

TO WATCH THE ILLUSTRATIONS OF THE ORIGINAL ARTICLE, PLEASE CLICK THE "DAMASTSALAT UND NANODRAHT"-LINK ON THE GERMAN RESEARCH-PAGE. THE ENGLISH TRANSLATION OF THE FIGURES' TEXT IS ATTACHED BELOW AFTER APPENDIX 1 AND THE BIBLIOGRAPHY.

SCOTT'S „TALISMAN“, DAMASCONFUSION AND NANOWIRES -
COMMENTS ON THE BASIS OF SCIENTIFIC RESEARCH INTO A MYTH, SO-CALLED
DAMASCUS-STEEL

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INTRODUCTION:

THROUGHOUT THE PRESENT STUDY THE ONGOING MYSTIFICATION OF A TYPE OF BLADE-STEEL FROM THE ISLAMIC CULTURAL SPHERE IS CONFRONTED WITH A CONCISE SUMMARY OF EVIDENCE FROM A HISTORICAL AND ARCHAEO-METALLURGICAL PERSPECTIVE. REFERRING TO THE PERIODICALLY (SINCE THE 19TH CENTURY) RECURRING FASHION TO LINK UP SO-CALLED "DAMASCUS STEEL" WITH SOME NEBULOUS "SECRETS", SOME OBSERVATIONS ARE SUBMITTED HERE FOR FUTURE DEALINGS WITH THE SUBJECT. STATEMENTS REGARDING AN ALLEGED SUPERIORITY OF HISTORICAL "ORIENTAL DAMASCUS"/WOOTZ" OVER WELL-REFINED AND TEMPERED EUROPEAN BLADE-STEELS HAVE TO BE TREATED IN A SIGNIFICANTLY MORE DIFFERENTIATED MANNER FROM A HISTORICAL PERSPECTIVE THAN WAS THE CASE IN MOST TOPIC-RELATED PUBLICATIONS FROM A VIEWPOINT OF MODERN MATERIALS SCIENCE THROUGHOUT THE LAST FEW DECADES. ALSO THE MOST RECENT IN A SEQUENCE OF "LIFTINGS OF THE SECRETS OF DAMASCUS STEEL"¹ THAT ARE PUBLISHED BY THE MEDIA ABOUT EVERY FIVE YEARS SINCE THE EARLY 1980S, REANIMATES WITHOUT ANY HARD EVIDENCE THE LONG DISPROVED FAIRY-TALES AROUND AN ALLEGED SUPERIORITY OF ORIENTAL DAMASCUS OVER THE MATERIALS OF EUROPEAN SWORD-BLADES². FOR EXPERTS STRUGGLING TO OBTAIN A MORE DIFFERENTIATED VIEW ON HISTORICAL EDGED-WEAPONS IN GENERAL AND ON BLADE-TECHNOLOGY IN PARTICULAR, THE REACTION OF THE INTERNATIONAL MEDIA³ ON THE SUPPOSEDLY SENSATIONAL DISCOVERY ON A NANO-SCALE IS A CAUSE FOR CONCERN⁴. NOW HIGH RESOLUTION TRANSMISSION ELECTRON MICROSCOPY, BY APPLICATION OF WHICH FOR THE FIRST TIME "CARBON NANOTUBES" AND "CEMENTITE NANOWIRES" HAVE BEEN DISCOVERED IN AN "ANCIENT DAMASCUS BLADE", IS SUPPOSED TO "CONTRIBUTE TO ACHIEVE A REFINED INTERPRETATION OF DAMASCUS STEEL AND ITS REMARKABLE MECHANICAL PROPERTIES". BASIC METHODOLOGICAL FAULTS WITHIN THE STUDY HOWEVER PREVENT IT FROM REACHING THIS AIM. IN THE COURSE OF THE PRESENT STUDY LIGHT CAN BE SHED ONLY ON A SELECTION OF MISCONCEPTIONS AND OMISSIONS THAT SHOULD BE AVOIDED BY CONSULTING AND COOPERATING WITH HISTORIANS, LINGUISTS, ARCHAEOLOGISTS, EXPERIENCED METALLOGRAPHERS AND LAST BUT NOT LEAST MODERN BLADESMITHS IN THE FUTURE⁵.

REMARKS FROM A HISTORICAL AND ARCHAEOLOGICAL PERSPECTIVE:

1. UNFORTUNATELY MORE THAN 120 YEARS OF RESEARCH ON THE METALLOGRAPHY AND ARCHAEOLOGY OF EUROPEAN SWORDS FROM THE EARLY IRON-AGE UNTIL THE 19TH CENTURY WERE NOT TAKEN INTO ACCOUNT FOR THE LATEST SCIENTIFIC STUDY. HAD THIS BEEN DONE, IT WOULD HAVE BECOME OBVIOUS THAT EUROPEAN HAMMER- AND BLADESMITHS FROM THE DARK AGES UNTIL THE 19TH CENTURY HAD NO NEED FOR ARABIC, PERSIAN OR INDIAN STEELS DUE TO THE TECHNOLOGICAL STANDARDS OF THEIR OWN PRODUCTS AND TO ECONOMIC CIRCUMSTANCES OF THE TIMES. THROUGHOUT THE SHORT ARTICLE OF THE DRESDEN RESEARCH-TEAM, THE PREVIOUS ANALYSES OF HISTORICAL BLADE-STEELS BY MEANS OF ELECTRON-MICROSCOPY ARE NOT MENTIONED⁶. IN SPITE OF YEARS OF RESEARCH ON THE TOPIC OF SWORD-BLADES THE PRESENT WRITER HAS NOT YET COME ACROSS

ANY EVIDENCE FOR THE ASSUMPTION THAT EUROPEAN BLADESMITHS WOULD HAVE TRIED TO PRODUCE AN EASTERN CRUCIBLE STEEL. WHAT SOME BLADESMITHS ACTUALLY TRIED TO IMITATE FROM THE 17TH CENTURY ONWARDS WERE THE PATTERNS MADE VISIBLE BY ETCHING ON SOME CURVED BLADES FROM TURKEY AND THE MIDDLE EAST. TAKING INTO ACCOUNT HITHERTO ACHIEVED RESULTS OF SERIOUS ARCHAEO-METALLURGICAL RESEARCH, STATEMENTS AS “*HOWEVER, EUROPEAN BLADESMITHS WERE UNABLE TO REPLICATE THE PROCESS, AND ITS SECRET WAS LOST AT ABOUT THE END OF THE 18TH CENTURY. IT WAS UNCLEAR HOW MEDIEVAL BLACKSMITHS WOULD HAVE OVERCOME THE INHERENT BRITTLINESS OF THE PLATES OF CEMENTITE (...)*”, OR “*IT IS BELIEVED THAT DAMASCUS BLADES WERE FORGED DIRECTLY FROM SMALL CAKES OF STEEL (NAMED “WOOTZ”) PRODUCED IN ANCIENT INDIA*”⁷ ARE OUT OF PLACE IN A PUBLICATION CLAIMING SCIENTIFIC CREDIBILITY.

2. ONE SWALLOW DOES NOT MAKE A SUMMER: ALL METALLOGRAPHICALLY ANALYZED BLADES FROM DIFFERENT PERIODS AND AREAS OF THE WORLD POINT TOWARDS HIGHLY INDIVIDUAL BLADE-STEELS, THEIR PURPOSEFUL COMBINATION, DIFFERENT METHODS FOR QUENCHING AND TEMPERING, A VARIETY OF SURFACE TREATMENTS ETC.. WITHOUT COMPARATIVE STUDIES GENERALIZING STATEMENTS ON SPECIFIC CHARACTERISTICS OF A “DAMASCUS STEEL” ARE OF A VERY LIMITED VALUE. ACCORDING TO A WIDESPREAD NOTION OF SCIENTIFIC PROCEEDING AT LEAST ONE EUROPEAN SWORD-BLADE FROM THE SAME PERIOD OUGHT TO HAVE BEEN ANALYZED BY APPLICATION OF THE SAME METHODS. THUS A DIRECT AND OBJECTIVE - HOWEVER BY NO MEANS REPRESENTATIVE - COMPARISON COULD HAVE BEEN CARRIED OUT. WITH THAT MINIMUM OF OBJECTIVITY MISSING, CAN IT BE DENIED RIGHT AWAY THAT IN EUROPEAN STEELS OF THE 17TH CENTURY *CARBON NANOTUBES* AND *CEMENTITE NANOWIRES* COULD BE EXTANT ALSO?

