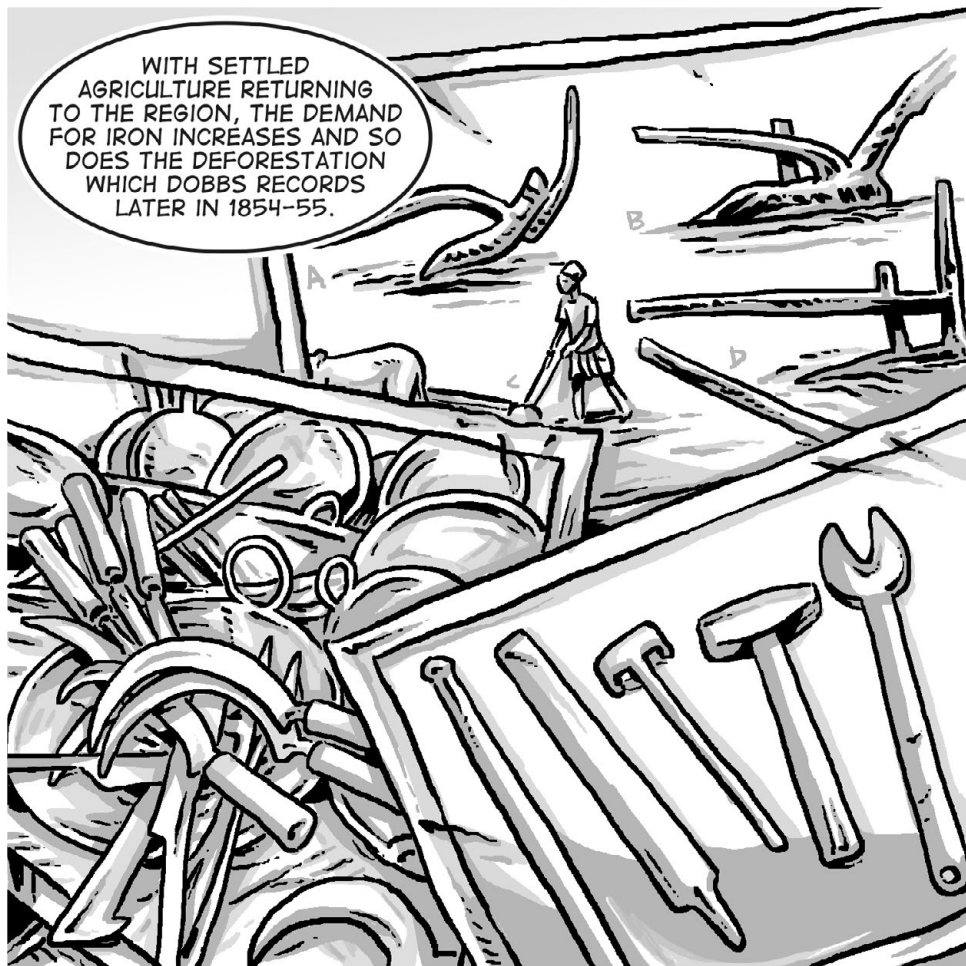








WITH SETTLED
AGRICULTURE RETURNING
TO THE REGION, THE DEMAND
FOR IRON INCREASES AND SO
DOES THE DEFORESTATION
WHICH DOBBS RECORDS
LATER IN 1854-55.





* 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*







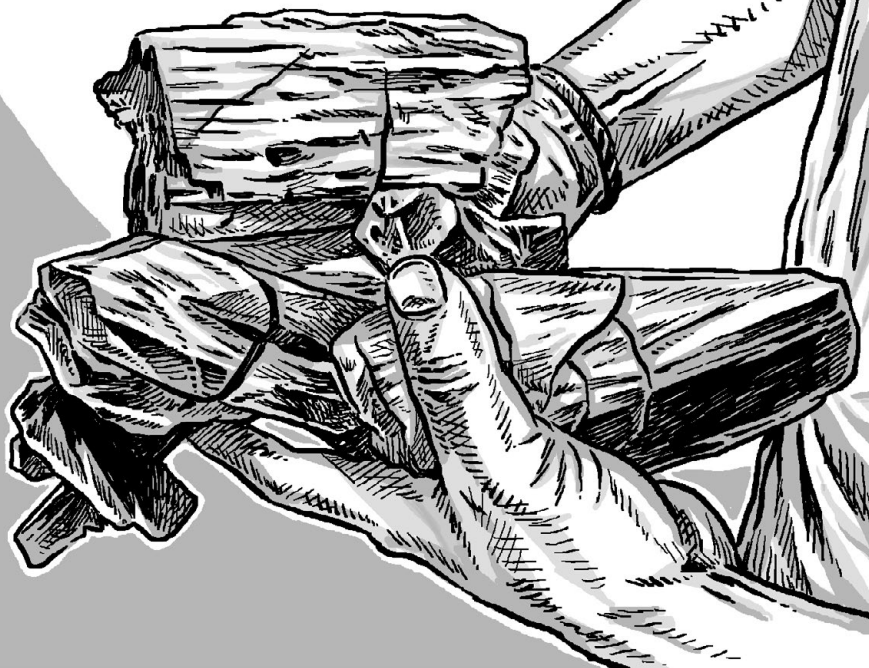
THE MOUND IS
SET ALIGHT WITH
HOT CHARCOAL.



WE MUST COOL IT DOWN
WITH WATER AT REGULAR
INTERVALS. DAY AND NIGHT.



AFTER
30 DAYS THE
CHARCOAL IS
READY.