3. IN THE INTRODUCTION TO THE DRESDEN STUDY REFERENCE IS MADE TO THE SWORDS OF EUROPEAN KNIGHTS AND THE ONES OF THE MUSLIMS DURING THE ERA OF THE CRUSADES⁸. IN THIS CONTEXT THE QUESTION ARISES WHY NO MEDIEVAL SWORDS FROM BOTH CULTURAL SPHERES WERE ANALYZED. CHRONOLOGICAL AND GEOGRAPHICAL DIFFERENTIATIONS ARE INDISPENSABLE FROM A HISTORICAL PERSPECTIVE. THE ANALYZED BLADE, A “*REAL DAMASCUS SABRE*” FROM THE 17TH CENTURY IS DESCRIBED AS BEING A PRODUCT OF THE PERSIAN SWORDSMITH ASSAD ULLAH, WHOSE LIFE-DATES ARE USUALLY TAKEN TO FALL INTO THE REIGN OF SCHAH ABBAS (1587-1629). REGARDING THE SIGNIFICANCE OF ASSAD ULLAH WITH RESPECT TO RESEARCH INTO THE LEGENDARY “DAMASCENE” MATERIAL SEVERAL POINTS MUST BE KEPT IN MIND: THE SMITH IS ALWAYS MENTIONED AS AN INHABITANT OF ISFAHAN (PERSIA (IRAN), NOT SYRIA, FAR AWAY FROM DAMASCUS) AND THE CARTOUCHE WITH HIS NAME ON CURVED SWORDS IS ONE OF THE MOST NUMEROUSLY COPIED ONES IN THE HISTORY OF EDGED WEAPONS. ORIGINALS AND IMITATIONS ARE STILL NOT SEPARATED CONVINCINGLY TODAY. THE POSSIBILITY SHOULD ALSO BE KEPT IN MIND THAT THE BLADE ANALYZED BY THE DRESDEN RESEARCH-TEAM COULD DATE AS LATE AS THE 19TH CENTURY WHEN IT WAS ACQUIRED BY THE SWISS ADVENTURER AND COLLECTOR HENRI MOSER OF CHARLOTTENFELS. TURNING TO THE USE OF INDIAN WOOTZ (THE WORD ACTUALLY TRANSLATES VERY GENERALLY AS “STEEL”) FOR PERSIAN BLADES FROM THE MIDDLE AGES ARCHAEOLOGICAL INVESTIGATIONS OF THE LAST 15 YEARS HAVE PROVEN THAT IN PERSIA/MIDDLE ASIA, AT LEAST SINCE THE 10TH CENTURY A.D., BLADE-STEELS HAVE BEEN PRODUCED IN CRUCIBLES FROM INDIGENOUS ORES ALSO⁹.

4. QUITE CONTRARY FROM A STEADILY AND UNREFLECTEDLY REPEATED CLICHÉ (FOR ONE OF ITS ORIGINS SEE BELOW, ATTACHMENT 1) THE CRUSADERS WERE NOT THE FIRST EUROPEANS TO ENCOUNTER THE – AT THAT TIME MOSTLY STRAIGHT AND DOUBLE-EDGED – SWORDS OF THE ARABS. ALSO THE STUDY OF THE DRESDEN TEAM OF RESEARCHERS IGNORES E.G. THE HISTORY OF THE MOORS, WHO INVADDED SPAIN FROM A.D. 711 AND THUS INTRODUCED ISLAMIC ARMS’ TECHNOLOGY INTO SOUTH-WESTERN EUROPE. SOME LINES FROM THE QUILL OF THE ARAB CHRONICLER IBN MISKAWAIH (DIED AROUND 1043 A.D., 52 YEARS BEFORE THE ACCLAMATION OF THE

FIRST CRUSADE) MAY SERVE TO SHED A DIFFERENT LIGHT ON THE REPEATEDLY ACCLAIMED SUPERIORITY OF SWORDS MADE FROM CRUCIBLE-STEELS OVER THEIR WELDED EUROPEAN COUNTERPARTS: AFTER THE RUS WHO ORIGINATED IN SCANDINAVIA (POPULARLY “VIKINGS”) LOST THEIR PREDOMINANCE IN A PART OF THEIR SOUTH-EASTERN TERRITORY “*THE MUSLIMS OPENED THEIR GRAVES AND TOOK OUT A NUMBER OF SWORDS, THAT ARE IN HIGH DEMAND UNTIL TODAY BECAUSE OF THEIR SHARPNESS AND EXCELLENT QUALITY*”.

ANOTHER VIEW THAT WENT NEARLY UNNOTICED ALSO UNVEILS THE ALLEGED SUPERIORITY OF HISTORICAL CRUCIBLE-STEELS OVER EUROPEAN FORGE-WELDED STEELS AND WAS WRITTEN DOWN 900 YEARS LATER BY C. PANSERI AFTER THOROUGH COMPARATIVE ANALYSIS, INCLUDING ELECTRON-MICROSCOPY¹⁰:

“IS ORIENTAL DAMASCUS STEEL INDEED THE BEST THE METALLURGICAL ART OF THE ANCIENTS CONTRIVED TO PRODUCE? DESPITE THE FLOWERY ORIENTAL LEGENDS AND THE ENTHUSIASM AROUSED BY THE RATHER NEBULOUS NARRATIVES OF SOME RUSSIAN PIONEERS IN METALLOGRAPHY, WE HOLD THAT THE REPLY CAN BE A DOUBTFUL ONE. ORIENTAL DAMASCUS IS ASSUREDLY ENDOWED WITH ESTHETIC EXCELLENCES WHICH SHARPLY DISTINGUISH IT FROM ANY OTHER METALLURGICAL PRODUCT OF THE SORT, BUT ON THE PRACTICAL AND FUNCTIONAL PLANE IT CANNOT BEAR COMPARISON WITH THE PRODUCTS OF THE TECHNIQUE (REFINED AND PERFECTED THROUGH ALTOGETHER DIFFERENT MEANS) OF OTHER DIVERSE METALLURGICAL TRADITIONS, THE FIRST AMONG WHICH IS THAT OF OLD FEUDAL JAPAN. AND IF, IN REALITY, THE COMPOSITION AND THE STRUCTURE OF A GOOD ORIENTAL DAMASCUS STEEL REPRESENTS THE IDEAL FOR AN INSTRUMENT INTENDED FOR DELICATE AND REPEATED CUTTING OPERATIONS, SUCH AS A RAZOR, THE SAME CANNOT BE SAID FOR SWORD OR SABER BLADES, INTENDED TO DEAL LOCALIZED, VIOLENT AND SUDDEN BLOWS.”