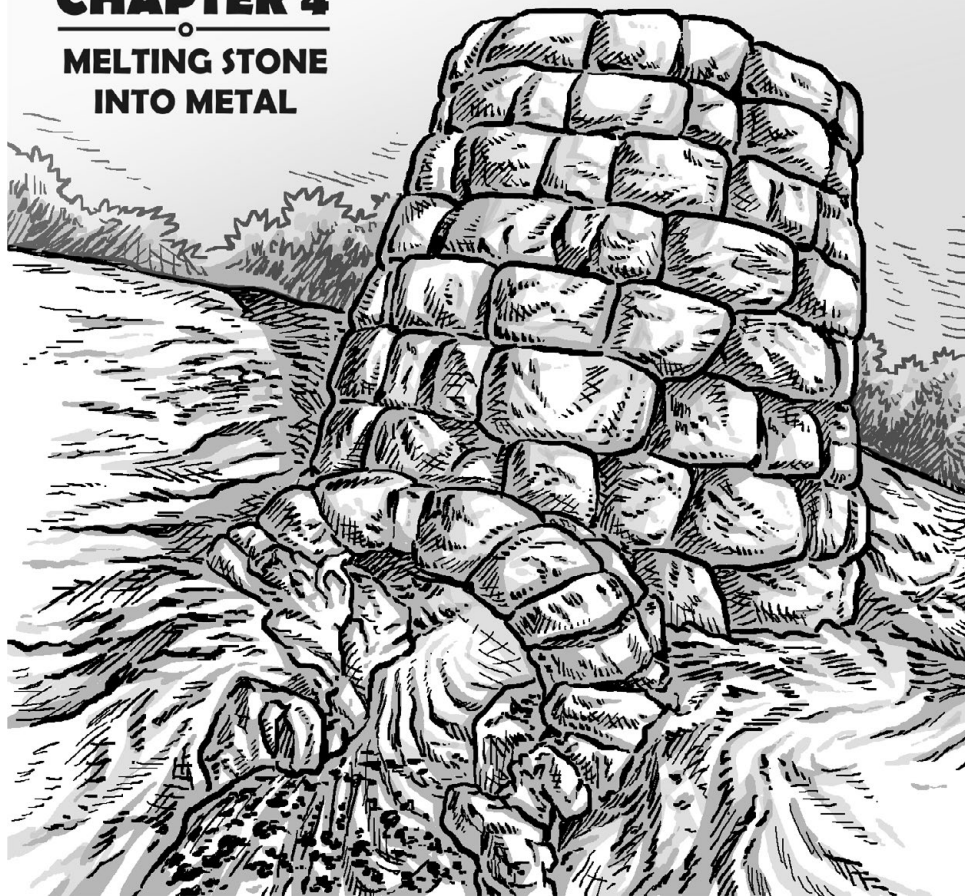


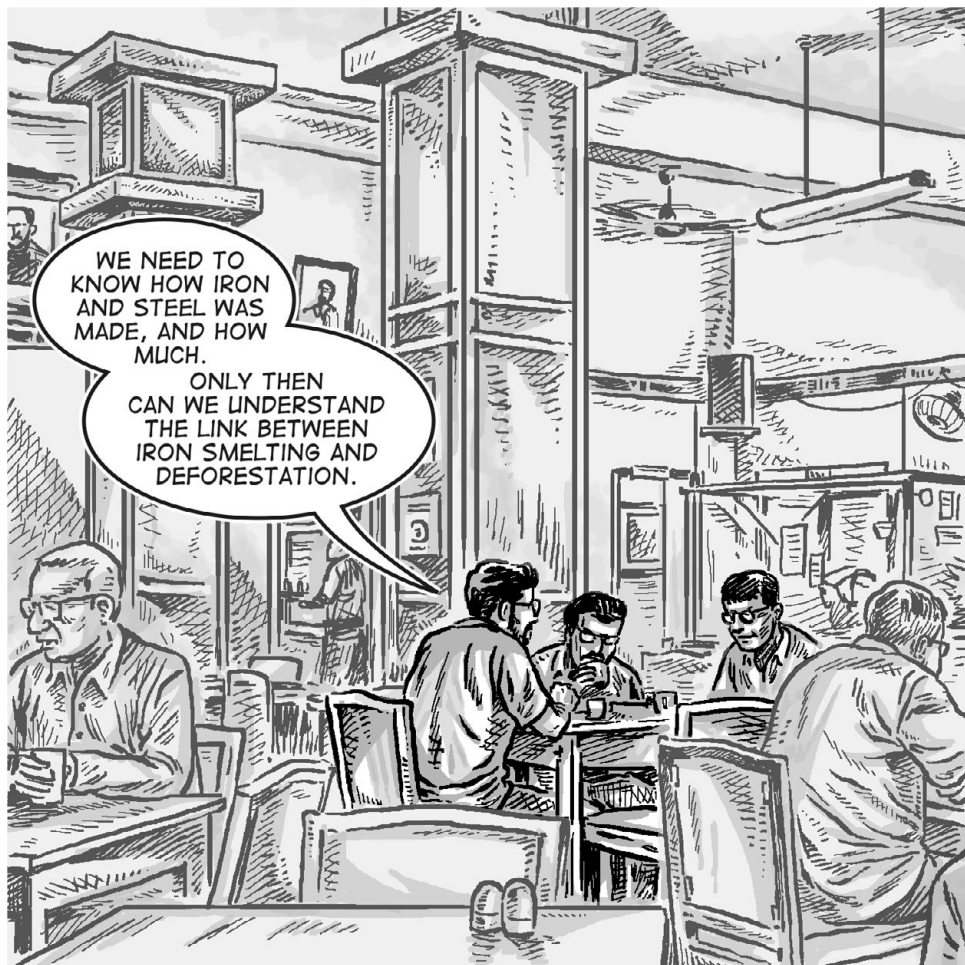




CHAPTER 4

MELTING STONE INTO METAL







BUCHANAN
ANSWERS THE FIRST
QUESTION. HE SPEAKS
OF A LARGE SMELTING
SITE AT GHETTIPURA,
NOW GATTIPURA, NEAR
BANGALORE.

WOULD
YOU LIKE
TO GO?





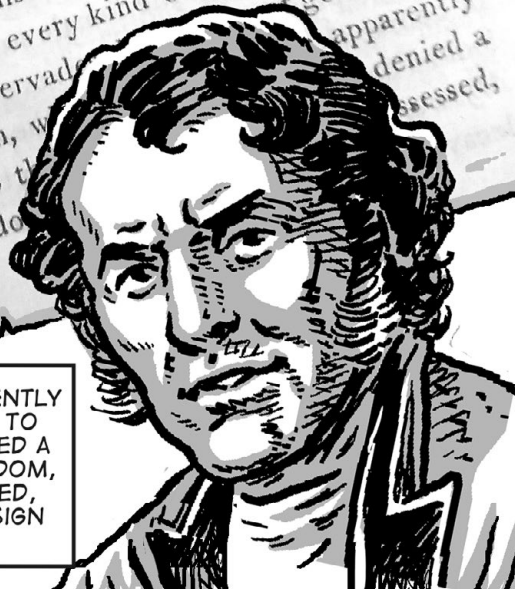






of the various
after the iron mines: but
ent, that, nobody having wrought
tuation was not now known. After a long search,
ad found a few stones, which they sent, believing that they
be iron-ore. I then sent for the man who had given me the
mation; and on the following day,
th June,—I took him along with 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 the government
and the other inhabitants. Men, who apparently
correct information relative to the
knowledge of the fossile kingdom
denied a
essed,

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."





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.









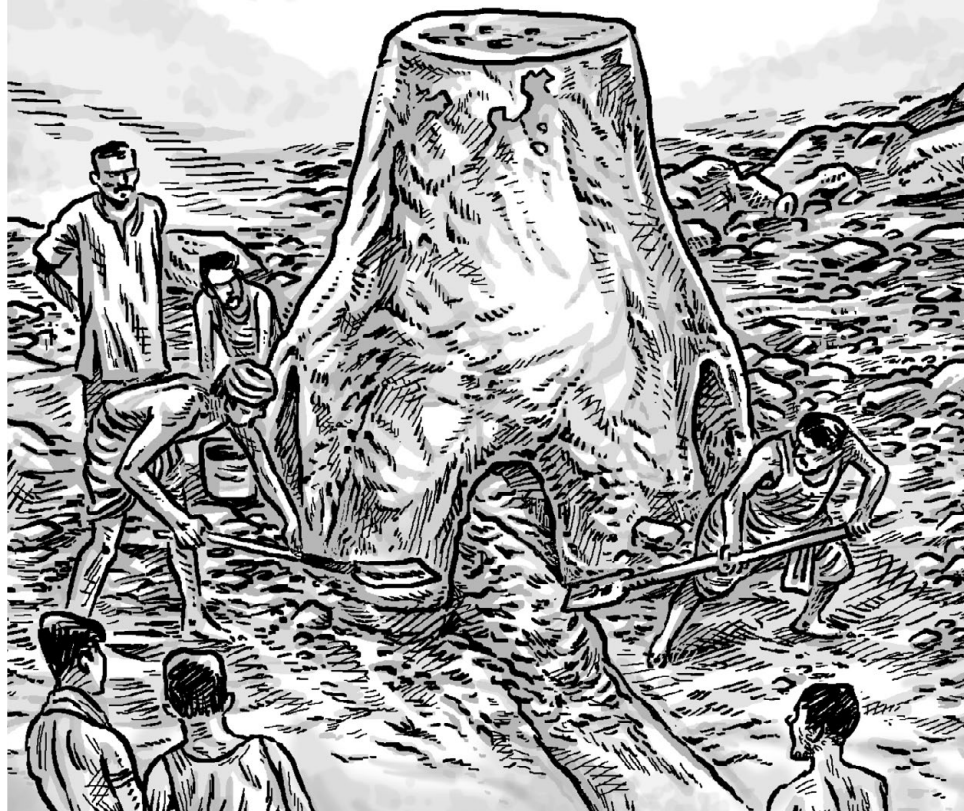





DURING THE 4 MONTHS OF
HEAVY RAIN, MEN WOULD
COLLECT THE ORE RUNNING
DOWN THE HILL AND WASH
IT TO REMOVE THE QUARTZ.



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

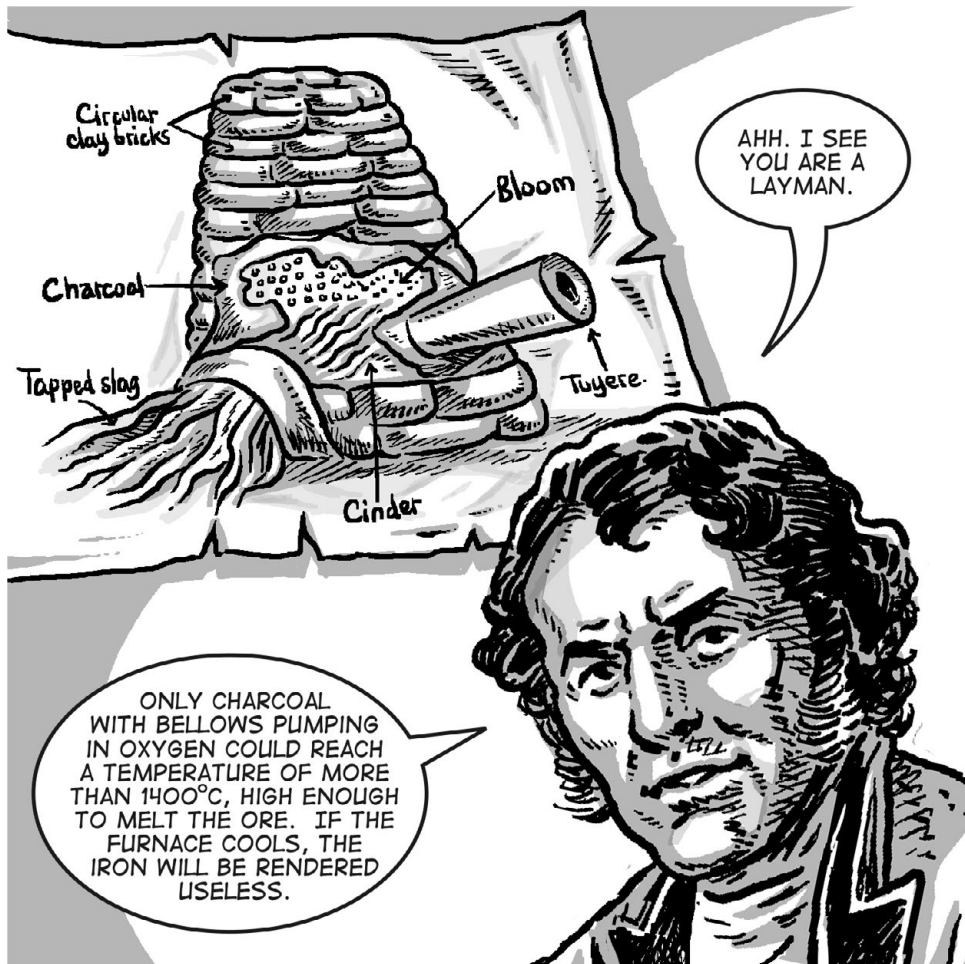


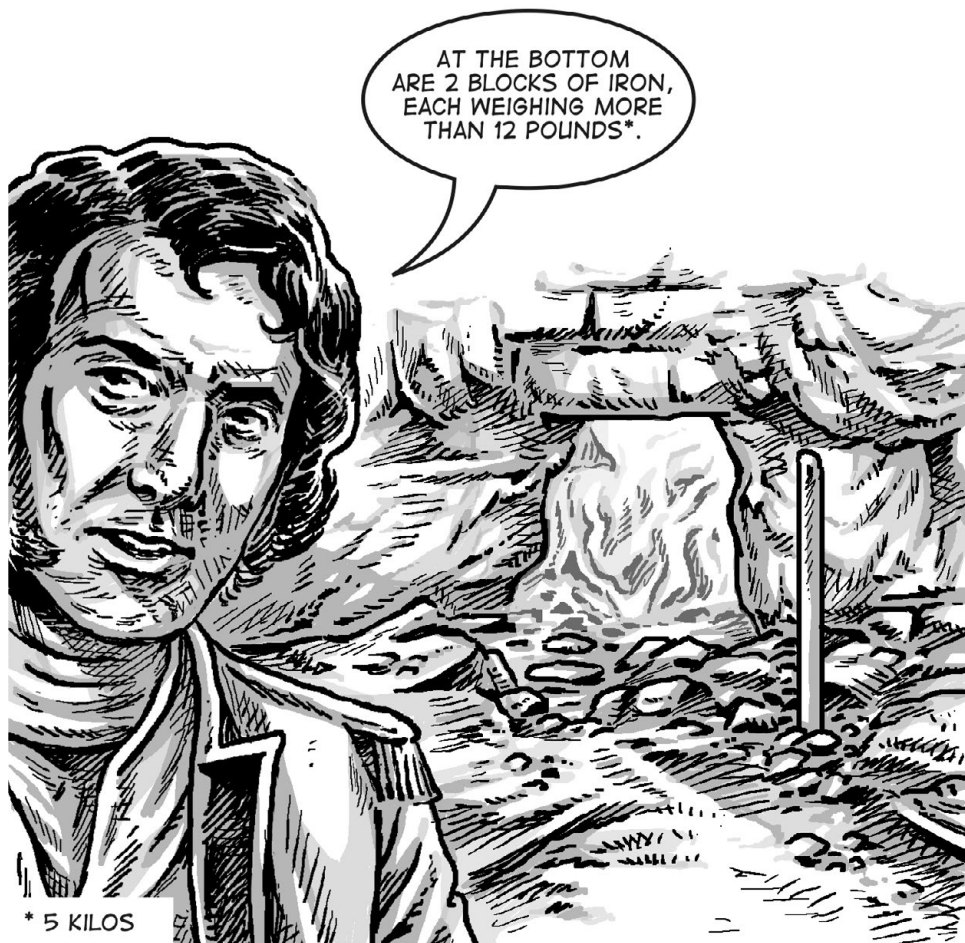


IT TOOK 6 AND 1/2
HOURS TO SMELT A
BATCH OF IRON FROM
THE ORE.

THE BELLOWS WOULD HAVE TO BE
WORKED THROUGHOUT THE PROCESS.












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.



A black and white illustration showing a hand holding a small, rounded, textured object, likely a steel ingot. The hand is positioned in the foreground, with fingers spread. The background shows a rough, rocky surface with some small, irregular shapes scattered around. A speech bubble is located above the hand, containing text.

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

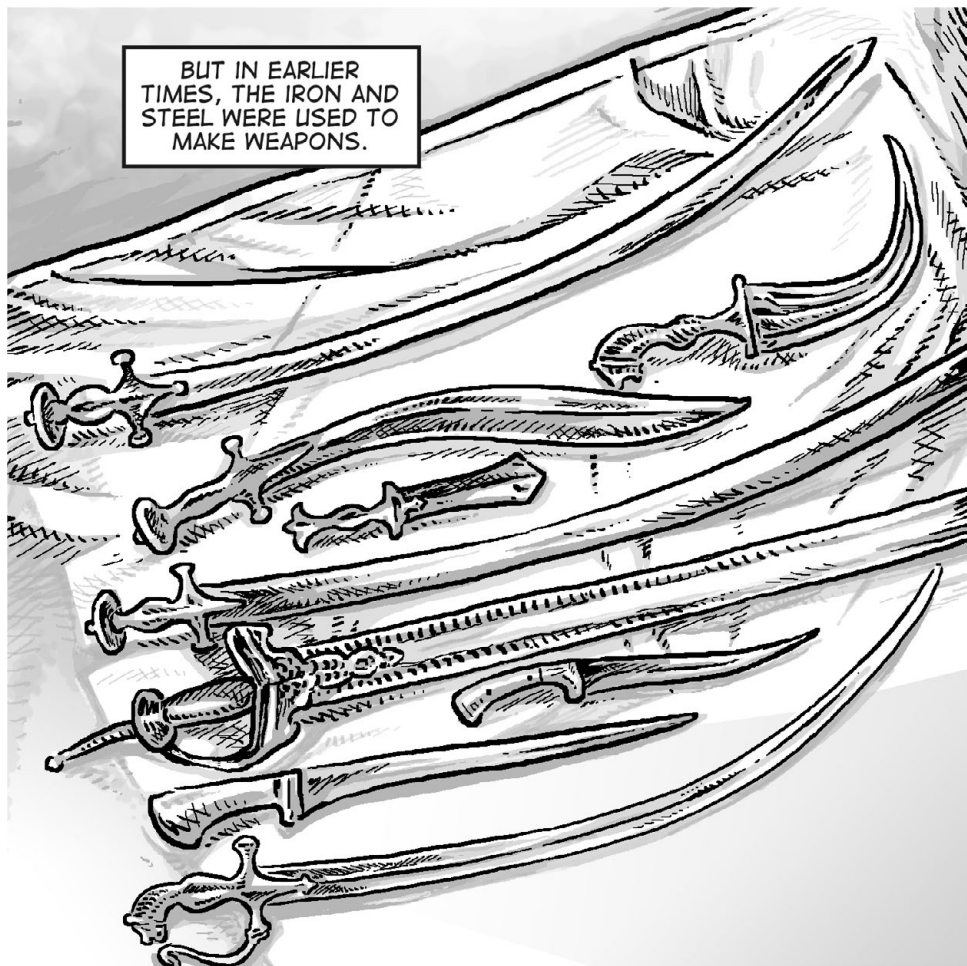








BUT IN EARLIER
TIMES, THE IRON AND
STEEL WERE USED TO
MAKE WEAPONS.






I HAVE READ
THAT THE COVETED
DAMASCUS SWORDS
WERE MADE FROM
INDIAN WOOTZ
STEEL.

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.



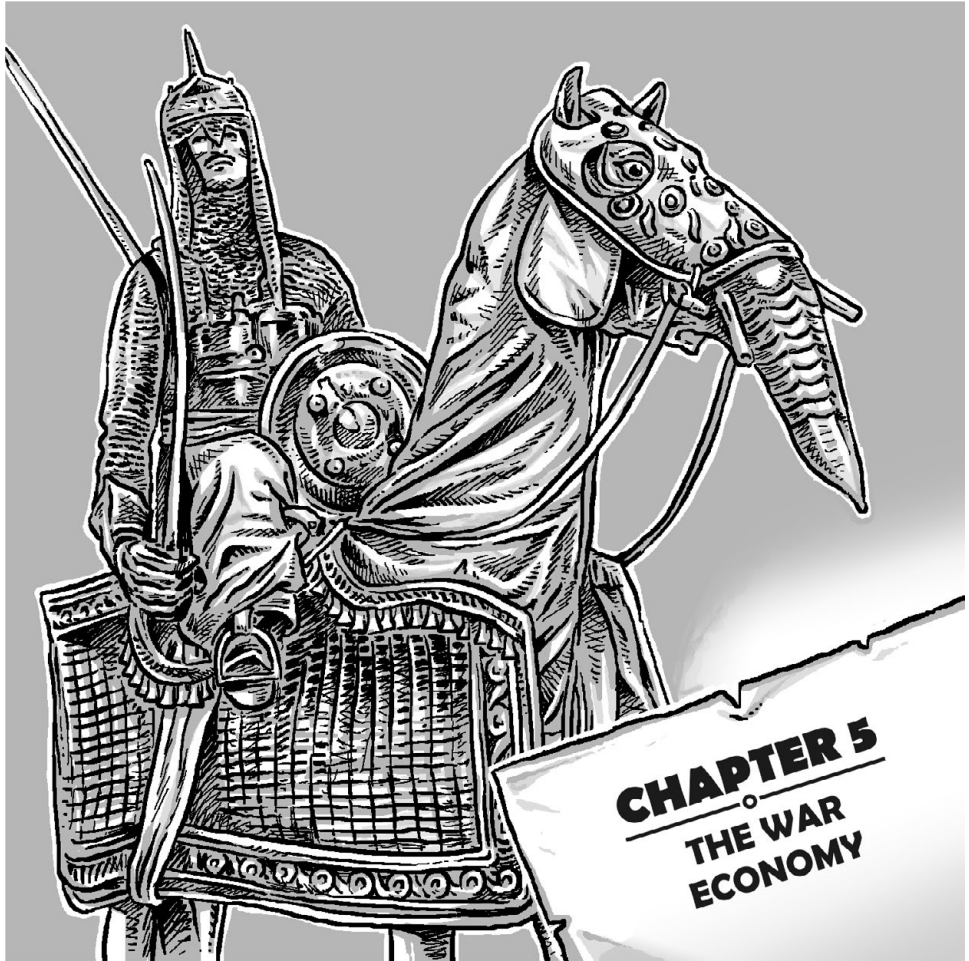


LINGARAJ, I THINK
WE NEED TO WEAVE
TOGETHER IRON SMELTING
AND WEAPONS
MANUFACTURE.

INTERESTING...