SIR WALTER SCOTT IN HIS NOVEL “THE TALISMAN” INVOLUNTARILY PAVED THE WAY FOR THE MYSTIFICATION OF DAMASCUS-STEEL. THE ENCOUNTER BETWEEN CRUSADER AND DAMASCUS-BLADE HAS OFTEN SINCE BEEN STYLIZED AS A NEARLY TRAUMATIC ONE (FIG. 1). NEVERTHELESS SCOTT ATTRIBUTES THE CHARACTERISTIC SURFACE-PATTERN OF SALADIN’S “SCIMITAR” THAT WAS “*MARKED WITH TEN MILLIONS OF MEANDERING LINES*” TO A WELDING PROCESS AND NOT TO THE PROCESS OF FORGING A BLADE FROM CRUCIBLE-STEEL. SAD BUT TRUE: THE DETAILED TERMINOLOGY WITHIN THE HISTORICAL NOVEL FROM 1825 IS SHARPLY CONTRASTED BY THE HISTORICALLY INACCURATE TERM “DAMASCUS SABRE” IN THE TITLE AND TEXT OF THE LATEST PUBLICATION (NOVEMBER 16TH, 2006) ON THE SUBJECT FROM A VIEWPOINT OF MATERIALS SCIENCE. FURTHERMORE THE ROMANTIC WRITER IN HIS FICTIONAL CONFRONTATION BETWEEN ARABIC AND EUROPEAN BLADES IS STRIVING FAR MORE FOR AN OBJECTIVE JUDGEMENT IN HIS COMPARISON THAN NUMEROUS SCIENTIFIC PUBLICATIONS ON THE SUBJECT OF “DAMASCUS STEEL” OF THE LAST 100 YEARS. HERE IT ALSO DESERVES MENTION THAT SCOTT WAS A CONNOISSEUR, WHOSE COLLECTION OF ARMS AND ARMOUR CAN STILL BE VIEWED IN HIS FORMER RESIDENCE IN ABBOTSFORD, SCOTLAND¹¹. SCOTT’S ROMANTIC INACCURACY IN EQUIPPING THE SULTAN WITH “*A CURVED AND NARROW BLADE*” AND KING RICHARD WITH A HUGE “*TWO-HANDED SWORD*” IS EASILY EXCUSABLE WITHIN THE CONTEXT OF A NOVEL FROM THE EARLY 19TH CENTURY. HOWEVER, TO TAKE LEGENDS THAT AROSE FROM AN EPISODE IN THIS NOVEL LITERALLY DOES NOT REALLY FLATTER THE SCIENTIFIC VALUE OF SOME STUDIES ON “DAMASCUS STEEL” FROM THE END OF THE 20TH AND THE BEGINNING OF THE 21ST CENTURY. SCOTT’S INFLUENCE ON THE MODERN IMAGE OF “DAMASCUS STEEL” WAS FIRST NOTED AND COMMENTED UPON BY O.D. SHERBY AND J. WADSWORTH IN THEIR STUDY “DAMASCUS STEELS”¹². IN THE PRESENT ARTICLE THE EPISODE IN QUESTION FROM “THE TALISMAN” IS PROVIDED IN FULL IN ITS CONTEXT WITH THE DAMASCUS-SUBJECT IN APPENDIX 1 BELOW. AS THE PRESENT AUTHOR IS STAYING IN JAPAN AT THE MOMENT TO FURTHER RESEARCH THE SUBJECT OF EUROPEAN AND JAPANESE BLADE-TECHNOLOGY, ONLY AN E-BOOK VERSION OF “THE TALISMAN” COULD BE USED TO QUOTE FROM.

5. IT IS NOT MENTIONED ON WHICH OF THE NUMEROUS DEFINITIONS EXTANT FOR “DAMASCUS STEEL” THE RESEARCH-PROJECT WAS BASED. THE STATEMENTS

REGARDING THE “EXTRAORDINARY” AND “REMARKABLE”¹³ PROPERTIES OF “DAMASCUS BLADES” LACK IN SUBSTANCE WITHOUT COMPARATIVE DATA AS ALSO DOES THE TERM “DAMASCUS” ITSELF IN A METALLURGICAL CONTEXT. ESPECIALLY IN THE GERMAN SPEAKING COUNTRIES TERMS CORRESPONDING TO “DAMASK”, “DAMASCUS STEEL”, “DAMASCENE STEEL”, “DAMASCENING” E.A. HAVE BEEN USED QUITE AT RANDOM OVER THE LAST 100 YEARS. THEY HAVE BEEN APPLIED TO A VARIETY OF FERROUS MATERIALS FROM DIFFERENT CULTURES AND TIME-PERIODS WHICH SHOW A SURFACE-PATTERN OF SOME KIND DUE TO THE RESPECTIVE PRODUCTION PROCESSES. THIS PRACTICE IS AN OBSTACLE FOR THE INDISPENSABLE DIFFERENTIATION BETWEEN THE VARYING METHODS AND LEVELS OF DEVELOPMENT FOR PRODUCING SERVICEABLE MATERIAL FOR SWORD-BLADES ALL OVER THE WORLD. THUS THE APPLICATION OF THE TERM “DAMASCUS STEEL” AND ITS RELATED FORMS SHOULD BE EVADED IN A SCIENTIFIC CONTEXT IN GENERAL AND IN TECHNOLOGICAL CONTEXTS IN PARTICULAR¹⁴.

THIS STATEMENT APPLIES ALL THE MORE WHEN TAKING INTO ACCOUNT THE FACT THAT IN EUROPE AT LEAST SINCE THE LATE ROMAN PERIOD THOROUGHLY REFINED (REPEATEDLY FOLDED) STEELS HAVE BEEN COMBINED TO PRODUCE HIGHLY EFFECTIVE SWORD-BLADES¹⁵ (FIG. 2 A,B). THE SWORD-BLADES FROM THE LATE ROMAN PERIOD UNTIL THE 11TH CENTURY WITH THEIR ELABORATELY WELDED PATTERNS (COMPARE THE APPROPRIATE ENGLISH TERM “PATTERN-WELDING”) REPRESENT A COMPLEX SUBJECT IN THEMSELVES, WHICH CANNOT BE DEALT WITH IN THE COURSE OF THE PRESENT PAPER (FIG. 3). AS A CONSEQUENCE, WHEN APPLYING AN IDENTICAL SURFACE-TREATMENT, I.E. BY CARRYING OUT THE JAPANESE METHOD OF SWORD-POLISHING, THE SAME KINDS OF EXTREMELY FINE FORGING-TEXTURES AND TRAITS OF THE BLADES’ TEMPERING BECOME VISIBLE IN THE STEEL OF CORRODED EUROPEAN BLADES AS CLEAR AS IN JAPANESE SWORD-BLADES (FIG. 4-6, SEE NOTE 29). AS ANOTHER CLUE FOR THE COMPLEXITY OF RESEARCH INTO ANCIENT STEEL AND TOWARDS THE REACH OF EARLY TRADING CONTACTS, A PASSAGE FROM PLINY THE ELDER’S (CA. 23 – 79 A.D.) “*HISTORIA NATURALIS*” PROVIDES VALUABLE EVIDENCE FOR THE ROMAN IMPORT OF IRON FROM CHINA:

„*EX OMNIBUS AUTEM GENERIBUS PALMA SERICO FERRO EST; SERES HOC CUM VESTIBUS SUI PELLIBUSQUE MITTUNT; SECUNDA PARTHICO.*“ („AMONG ALL KINDS THE PALM BELONGS TO THE SERIC IRON; THE SERES SEND IT TOGETHER WITH THEIR GARMENTS AND FURS; THE PARTHIC (IRON) HOLDS THE SECOND RANK.”)¹⁶