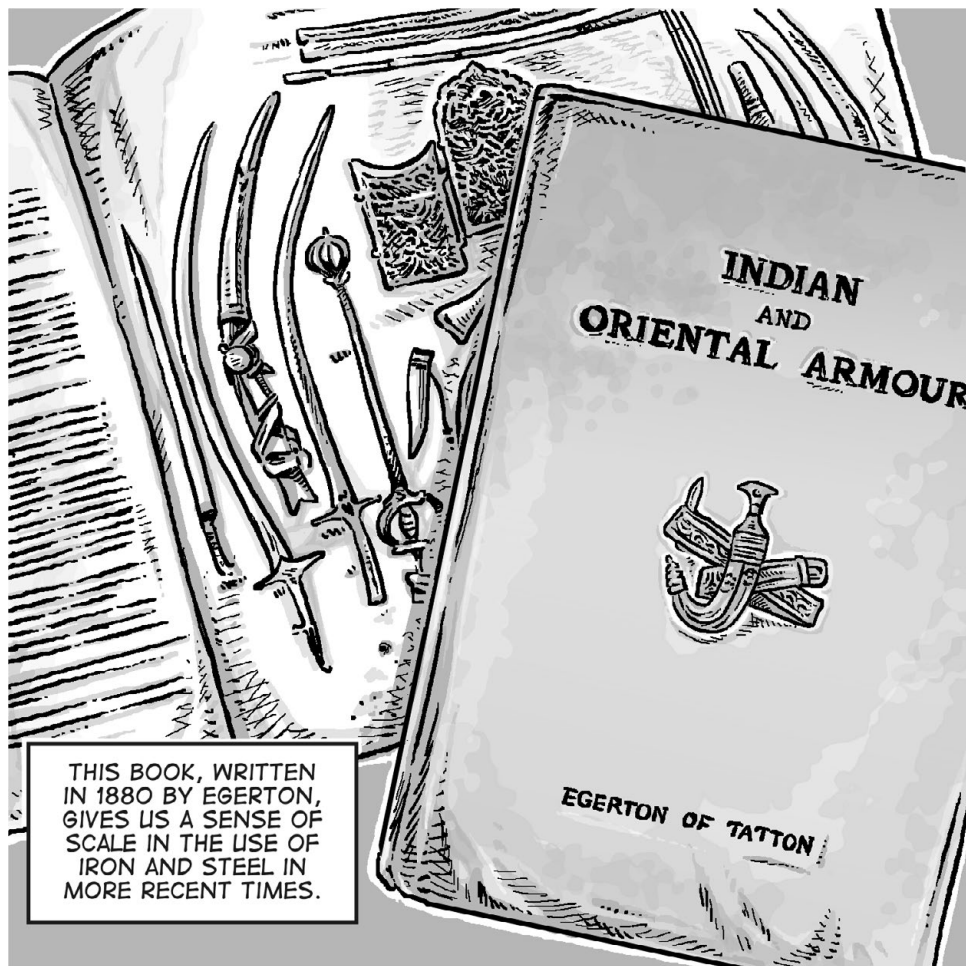


WHEN ALEXANDER INVADED INDIA IN 327 BCE, THE ARMY OF HIS INDIAN OPPONENT, PORUS, CONSISTED OF 85 ELEPHANTS, 300 CHARIOTS, 30,000 SOLDIERS ON FOOT AND 4,000 HORSES.





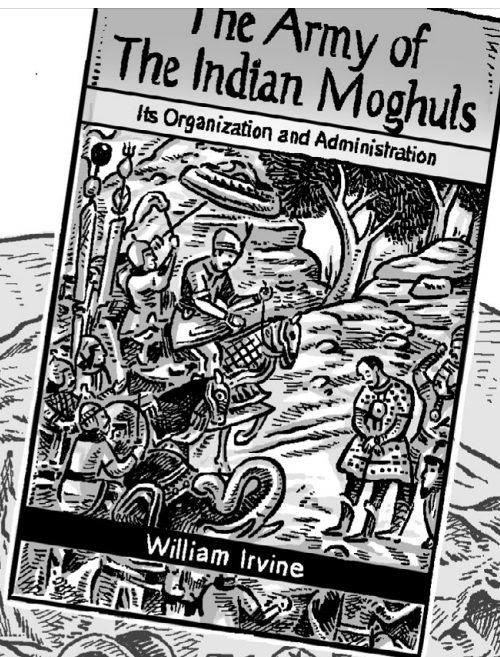
APPARENTLY, PORUS GIFTED ALEXANDER
WITH 30 POUNDS OF WOOTZ STEEL. SURELY
MUST HAVE BEEN SOMETHING SPECIAL
AND WORTHY OF A GIFT TO ALEXANDER.





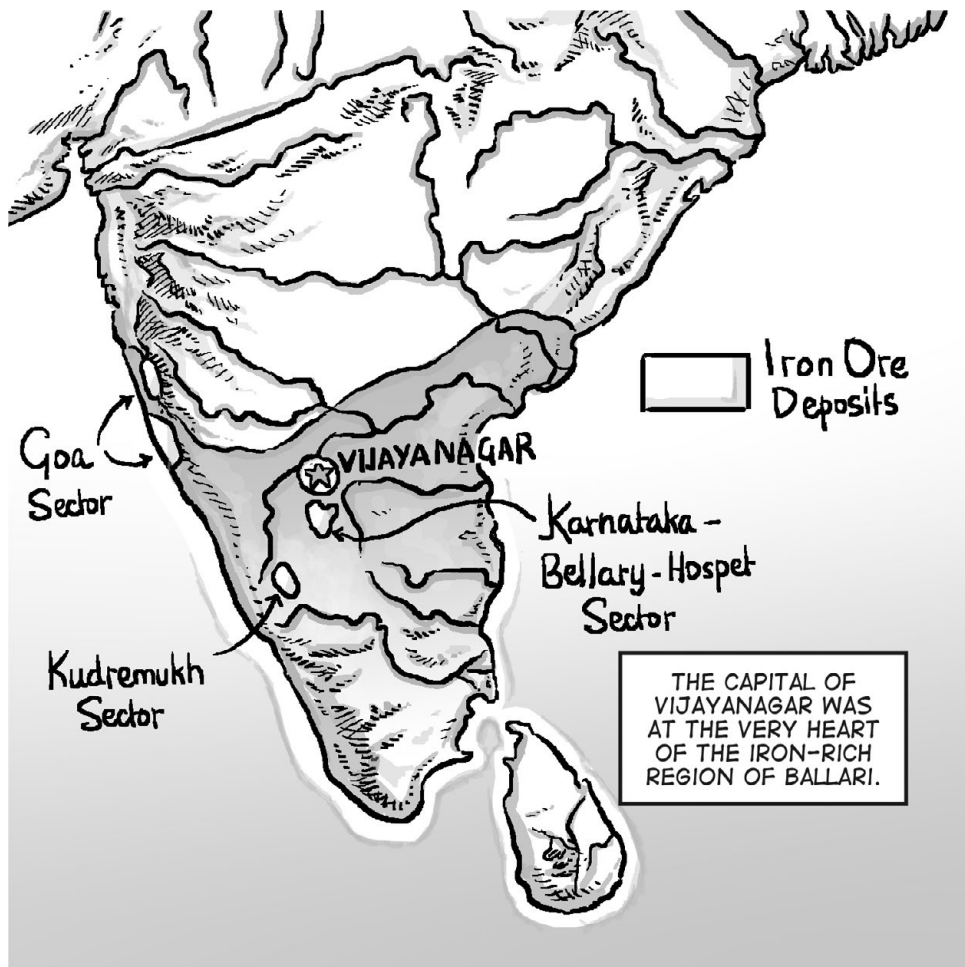
THE MUGHAL
ARMIES HAD HUNDREDS
OF THOUSANDS OF
SOLDIERS AND HUNDREDS
OF ELEPHANTS CLOTHED
IN STEEL ARMOUR.

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.



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.







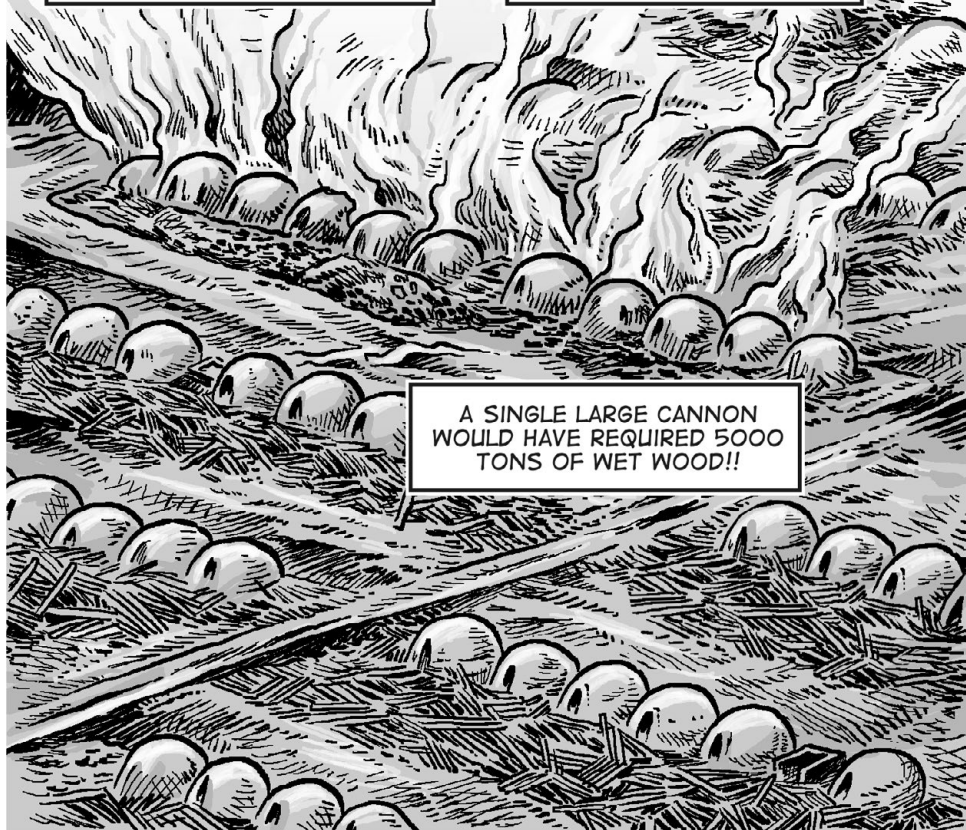
YOU ALSO HAD MASSIVE CANNONS LIKE THE ONES
FOUND IN THE FORTS OF RAJASTHAN, DAULATABAD
AND THAJAVUR, EACH WEIGHING 40-50 TONS.