6. CONSIDERING THE TEMPERING AND ANNEALING OF SWORD-BLADES IN GENERAL AND THE ALLEGEDLY “EXTRAORDINARY SHARP EDGES” OF “DAMASCUS BLADES” IN PARTICULAR, THE FOLLOWING OBSERVATIONS MAY PROVE USEFUL: IF - WITHIN THE PUBLICATIONS ON “DAMASCUS STEEL” OF THE LAST FEW YEARS - THE STATE OF ARCHAEO-METALLURGICAL RESEARCH INTO EUROPEAN SWORDS HAD BEEN ACKNOWLEDGED, THE VARIETY OF METHODS FOR THE EFFECTIVE TEMPERING OF SWORDS FROM THE EARLY TO THE HIGH MIDDLE-AGES AND OF THE EARLY MODERN ERA COULD HAVE BEEN INCLUDED AS COMPARATIVE DATA. VALUABLE STATEMENTS CONCERNING THE HEAT-TREATMENT AND QUENCHING PROCESSES OF MEDIEVAL SWORDS FROM THE MIDDLE-EAST AND INDIA ARE TO BE FOUND IN THE WORKS OF AL-KINDI FROM THE 9TH AND OF AL-BIRUNI FROM THE 11TH CENTURY A.D. (SEE NOTE 40), AS WELL AS IN THE STUDY BY SCHWARZLOSE ON THE “WEAPONS OF THE ANCIENT ARABS” PUBLISHED IN 1886 (SEE BELOW, NOTE 35). THE MOST COMPREHENSIVE SCIENTIFIC STUDY ON THE EDGES OF BLADES, ALTHOUGH BASED ON MODERN KNIVES AND THEIR MATERIALS, WAS WRITTEN BY R. LANDES AND PUBLISHED IN 2002¹⁷. WITH REGARD TO THE CUTTING-ABILITY OF HISTORICAL CURVED AND STRAIGHT SWORDS, THE GEOMETRY OF THE EDGES IS OF IMPORTANCE AS WELL AS THE QUALITY AND TEMPER OF THE STEEL THAT HAS BEEN USED FOR THE EDGES¹⁸. THE MOST FAMOUS CLUE TOWARDS THE SEEMINGLY SUPERIOR SHARPNESS OF ARAB SWORD-BLADES IS AN EPISODE INVOLVING A SILK-CLOTH FLOATING IN MID-AIR THAT ALLEGEDLY HAD BEEN CUT IN TWO WITH A “DAMASCUS”-SWORD. THIS EPISODE HAS BEEN CITED OVER AND OVER AGAIN IN SCIENTIFIC STUDIES ON THE SUBJECT OF “DAMASCUS STEEL”. TO SPECIFY THE SCIENTIFIC VALIDITY OF THIS EPISODE, THE READER WILL BE ABLE TO PASS A MORE ACCURATE JUDGEMENT HAVING READ POINT NO. 4 AND APPENDIX 1 OF

THE PRESENT ARTICLE. STILL THERE REMAINS THE OPTION OF PROBING THE EPISODE UNDER SCIENTIFICALLY JUSTIFIABLE CONDITIONS TO EVALUATE ITS RELEVANCE FOR FUTURE RESEARCH ON THE SUBJECT OF ANCIENT BLADE-STEELS.

ULTIMATELY HOWEVER, NEITHER THE MATERIAL AND THE TEMPER, NOR THE SHAPE AND EDGE-GEOMETRY WERE THE DECISIVE FACTORS FOR THE EFFECTIVENESS OF A SWORD-BLADE. IN FACT THESE WERE REPRESENTED BY THE TRAINING, DEXTERITY AND EXPERIENCE OF THE FIGHTER IN HIS RESPECTIVE ERA AND CULTURAL SPHERE. A WELL-TRAINED SWORDSMAN COULD INFLICT SUFFICIENTLY TERRIBLE HARM IN ALL PERIODS OF HISTORY WITH A “MIDDLE-CLASS” BLADE ALSO. ON THE CONTRARY FOR A HIGHEST QUALITY BLADE - E.G. FOR A JAPANESE SWORD MADE OF FLAWLESSLY REFINED STEEL WITH AN EXACTLY ADJUSTED TEMPER – IN THE HANDS OF AN UNSKILLED WIELDER, THE BENDING OF THE BLADE AND/OR THE CHIPPING OF ITS EDGE WERE FORESEEABLE TO THE SAME EXTENT AS THE UNFORTUNATE FATE OF ITS USER. SWORD BLADES WITH - IN A BASIC SENSE OF THE TERM - FANTASTIC CHARACTERISTICS DESCRIBED IN THE MEDIEVAL LITERATURE OF SEVERAL CULTURAL SPHERES MUST BE REGARDED AS WISHFUL THINKING WHEN HITHERTO ACHIEVED RESULTS OF ACADEMIC RESEARCH ARE TAKEN INTO ACCOUNT. SUCH SWORDS WERE EXTANT NEITHER IN EUROPE, THE MIDDLE-EAST, INDIA AND CHINA, NOR IN JAPAN.

DEALING WITH THE TERM “DAMASCUS STEEL” AND SOME HISTORICAL SOURCES:

AS ALREADY POINTED OUT ABOVE (SEE 4.) IN GERMANY, AUSTRIA AND SWITZERLAND THE TERM “DAMASCUS STEEL” (AND RELATED TERMS LIKE “DAMASK / DAMASCENED / DAMASCENING”) HAS BEEN APPLIED TO ANY FERROUS MATERIAL SHOWING A KIND OF SURFACE TEXTURE VISIBLE FOR THE NAKED EYE SINCE AT LEAST THE LAST 120 YEARS. SOME DEFINITIONS DIFFERENTIATE BETWEEN “TRUE” AND “FALSE DAMASK” SINCE THE LATE 19TH CENTURY¹⁹. THE SO-CALLED “TRUE DAMASKS” – AMONG WHICH IS COUNTED E.G. THE INDIAN *WOOTZ* – I.E. STEELS INDIRECTLY SMELTED IN CLAY-CRUCIBLES, SHOW MACROSCOPICALLY VISIBLE TEXTURES ALREADY ON THE SURFACE OF THE INGOTS (**FIG. 7**). THESE RESULT FROM SEGREGATION- AND CRYSTALLIZATION-PROCESSES WITHIN THE SLOWLY COOLING HIGH-CARBON STEEL INGOTS²⁰. INDIA INDEED PROVIDED THE ARAB PENINSULA AND PERSIA WITH BLADE-STEEL AND FINISHED BLADES FOR CENTURIES. (**FIG. 8**). THIS FACT CAN BE EXTRACTED FROM THE WORK OF YAKUB AL-KINDI FROM THE EARLY 9TH CENTURY²¹ AS WELL AS FROM MODERN ARCHAEOLOGICAL INVESTIGATIONS ON SRI LANKA²². A LARGELY UNNOTICED PROOF FOR THE USE OF INDIAN STEEL FOR ARABIAN SWORDS AT THE TIME OF THE CRUSADES IS THE AUTOBIOGRAPHICAL DESCRIPTION OF THE LIFE OF USÂMAH IBN MUNQUIDH FROM THE 12TH CENTURY. LOOKING BACK ON HIS LIFE HE WROTE²³:

*(...) MY WHOLE AMBITION WAS TO ENGAGE IN COMBAT WITH MY RIVALS,
WHOM I ALWAYS TOOK FOR PREY.
THEY THEREFORE WERE IN CONSTANT TREMBLING ON ACCOUNT OF ME.
MORE TERRIBLE IN WARFARE THAN NIGHT-TIME, MORE IMPETUOUS IN ASSAULT
THAN A TORRENT, AND MORE ADVENTUROUS ON THE BATTLEFIELD THAN
DESTINY!
BUT NOW I HAVE BECOME LIKE AN IDLE MAID WHO LIES
ON STUFFED CUSHIONS BEHIND SCREENS AND CURTAINS.
I HAVE ALMOST BECOME ROTTEN FROM LYING STILL SO LONG, JUST AS
THE SWORD OF INDIAN STEEL BECOMES RUSTY WHEN KEPT LONG IN ITS SHEATH.
(...) ²⁴*

FROM THE EARLY 13TH CENTURY – BETWEEN THE YEARS 1208 AND 1220 TO BE MORE PRECISE – DATES THE “*WIGALOIS*” OF WIRNT VON GRAFENBERG. THIS

WRITTEN SOURCE IMPRESSIVELY INDICATES THAT THE REPUTATION OF AN INDIAN STEEL, THAT CAN BE INTERPRETED ALSO AS A SYNONYM FOR “SWORD”, HAD REACHED CENTRAL EUROPE BY THAT TIME²⁵:

*IN DER INNERN INDIA
DÄ IST EINER SLAHTE STÄL
DAZ HÄT VON GOLDE RÖTIU MÄL,
UND IST SO HARTE,
DAZ ES DEN STEIN
REHTE SNIDET ALS EIN ZEIN.*

IN INNER INDIA
THERE IS A STEEL/SWORD OF BATTLE
THAT HAS RED DOTS/SIGNS OF GOLD,
AND IS SO HARD,
THAT STONE
IT CUTS AS WELL AS UNHARDENED BARS OF STEEL.

FOR THE “FALSE DAMASKS”, IN WHICH THE CHARACTERISTIC SURFACE-TEXTURES ARE BROUGHT ABOUT BY OFTEN PURELY ORNAMENTAL FORGE-WELDING, TWISTING AND PUNCHING OF DIFFERENT FERROUS MATERIALS, A DIFFERENTIATION INTO FORGE-WELDED AND PATTERN-WELDED STEELS IS TO BE PREFERRED. IN BRITAIN A DISTINCTION BETWEEN “PATTERN-WELDING” AND “DAMASCENING” IS APPLIED SINCE THE 1960S²⁶. FOR THE “WURMBUNTE/WORM-COLOURED”²⁷ SWORD-BLADES OF THE EARLY DARK AGES W. ARENDT HAS INTRODUCED THE APPROPRIATE TERM “SCHWEISSMUSTER” (= WELDED PATTERN) ALREADY 30 YEARS BEFORE THE ABOVE MENTIONED DISTINCTION WAS MADE BY MARYON. HOWEVER THIS IMPORTANT STEP FOR FURTHER CLASSIFICATION OF MEDIEVAL SWORD-BLADES WAS ACKNOWLEDGED NEITHER BY ARCHAEOLOGISTS, NOR BY REPRESENTATIVES OF THE NATURAL SCIENCES IN ARCHAEO-METALLURGY²⁸. RECENT RESEARCH CARRIED OUT ON 4 “UNDAMASCENED” SINGLE-EDGED SAX-BLADES (6TH TO 8TH CENTURIES A.D) FROM SOUTHERN GERMANY THAT WERE POLISHED IN JAPAN BROUGHT TO LIGHT FINE FORGING-TEXTURES AS IN JAPANESE BLADES OF THE SAME AND SUBSEQUENT ERAS (FIG. 4-6). REFERRING TO THE VARIETY OF DEFINITIONS FOR “DAMASCUS STEEL” IN GERMANY THE MATERIAL OF THESE EARLY MEDIEVAL SWORD-BLADES WOULD HAVE TO BE TERMED “DAMASK” ETC. ALSO²⁹. FOLLOWING ANOTHER POPULAR DEFINITION FOR “DAMASCUS STEEL” WITHIN ARCHAEOLOGY, INDEED ANY STEEL FABRICATED IN THE PRE-INDUSTRIAL ERA WOULD HAVE TO BE TERMED “DAMASCUS STEEL, DAMASK, DAMASCENED” ETC..

FOR THE ARABIAN, THE PERSIAN AND INDIAN CULTURAL SPHERES ALL SCIENTIFIC INVESTIGATIONS OF THE LOCAL CRUCIBLE STEELS POINT TOWARDS ONE DECISIVE FACT: THERE WERE AT LEAST AS MANY DIFFERENT KINDS OF CRUCIBLE-STEEL AS THERE WERE CENTRES FOR ITS PRODUCTION. AS IS AND WAS THE CASE WITH EUROPEAN BLADE-STEELS THERE NECESSARILY WERE ONES OF A VERY HIGH QUALITY AND STEELS THAT WERE NOT VERY SUITABLE FOR SWORD-PRODUCTION. HOWEVER, IT CAN SAFELY BE STATED THAT IN BOTH AREAS OF THE WORLD SWORDS WHICH SUITED THE PRACTICAL REQUIREMENTS³⁰ WERE PRODUCED.

KEEPING IN MIND THE POPULAR CLICHÉS AFFIXED TO “ORIENTAL DAMASCUS BLADES” A TELLING SOURCE REFERRING TO INDEED REMARKABLE PROPERTIES OF THEIR FAMED MATERIAL DESERVES MENTION HERE. THE FRENCH TRAVELLER AND MERCHANT M. DE THEVENOT WROTE DOWN THE FOLLOWING LINES DURING A JOURNEY IN INDIA DURING THE SECOND HALF OF THE 17TH CENTURY³¹:

“(...) THE SWORDS / MADE BY THE INDIANS / BREAK EASILY / HOWEVER THE ENGLISH PROVIDE THEM WITH GOOD ONES / THAT THEY BRING THERE FROM ENGLAND (...).”

QUITE CONTRARY TO THE RANDOM ASSERTIONS STATING THE SUPERIORITY OF BLADES MADE FROM CRUCIBLE STEELS, THERE IS HARD EVIDENCE FOR DE THEVENOT’S OBSERVATIONS IN THE SHAPE OF UNCOUNTED EUROPEAN SWORD- AND SABRE-BLADES FROM THE 16TH AND 17TH CENTURIES THAT WERE MOUNTED IN INDIA

WITH LOCAL HILTS AND SCABBARDS (FIG. 9A,B). VICE VERSA THERE ARE ONLY VERY FEW BLADES EXTANT (MAINLY 18TH/19TH CENTURY) IN WESTERN COLLECTIONS THAT ORIGINATED IN PERSIA OR INDIA AND WERE MOUNTED IN EUROPEAN STYLE. ALSO THE LIABILITY TO BREAKING OF INDIAN BLADES OF THE 17TH CENTURY OBVIOUSLY WAS NOT THE FRENCH TRAVELLER'S INVENTION AS RECENT RESEARCH SUGGESTS (FIG. 10 A,B).

DAMASCUS WAS AN IMPORTANT PIVOTING POINT FOR TRADE IN ALL DIFFERENT KINDS OF GOODS, INCLUDING ARMS AND ARMOUR, FROM THE MIDDLE-AGES UNTIL THE EARLY MODERN PERIOD (FIG. 11). NEVERTHELESS, UP UNTIL TODAY THERE ARE NO CHARACTERISTIC KINDS OF STEEL AND/OR BLADE-TYPES IDENTIFIED, WHICH COULD BE SECURELY LINKED UP WITH THE TOWN OF DAMASCUS. IN THE LANGUAGES OF THE REGIONS WHERE CRUCIBLE STEEL AND WEAPONS WERE PRODUCED, THERE IS NO EQUIVALENT FOR THE TERM "DAMASCUS STEEL" AND ITS DERIVATIVES IN A CONTEXT WITH STEEL. THESE CIRCUMSTANCES RENDER THE FURTHER USE OF THE TERM "DAMASCUS STEEL" QUESTIONABLE IN SCIENTIFIC CONTEXTS AT LEAST. WHAT IS THE VALUE OF A DEFINITION THAT HAS BEEN WEAKENED AND WIDENED FOR MORE THAN 200 YEARS TO A POINT WHERE IT NO LONGER ALLOWS FOR ANY DIFFERENTIATION?

THE EARLIEST WRITTEN EVIDENCE FOR THE TERM "DAMASK" FROM THE THEN GERMAN SPEAKING REGIONS DATES FROM THE 14TH CENTURY WHEN IT REFERRED TO ELABORATELY ORNAMENTED SILK-TEXTILES. THESE COULD INDEED SHOW A CERTAIN LIKENESS TO THE APPEARANCE OF SURFACE-TEXTURES IN SWORD-BLADES³². A WIDE RANGE OF DEFINITIONS IS PROVIDED BY THE ENCYCLOPAEDIC LITERATURE OF THE 18TH AND 19TH CENTURY. THERE CAN BE FOUND COMPREHENSIVE STATEMENTS ON THE QUALITIES OF "DAMASCUS BLADES", WHICH ALSO ALLOW FOR SOME CONCLUSIONS REGARDING THE DEVELOPMENT OF CERTAIN LEGENDS CONCERNING THESE WEAPONS. ON THE OTHER HAND SOME SOLID ANSWERS CAN BE OBTAINED FOR THE QUESTIONS OF MODERN ARCHAEO-METALLURGY AND FOR THE STUDY OF HISTORICAL ARMS AND ARMOUR. E.G. IN THE ENCYCLOPEDIA COMPILED BY KRUEINIZ AND HIS SUCCESSORS FROM 1773 UNTIL 1858 IS RENDERED A MORE ACCURATE EXPLANATION FOR "REMARKABLE PROPERTIES" AND THE ALLEGED HARDNESS OF TURKISH "DAMASCUS STEEL" FROM THE 18TH CENTURY THAN PROVIDED BY SOME SCIENTIFIC STUDIES OF RECENT YEARS³³.