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

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

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





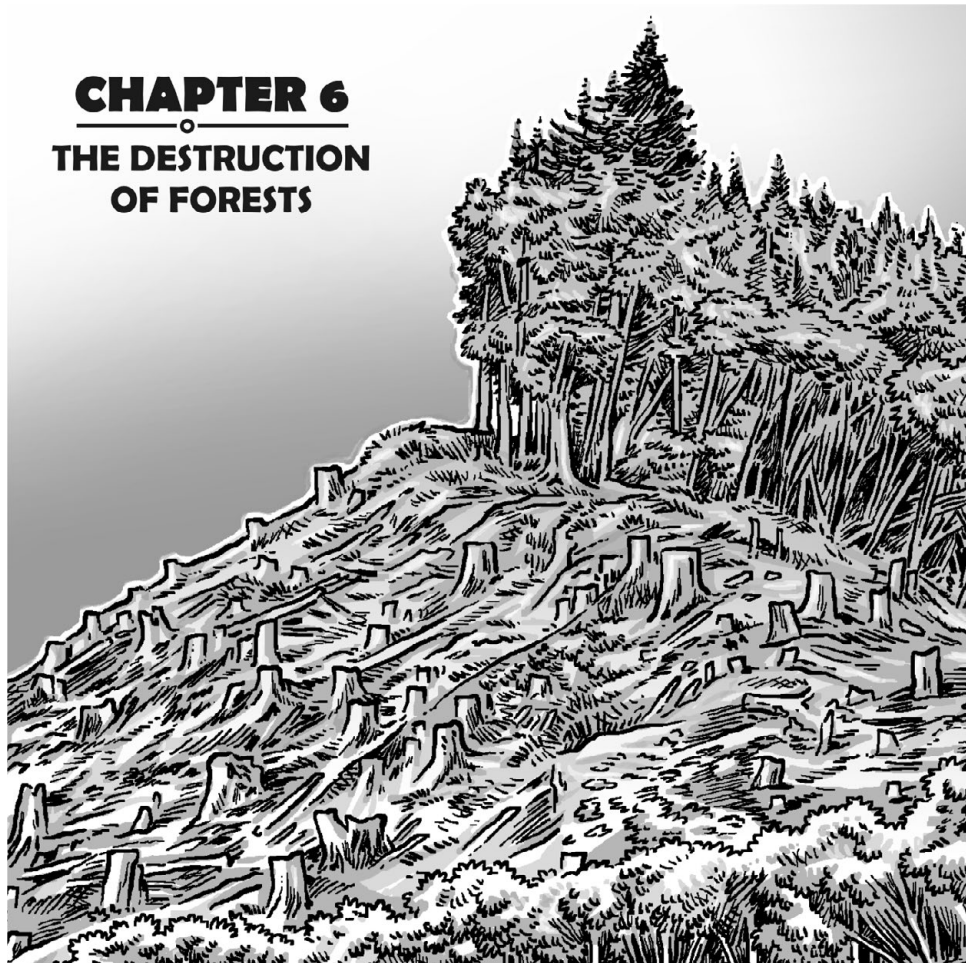


NOW IT'S
CLEAR WHY TIPLU'S
WARS COULD HAVE
LED TO MASSIVE
DEFORESTATION
ACROSS ERSTWHILE
MYSORE.



CHAPTER 6

THE DESTRUCTION OF FORESTS









HI, AMAL.

HEY, SASHI.
GREAT TO SEE
YOU. CAN'T WAIT
TO HEAR ABOUT YOUR
IRON SMELTING
STORY.



LET ME
GIVE YOU A FULL
RUN DOWN ON WHAT
WE HAVE DONE
SO FAR...

FASCINATING...






A black and white comic-style illustration of a man with a beard and glasses, wearing a light-colored shirt. He is holding a large, crumpled map of the region around Mysore. The map shows the city of Mysore at the top, with a smaller inset map showing its location within a larger region. The main map is filled with numerous small, handwritten-style labels representing various locations. A speech bubble from the man's mouth contains text about the Mysore Gazetteer of 1897. Another speech bubble at the bottom right contains text about iron and steel production.

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
Kappatgad Hills in Dharwar, Belgaum,
Ratnagiri, Rewa Kantha, Kaira.
Nellore, North Arcot, Madura, Salem,
Tiruchirappalli, Mysore State and
the Deccan plateau.
Canara, Beypore in the Malabar.

PAPERS ON
THE IMPACT OF IRON
SMELTING 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**

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

Léonel Fouédieu & Sylvain M.

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

Industry really
in the



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.



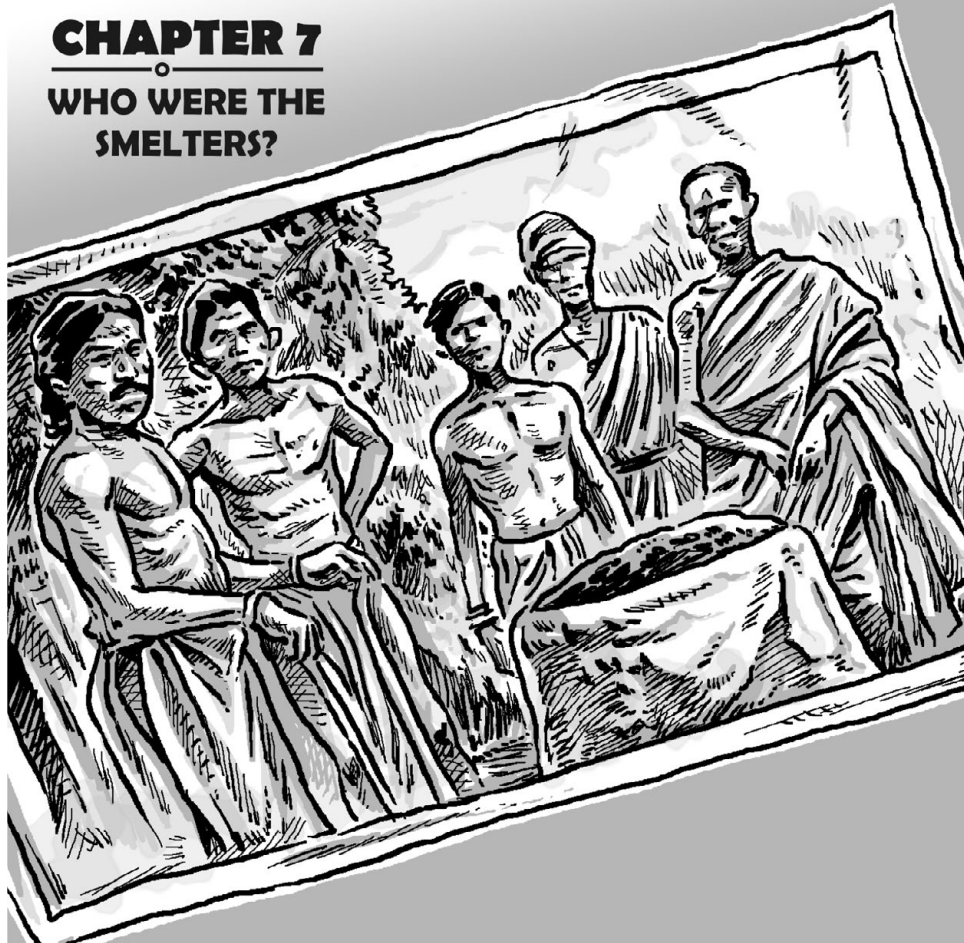
AND INHABITED BY TRIBES WHO
WERE THE GREATEST IRON
SMELTERS IN ANCIENT INDIA.





CHAPTER 7

WHO WERE THE SMELTERS?