IN THE "DEUTSCHES WOERTERBUCH" BY THE BROTHERS GRIMM THE FOLLOWING INFORMATION IS GIVEN UNDER THE KEYWORD "DAMASCENING". THIS INFORMATION CAN BE TRACED BACK TO A FRENCH DEFINITION OF THE 17TH CENTURY, WHERE IT REFERS EXCLUSIVELY TO THE SURFACE-TREATMENT OF STEEL AND IRON³⁴:

"DAMASCENING, FRENCH DAMASQUINER, TO GIVE TO STEEL AND IRON A CLOUDY, FLAME-LIKE APPEARANCE ACCORDING TO THE CUSTOM OF THE PEOPLE OF DAMASCUS BY THE APPLICATION OF ETCHING SUBSTANCES OR TO INLAY IT WITH GOLD AND SILVER, THUS A DAMASCENED SWORD, A DAMASCENED GUN-BARREL."

A DERIVATION OF THE TERM FROM THE ARABIC EQUIVALENT FOR "WATER/WATERED", THAT PURPORTEDLY IS PRONOUNCED "DAMAS" CAN PROBABLY BE EXCLUDED AS IT DOES NOT OCCUR IN EARLY ARABIC LITERATURE WHERE DETAILED DESCRIPTIONS OF SWORDS ARE ABUNDANT³⁵. IN THE WORKS OF AL-KINDI AND AL-BIRUNI THE SURFACE-TEXTURES OF SWORD-BLADES ARE COMMONLY SUMMED UP BY THE TERM "FIRIND". REGARDING THIS POINT HOWEVER A LINGUISTIC EVALUATION REMAINS TO BE OBTAINED.

TO PROCEED FURTHER A CONCISE SUMMARY OF SOME HISTORICAL FACTS CONCERNING THE STATUS OF DAMASCUS AS A CENTRE FOR ARMS-PRODUCTION MAY PROVE MEANINGFUL: THE EARLIEST EVIDENCE IS PROVIDED BY THE FOUNDATION OF A FACTORY FOR ARMS AND ARMOUR UNDER THE REIGN OF DIOCLETIAN IN THE 3RD CENTURY A.D.. 22 YEARS AGO THE MODEST REPUTATION OF SWORDS FROM DAMASCUS DURING THE 9TH AND 10TH CENTURIES A.D. WAS FIRST POINTED OUT BY D.G. ALEXANDER BY REFERENCE TO THE WRITINGS OF YAKUB AL-KINDI ON SWORDS AND THEIR KINDS³⁶.

IN 1432 A FRENCH MERCHANT, BERTRANDON DE LA BROUQUIERE, TRAVELLED TO SYRIA. ON THAT OCCASION HE MENTIONED THE EXCELLENT QUALITY AND THE MIRROR-LIKE POLISH OF THE SWORDS AVAILABLE IN DAMASCUS AT THE TIME:

“THE DAMASCENE BLADES ARE THE MOST BEAUTIFUL AND BEST IN ALL OF SYRIA; AND IT IS WONDERSOME TO REGARD THE WAY IN WHICH THEY EVEN OUT THEIR SURFACES. THIS STAGE OF WORK IS CARRIED OUT BEFORE TEMPERING; AND THEY USE FOR THE SAID PURPOSE A SMALL PIECE OF WOOD, IN WHICH AN IRON IS SET, WHICH THEY RUB UP AND DOWN ALONG THE BLADE, THUS GETTING RID OF ALL UNEVENNESS, JUST AS A PLANE DOES ON WOOD. THEN THEY TEMPER AND POLISH THEM. THIS POLISH IS SO UTTERLY FLAWLESS THAT, IF ANYONE WANTS TO REARRANGE HIS TURBAN, HE USES HIS SWORD AS A MIRROR.”³⁷

SHOULD OF ALL SWORDS THE ONES’ PRODUCED IN LATE MEDIEVAL DAMASCUS HAVE BEEN CRAFTED IN A WAY THAT THE NOWADAYS STILL FAMED “DAMASCUS”-TEXTURE WAS VISIBLE ONLY AT THE SECOND OR THIRD GLANCE, IF INDEED IT WAS VISIBLE AT ALL? AS FAR AS THE AUTHOR KNOWS THIS IS THE EARLIEST WRITTEN SOURCE FROM EUROPE THAT EXPLICITLY POINTS TOWARDS A HIGH QUALITY-LEVEL OF BLADES APPARENTLY PRODUCED IN THE CITY OF DAMASCUS. THE MENTION OF A MIRROR-LIKE POLISH ON SYRIAN BLADES DURING THE TIMES OF BERTRANDON IS – TO SAY THE LEAST – REMARKABLE AS IS THE FACT THAT HE REFERS TO THEIR BEAUTIFUL SHINE IN MUCH MORE DETAIL THAN TO THEIR BATTLEWORTHINESS. A SUMMARY AND COMMENTARY ON THE GRADUALLY INCREASING REFERENCES TO THE PHENOMENON OF “DAMASCUS STEEL” FROM THE 17TH TO 19TH CENTURY HAS BEEN TAKEN UP, BUT WILL TAKE A GOOD WHILE TO COMPLETE.

SUMMARY AND PROSPECTS:

SUMMING UP THE METHODOLOGICAL REMARKS ON THE LATEST SCIENTIFIC RESEARCH OF A SINGLE “DAMASCUS SABER” THE AUTHOR CANNOT HELP BUT GIVE WAY TO THE IMPRESSION THAT ITS INACCURATE CULTURAL AND HISTORICAL FUNDAMENT GAVE RISE TO THE HIGH-END MICROSCOPICAL STUDY. A SCIENTIFICALLY SOUND INITIAL IMPETUS FOR THE RESEARCH IS NOT GIVEN IN THE SHORT ARTICLE. OF COURSE, ENTHUSIASM CONCERNING THE APPLICATION OF MODERN HIGH-TECH TO INVESTIGATE ARTEFACTS OF THE PAST IS JUSTIFIABLE TO A CERTAIN DEGREE, HOWEVER A BIT OF RESPECT FOR WELL-ESTABLISHED METHODS OF HISTORY AND ARCHAEOLOGY REMAINS TO BE DESIRED. THE CONCLUSION DRAWN FROM THE PRESENCE OF NANO-WIRES AND NANO-TUBES IN THE ANALYZED BLADE REMAINS VAGUE: “*WE SUGGEST THAT OUR FINDINGS COULD BE A LINK BETWEEN THE CHARACTERISTIC BANDED-STRUCTURE IN DAMASCUS BLADES AND IMPURITIES IN THE STEEL.*”³⁸ CONSIDERING THE MODESTY AND THE SCIENTIFIC IMPACT OF THIS STATEMENT THE HYPE THROUGHOUT INTERNATIONAL MEDIA APPEARS A BIT STRANGE; ALL THE MORE SO AS THE PUBLIC IS INFORMED WRONGLY ONE MORE TIME IN A DECEIVINGLY SCIENTIFIC MANNER. THE FOLLOWING FACTS REMAIN TO BE STATED:

1. THE VALUE OF THE STATEMENTS REFERRING TO THE CULTURAL AND HISTORICAL BACKGROUND OF SO-CALLED “DAMASCUS STEEL” IN THE FIRST THIRD OF THE ARTICLE RANGES FROM UNDIFFERENTIATED TO ABSOLUTELY WRONG.
2. THE DECISIVE FACT OF THE PUBLICATION IS THE DISCOVERY OF CEMENTITE-NANOWIRES AND CARBON-NANOTUBES IN ONE KIND OF NUMEROUS CRUCIBLE-STEELS. HOWEVER IT REMAINS AS YET UNCLEAR IF/HOW CARBON-NANOTUBES AND CEMENTITE-NANOWIRES INFLUENCE THE MECHANICAL PROPERTIES OF THE ANALYZED BLADE. FURTHER THE ANALYSIS IS OF LITTLE AVAIL IN DETERMINING WHETHER THE STEEL FOR THE BLADE CONSISTED OF INDIAN WOOTZ, A PERSIAN VARIANT OF THE FORMER OR EVEN OF A CRUCIBLE-STEEL FROM DAMASCUS.
3. THE TERM “DAMASCUS STEEL” AND THE INFORMATION PROVIDED ON ITS CHARACTERISTICS REMAIN IRRELEVANT, AS THEY WERE NOT DELIMITED FROM THE PROPERTIES OF EUROPEAN STEELS BUT ARE LARGELY BASED ON ANTIQUATED CLICHÉS. SOME OF THESE HAVE THEIR ORIGIN IN SIR WALTER SCOTT’S HISTORICAL NOVEL “THE TALISMAN” (PUBLISHED IN 1825), OTHERS IN INFORMATION PROVIDED BY THE ENCYCLOPAEDIC LITERATURE OF THE 18TH AND 19TH CENTURY. TO OBTAIN MORE

OBJECTIVE RESULTS BY MEANS OF A COMPARATIVE RESEARCH BETWEEN E.G. PERSIAN, ARABIAN, INDIAN CRUCIBLE-STEELS AND EUROPEAN FORGE-WELDED/REFINED STEELS AN IDENTICAL NUMBER OF EUROPEAN BLADES FROM CORRESPONDING TIME-PERIODS WOULD HAVE TO BE INCLUDED. HOWEVER AS BLADE QUALITY VARIES GREATLY EVEN WITHIN DIFFERENT SWORD-MAKING TRADITIONS, SUCH COMPARISONS ARE OF A VERY LIMITED VALUE. IN A FIGURATIVE SENSE THE LATEST RESEARCH ON “DAMASCUS STEEL” FROM A PERSPECTIVE OF MODERN MATERIALS SCIENCE DID NOT ONLY COMPARE APPLES TO ORANGES, IT EVEN NEGLECTED TO EXAMINE A SINGLE ORANGE.

KEEPING THIS IN MIND THE VALIDITY OF THE FOLLOWING PREDICTION BY THE PRESENT AUTHOR REMAINS TO BE VERIFIED: AS RESEARCH APPLYING HIGH-RESOLUTION TRANSMISSION ELECTRON MICROSCOPY IN GENERAL PROCEEDS FROM A MICRO-LEVEL TO A NANO-SCALE, IN THE FUTURE COMPARABLE NANO-PHENOMENA WILL BE DETECTED IN THE STEEL OF HISTORICAL EUROPEAN SWORD-BLADES ALSO.

IF THE NANO-CONSTITUENTS SHOULD INDEED TURN OUT TO BE A LANDMARK DISCOVERY IN THE FUTURE, THIS WOULD BE A STEP FORWARD FOR HISTORICAL AND ARCHAEO-METALLURGICAL RESEARCH WITHOUT ANY DOUBT. HOWEVER, NOT ONLY THE EXTENT TO WHAT THIS FEATURE CAN SERVE AS DISTINGUISHING CRITERIA BETWEEN EUROPEAN AND EASTERN BLADE MATERIALS REMAINS TO BE RESEARCHED, BUT ALSO ITS EFFECTS ON THE MECHANICAL PROPERTIES OF THE ANALYZED BLADE(S). EVENTUALLY ONE CRUCIAL QUESTION FOR THE CARRYING OUT OF SERIAL ANALYSES ARISES: HOW MANY BLADES CAN BE ANALYZED WITHIN A GIVEN AMOUNT OF TIME AND EFFORT – NOT TO MENTION FINANCIAL ASPECTS – BY THE LATEST DEVELOPMENTS IN ELECTRON-MICROSCOPY? ANOTHER ASPECT TO BE BOURNE IN MIND FROM AN ARCHAEOLOGICAL VIEWPOINT IS THE FACT THAT THE ANALYZED SAMPLES HAVE TO BE DISSOLVED IN HYDROCHLORIC ACID FOR THE DETECTION OF “CARBON-NANOTUBES” AND “CEMENTITE-NANOWIRES”³⁹.

TO AT LEAST CONFINE A CONTINUITY OF THE UNSCIENTIFIC TRANSFIGURATION SURROUNDING THE TERM “DAMASCUS STEEL” THE 2006 EDITION OF YAKUB AL-KINDI’S TREATISE “ON SWORDS AND THEIR KINDS” BY R.G. HOYLAND AND B. GILMOUR IS AN INDISPENSABLE TOOL⁴⁰. IN THAT CASE A TRULY EXEMPLARY COOPERATION BETWEEN A PHILOLOGIST AND AN ARCHAEO-METALLURGIST HAS TAKEN PLACE. PERHAPS A COMPARABLY COMPREHENSIVE INTERDISCIPLINARY COOPERATION IN THE FIELD OF HISTORICAL BLADE-RESEARCH SHOULD ALSO BE CONSIDERED IN GERMANY. THUS THE PUBLIC MIGHT BE SPARED FROM FURTHER PREMATURE SNAPSHOTS IN THE FUTURE. FOR THE TIME BEING THE SUBJECT HAS BEEN MYSTIFIED THOROUGHLY ONCE MORE BY SENSATION-CRAVING JOURNALISM.

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APPENDIX 1:

SOURCE: [HTTP://WWW.CLASSICREADER.COM/BOOKTOC.PHP/SID.1/BOOKID.1294/](http://www.classicreader.com/booktoc.php/sid.1/bookid.1294/)

FROM: SIR WALTER SCOTT: THE TALISMAN (1825)

CHAPTER 27:

(...)THEIR HELMETS AND HAUBERKS WERE FORMED OF STEEL RINGS, SO BRIGHT THAT THEY SHONE LIKE SILVER; THEIR VESTURES WERE OF THE GAYEST COLOURS, AND SOME OF CLOTH OF GOLD OR SILVER; THE SASHES WERE TWISTED WITH SILK AND GOLD, THEIR RICH TURBANS WERE PLUMED AND JEWELLED, AND THEIR SABRES AND PONIARDS, OF DAMASCENE STEEL, WERE ADORNED WITH GOLD AND GEMS ON HILT AND SCABBARD. (...)

(...) IT WAS RICHARD'S TWO-HANDED SWORD THAT CHIEFLY ATTRACTED THE ATTENTION OF THE SARACEN-A BROAD, STRAIGHT BLADE, THE SEEMINGLY UNWIELDY

LENGTH OF WHICH EXTENDED WELL-NIGH FROM THE SHOULDER TO THE HEEL OF THE WEARER.

"HAD I NOT," SAID SALADIN, "SEEN THIS BRAND FLAMING IN THE FRONT OF BATTLE, LIKE THAT OF AZRAEL, I HAD SCARCE BELIEVED THAT HUMAN ARM COULD WIELD IT. MIGHT I REQUEST TO SEE THE MELECH RIC STRIKE ONE BLOW WITH IT IN PEACE, AND IN PURE TRIAL OF STRENGTH?"

"WILLINGLY, NOBLE SALADIN," ANSWERED RICHARD; AND LOOKING AROUND FOR SOMETHING WHEREON TO EXERCISE HIS STRENGTH, HE SAW A STEEL MACE HELD BY ONE OF THE ATTENDANTS, THE HANDLE BEING OF THE SAME METAL, AND ABOUT AN INCH AND A HALF IN DIAMETER. THIS HE PLACED ON A BLOCK OF WOOD.

THE ANXIETY OF DE VAUX FOR HIS MASTER'S HONOUR LED HIM TO WHISPER IN ENGLISH, "FOR THE BLESSED VIRGIN'S SAKE, BEWARE WHAT YOU ATTEMPT, MY LIEGE! YOUR FULL STRENGTH IS NOT AS YET RETURNED -GIVE NO TRIUMPH TO THE INFIDEL."

"PEACE, FOOL!" SAID RICHARD, STANDING FIRM ON HIS GROUND, AND CASTING A FIERCE GLANCE AROUND; "THINKEST THOU THAT I CAN FAIL IN *HIS* PRESENCE?"

THE GLITTERING BROADSWORD, WIELDED BY BOTH HIS HANDS, ROSE ALOFT TO THE KING'S LEFT SHOULDER, CIRCLED ROUND HIS HEAD, DESCENDED WITH THE SWAY OF SOME TERRIFIC ENGINE, AND THE BAR OF IRON ROLLED ON THE GROUND IN TWO PIECES, AS A WOODSMAN WOULD SEVER A SAPLING WITH A HEDGING-BILL.