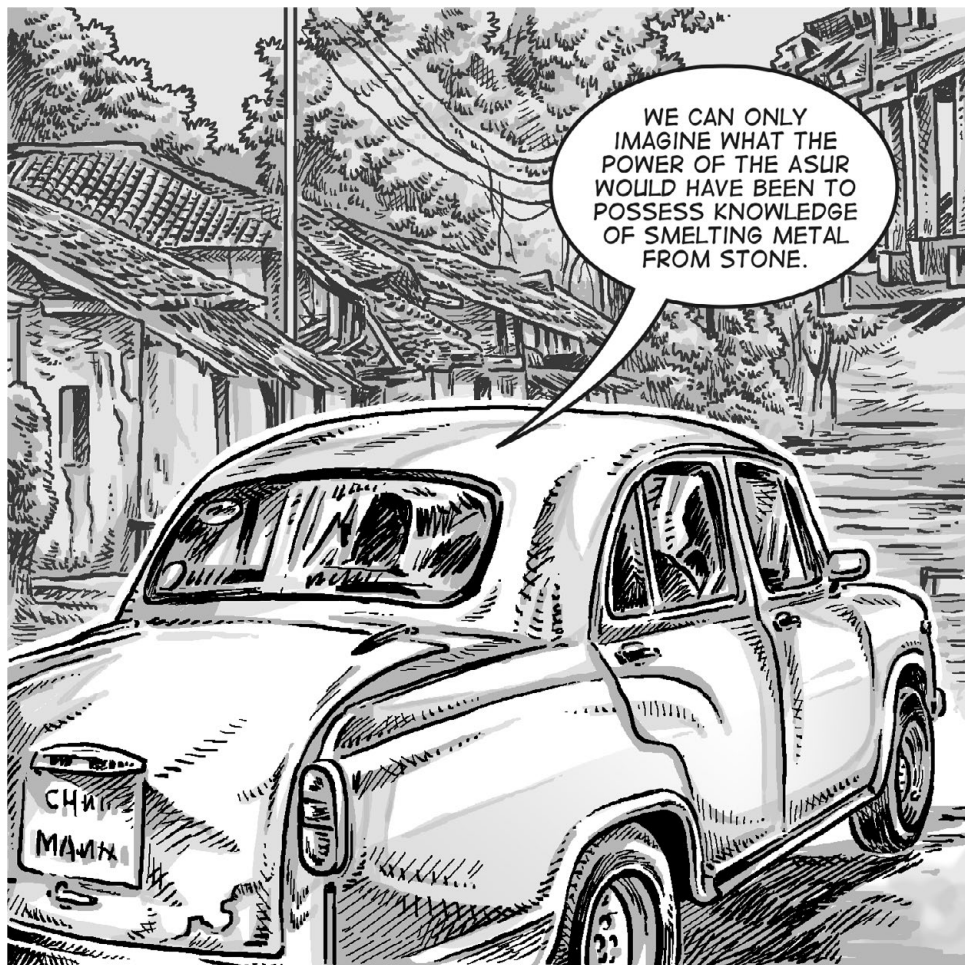
CHHATTISGARH, INDIA

IT'S GREAT,
TRAVELING IN AN
AMBASSADOR!

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







IT IS A
QUALITATIVE
RUPTURE IN THE
CAPABILITIES OF THE
HUMAN MIND.

FROM
MERELY SHAPING
STONE AND WOOD
TO CREATING METALS
FROM STONE.


REMINDS ME
OF *2001: A
SPACE ODYSSEY*...
NO WONDER SMELTERS
WERE REVERED AND
FEARED ACROSS
THE WORLD.





HERE WE
ARE ... HOPE WE
CAN SEE HOW IRON
WAS ACTUALLY
SMELTED.


WHILE WE
ARTICULATE A
MULTI-LAYERED
HISTORY OF
TRADITIONAL IRON
SMELTING.




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 BELLOWS ARE
MADE WITH WOOD
COVERED WITH
ANIMAL HIDE.



COULD IT
BE THAT IN EARLIER
TIMES THE SMELTERS
WOULD SUPPLY IRON
INGOTS TO THE
ORDNANCE FACTORIES
OF RULERS?

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



YES, I DO SEE AN INTERESTING POLITICAL ANGLE.

THE SMELTERS LIVED AWAY FROM AGRARIAN COMMUNITIES BUT THEY HAD A CLOSE RELATIONSHIP WITH THE STATE IN THE PRODUCTION OF WEAPONS.



THERE
ARE SEVERAL
REFERENCES TO
THIS IN BRITISH
RECORDS.


THE AGARIA BEGIN
MINING BY INVOKING
THE BLESSINGS OF
LOHAUR AND THEIR
ANCESTORS.



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

PERHAPS
FROM THE
AGRICULTURAL
VILLAGES, BUT
NOT THE
STATE.

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

A black and white illustration of a woman in a sari, seen from the side, pouring material from a large container into a furnace. In the background, there are trees and a small hut. A boy is sitting on the ground to the right of the furnace. The scene is set outdoors.

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.

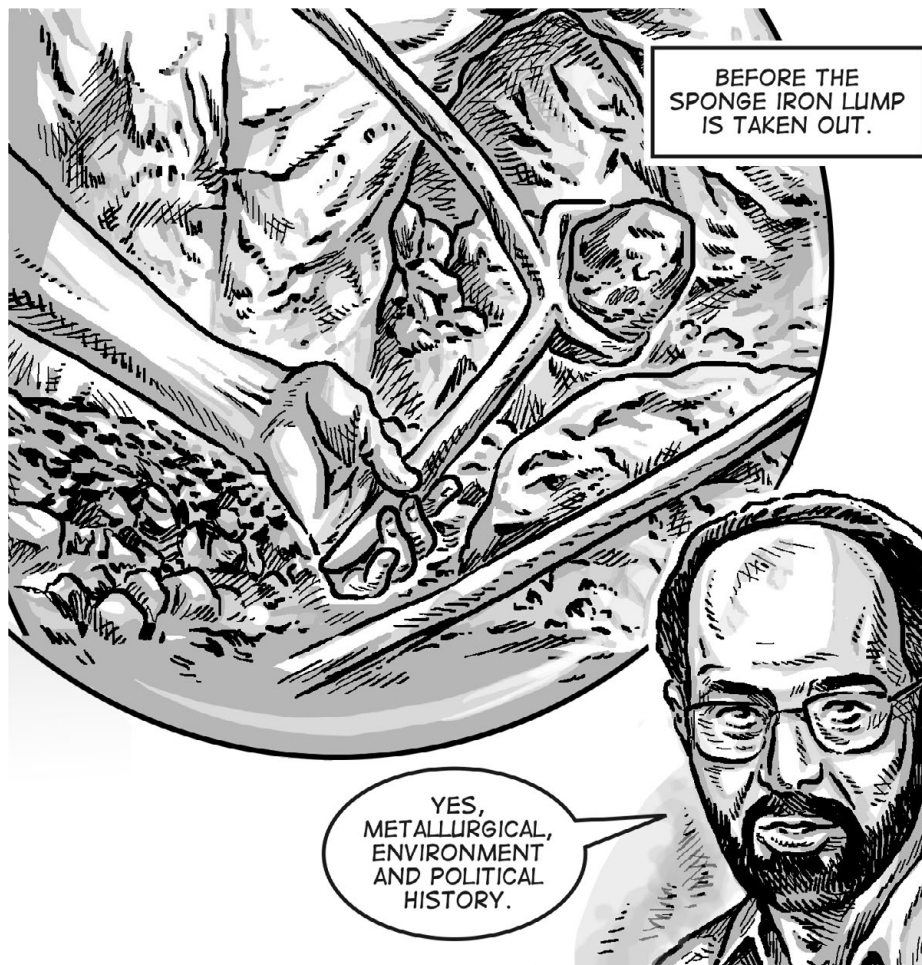


THEY COULD
ALSO HAVE PRACTICED
SHIFTING CULTIVATION.
CUTTING DOWN WOOD
FOR CHARCOAL AND
MOVING TO DIFFERENT
SITES.

THE AIR BLAST AND TEMPERATURE
ARE MAINTAINED BY CONTINUOUSLY
PUMPING THE BELLOWS.

THE PROCESS CAN
TAKE SEVERAL HOURS.

IT ALL FITS
IN TOGETHER,
DOESN'T IT?





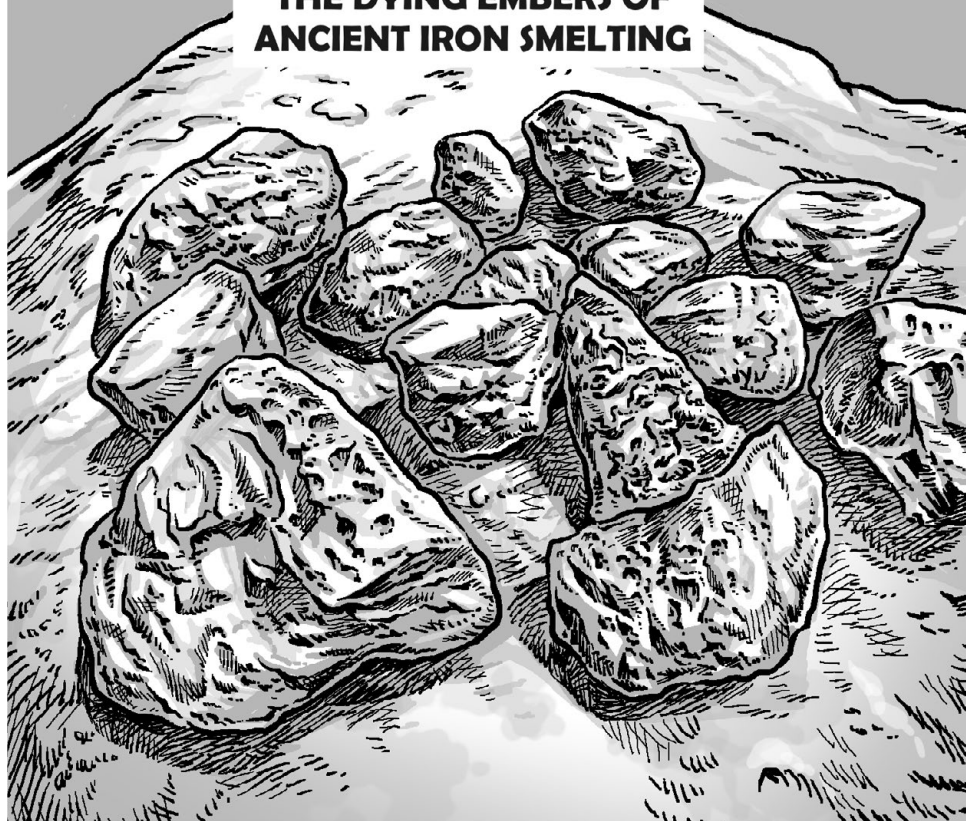
THE IRON IS SHAPED
THROUGH BEATING INTO
IMPLEMENTS... PERHAPS
AGRICULTURE, BUT
AT SOME TIME,
ALSO FOR WAR.

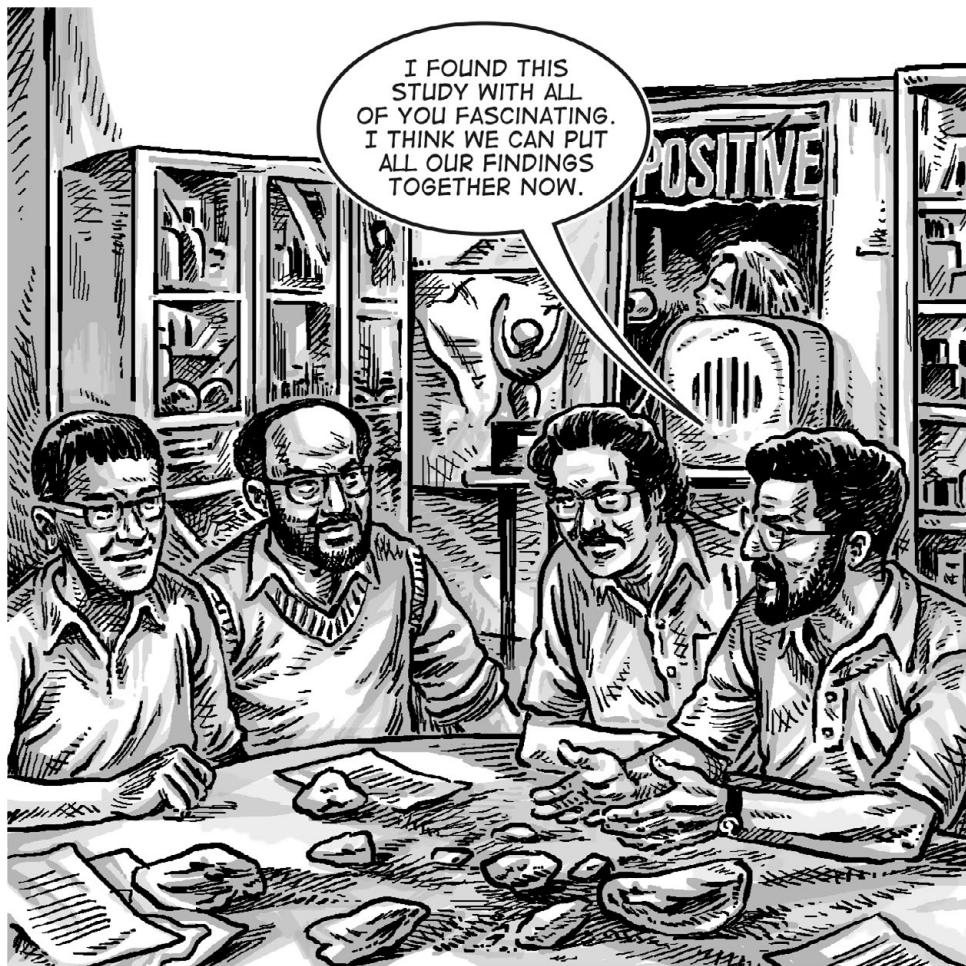




CHAPTER 8

THE DYING EMBERS OF ANCIENT IRON SMELTING

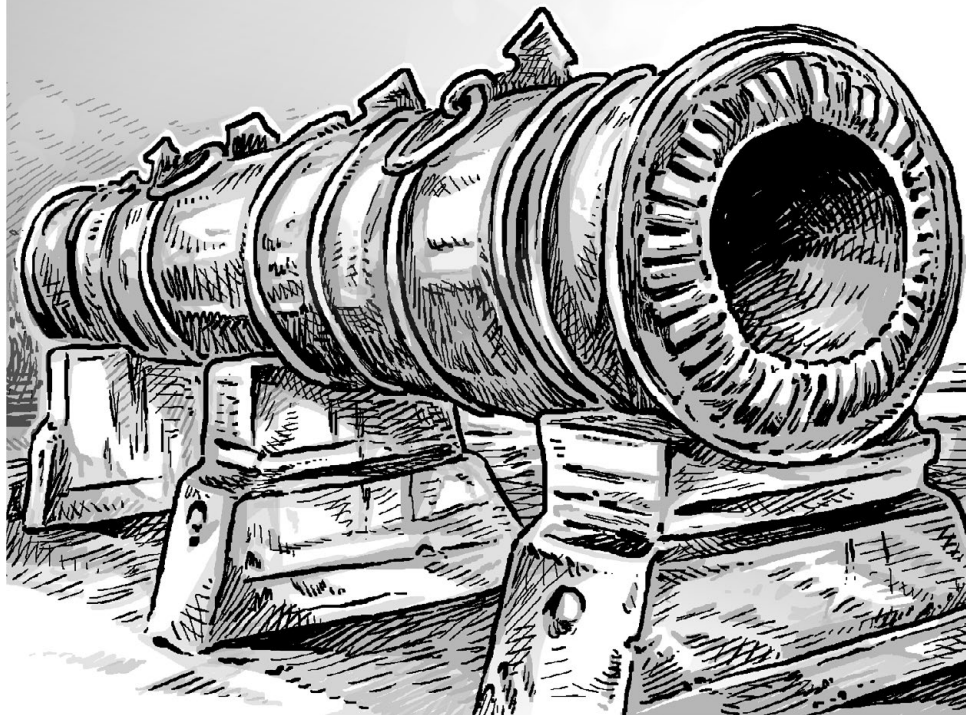






INDIA WAS A WAR ECONOMY
PRODUCING THOUSANDS - IF
NOT HUNDREDS OF THOUSANDS -
TONS OF IRON AND STEEL FOR
ARMS AND AGRICULTURE.

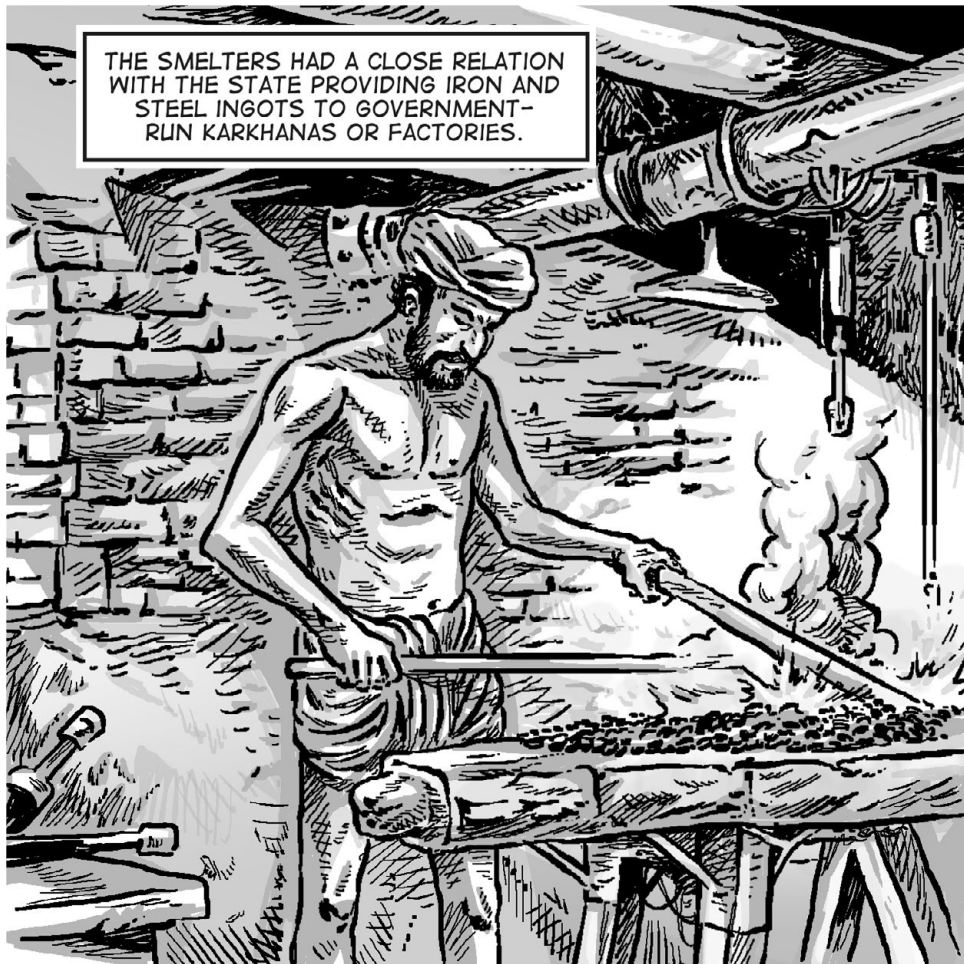
THE SMELTERS WERE TRIBES
LIKE THE ASUR AND AGARIA,
WHO WERE AT THE FOREFRONT
OF THIS TECHNOLOGY.



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.

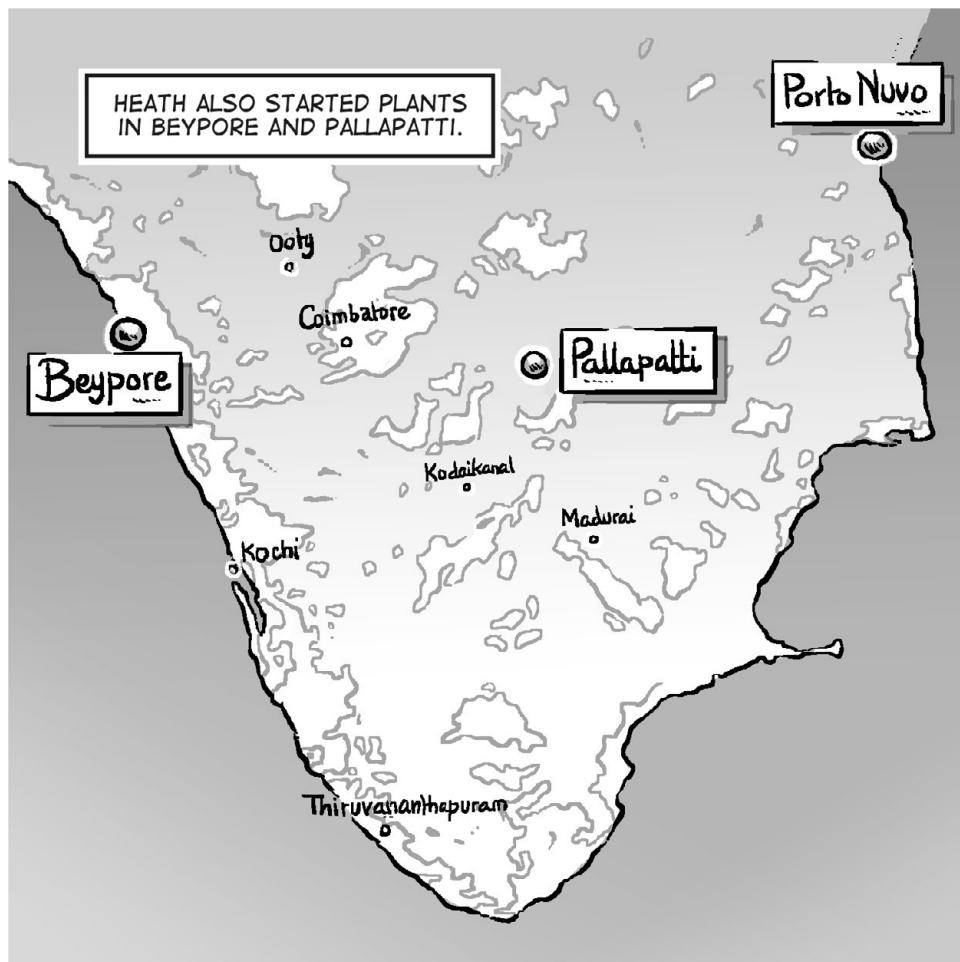



THE LOCAL SMELTERS BEGIN SERVING THE NEEDS OF AGRICULTURE WHILE THE BRITISH FACTORIES WERE INTERESTED IN EXPORTS TO BRITAIN AND FOR THE RAILWAYS IN INDIA.



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

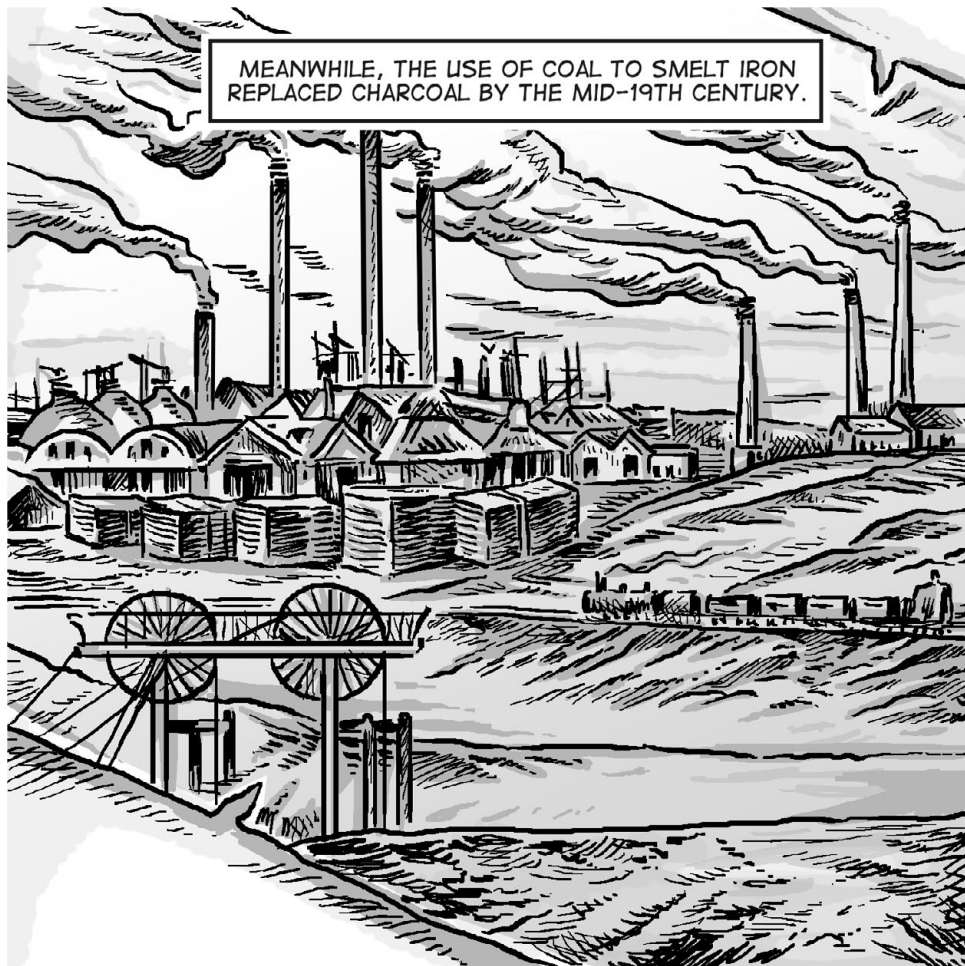






ALL THREE FAILED BY THE 1860S DUE
TO DIFFICULTY IN PROCUREMENT OF
CHARCOAL AND CONSEQUENTLY,
FINANCIAL DIFFICULTIES.

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

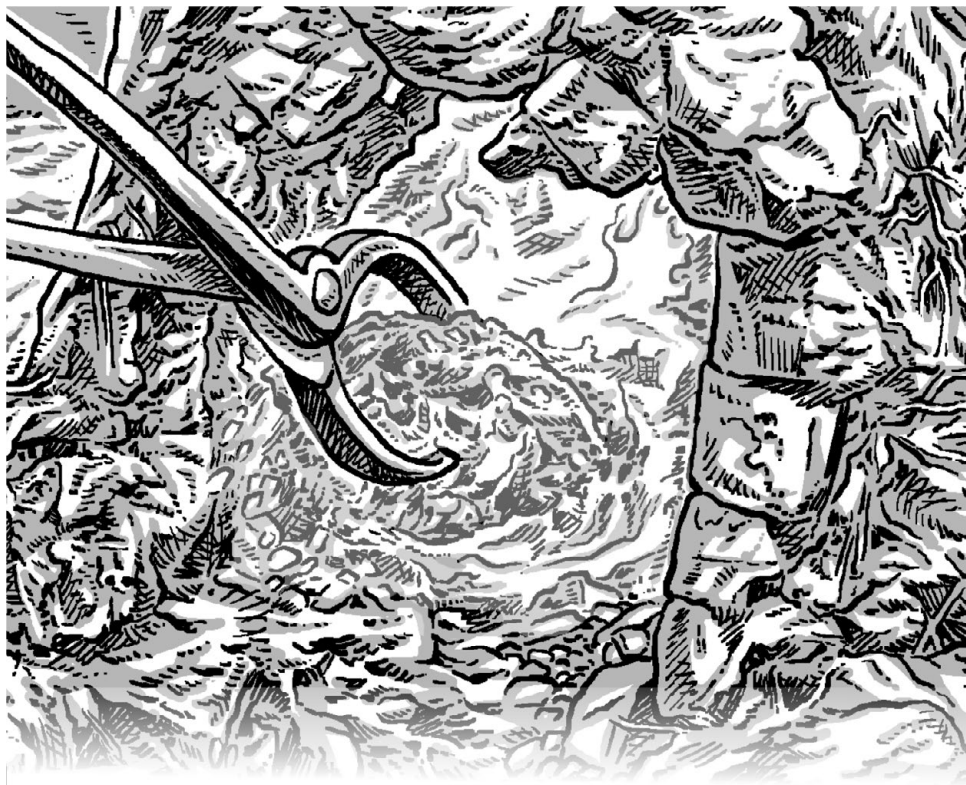




IT WAS THE EASY AND
CHEAP AVAILABILITY OF
IRON AND STEEL FROM
MODERN INDUSTRY THAT
ULTIMATELY DESTROYED
LOCAL SMELTING.



INTERESTINGLY, BOTH
THE BLACKSMITH AND
THE CHARCOAL-MAKERS
CAN STILL BE FOUND,
ALTHOUGH SMELTING HAS
ALMOST VANISHED
ACROSS INDIA.



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 CHATTORAJ

HARSHO MOHAN CHATTORAJ 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 TRAVELLED 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."