"BY THE HEAD OF THE PROPHET, A MOST WONDERFUL BLOW!" SAID THE SOLDAN, CRITICALLY AND ACCURATELY EXAMINING THE IRON BAR WHICH HAD BEEN CUT ASUNDER; AND THE BLADE OF THE SWORD WAS SO WELL TEMPERED AS TO EXHIBIT NOT THE LEAST TOKEN OF HAVING SUFFERED BY THE FEAT IT HAD PERFORMED. HE THEN TOOK THE KING'S HAND, AND LOOKING ON THE SIZE AND MUSCULAR STRENGTH WHICH IT EXHIBITED, LAUGHED AS HE PLACED IT BESIDE HIS OWN, SO LANK AND THIN, SO INFERIOR IN BRAWN AND SIN EW.

"AY, LOOK WELL," SAID DE VAUX IN ENGLISH, "IT WILL BE LONG ERE YOUR LONG JACKANAPE'S FINGERS DO SUCH A FEAT WITH YOUR FINE GILDED REAPING-HOOK THERE."

"SILENCE, DE VAUX," SAID RICHARD;"BY OUR LADY, HE UNDERSTANDS OR GUESSES THY MEANING-BE NOT SO BROAD, I PRAY THEE."

THE SOLDAN, INDEED, PRESENTLY SAID, "SOMETHING I WOULD FAIN ATTEMPT-THOUGH WHEREFORE SHOULD THE WEAK SHOW THEIR INFERIORITY IN PRESENCE OF THE STRONG? YET EACH LAND HATH ITS OWN EXERCISES, AND THIS MAY BE NEW TO THE MELECH RIC." SO SAYING, HE TOOK FROM THE FLOOR A CUSHION OF SILK AND DOWN, AND PLACED IT UPRIGHT ON ONE END. "CAN THY WEAPON, MY BROTHER, SEVER THAT CUSHION?" HE SAID TO KING RICHARD.

"NO, SURELY," REPLIED THE KING; "NO SWORD ON EARTH, WERE IT THE EXCALIBUR OF KING ARTHUR, CAN CUT THAT WHICH OPPOSES NO STEADY RESISTANCE TO THE BLOW."

"MARK, THEN," SAID SALADIN; AND TUCKING UP THE SLEEVE OF HIS GOWN, SHOWED HIS ARM, THIN INDEED AND SPARE, BUT WHICH CONSTANT EXERCISE HAD HARDENED INTO A MASS CONSISTING OF NOUGHT BUT BONE, BRAWN, AND SIN EW. HE UNSHEATHED HIS SCIMITAR, A CURVED AND NARROW BLADE, WHICH GLITTERED NOT LIKE THE SWORDS OF THE FRANKS, BUT WAS, ON THE CONTRARY, OF A DULL BLUE COLOUR, MARKED WITH TEN MILLIONS OF MEANDERING LINES, WHICH SHOWED HOW ANXIOUSLY THE METAL HAD BEEN WELDED BY THE ARMOURER. WIELDING THIS WEAPON, APPARENTLY SO INEFFICIENT WHEN COMPARED TO THAT OF RICHARD, THE SOLDAN STOOD RESTING HIS WEIGHT UPON HIS LEFT FOOT, WHICH WAS SLIGHTLY ADVANCED; HE BALANCED HIMSELF A LITTLE, AS IF TO STEADY HIS AIM; THEN STEPPING AT ONCE FORWARD, DREW THE SCIMITAR ACROSS THE CUSHION, APPLYING THE EDGE SO DEXTEROUSLY, AND WITH SO LITTLE APPARENT EFFORT, THAT THE CUSHION SEEMED RATHER TO FALL ASUNDER THAN TO BE DIVIDED BY VIOLENCE.

"IT IS A JUGGLER'S TRICK," SAID DE VAUX, DARTING FORWARD AND SNATCHING UP THE PORTION OF THE CUSHION WHICH HAD BEEN CUT OFF, AS IF TO ASSURE HIMSELF OF THE REALITY OF THE FEAT; "THERE IS GRAMARYE IN THIS."

THE SOLDAN SEEMED TO COMPREHEND HIM, FOR HE UN DID THE SORT OF VEIL WHICH HE HAD HITHERTO WORN, LAID IT DOUBLE ALONG THE EDGE OF HIS SABRE, EXTENDED THE WEAPON EDGEWAYS IN THE AIR, AND DRAWING IT SUDDENLY THROUGH

THE VEIL, ALTHOUGH IT HUNG ON THE BLADE ENTIRELY LOOSE, SEVERED THAT ALSO INTO TWO PARTS, WHICH FLOATED TO DIFFERENT SIDES OF THE TENT, EQUALLY DISPLAYING THE EXTREME TEMPER AND SHARPNESS OF THE WEAPON, AND THE EXQUISITE DEXTERITY OF HIM WHO USED IT.

"NOW, IN GOOD FAITH, MY BROTHER," SAID RICHARD, "THOU ART EVEN MATCHLESS AT THE TRICK OF THE SWORD, AND RIGHT PERILOUS WERE IT TO MEET THEE! STILL, HOWEVER, I PUT SOME FAITH IN A DOWNRIGHT ENGLISH BLOW, AND WHAT WE CANNOT DO BY SLEIGHT WE EKE OUT BY STRENGTH. NEVERTHELESS, IN TRUTH THOU ART AS EXPERT IN INFLECTING WOUNDS AS MY SAGE HAKIM IN CURING THEM. (...)

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TEXTS FOR THE FIGURES:

FIG. 1: ROMANTIC REPRESENTATION OF AN ENCOUNTER BETWEEN RICHARD THE LIONHEART AND SALADIN AT THE BATTLE OF AKKON IN 1191. THE ENGLISH KING IS DEPICTED USING A MACE. PRINT BY G. DORÉ (1832-1882).

FIG. 2A: A LATE ROMAN CAVALRY-MAN'S SPATHA FROM THE 3RD TO 4TH CENTURY A.D. DEEPER PITS OF CORROSION CLOSE TO THE POINT-AREA IMPLY A DIFFERENTIAL TEMPERING FOR THE PART MOST IMPORTANT FOR CUTTING. (PHOTO: J. SCHNEIDER)

FIG. 2B: EXTREMELY FINE FORGING-TEXTURE ON THE FLAT OF THE SAME BLADE THAT WAS POLISHED APPLYING THE TRADITIONAL JAPANESE METHOD. (PHOTO: J. SCHNEIDER)

FIG. 3: SURFACE-TEXTURE IN A "WURMBUNT"-PATTERN-WELDED SPATHA-BLADE FROM THE 6TH CENTURY A.D.. THIS SWORD WAS POLISHED IN JAPAN IN 1999. (PHOTO: AUTHOR)

FIG. 4: THE SWORD-POLISHER TAKUSHI SASAKI CHECKING HIS WORK ON A SAX-BLADE OF THE 6TH CENTURY A.D. FROM BAD KROZINGEN, GERMANY. (PHOTO: KENICHI NAKAJIMA)

FIG. 5: FORGING-TEXTURE OF THE SAX-BLADE FROM BAD KROZINGEN. THE BLADE CONSISTS OF TWO TYPES OF MATERIAL: A CORE STEEL AND A SKIN-STEEL. THE PRESENT PICTURE SHOWS A LENGTHWISE SECTION THROUGH THE BLADE'S BODY. CLOSE TO THE EDGE A PHENOMENON APPEARED THAT COULD BE COMPARED TO THE TEMPER-LINE ON A JAPANESE SWORD. (PHOTO: AUTHOR)

FIG. 6: EASILY DISTINGUISHABLE FORGING-TEXTURE ON A POLISHED FRAGMENT OF A LONG-SAX (8TH CENTURY A.D.) FROM BREISACH, GERMANY. (PHOTO: AUTHOR)

FIG. 7: RARE REPRESENTATION OF THE MANUFACTURE OF ARMS IN PERSIA FROM THE 16TH CENTURY.

FIG. 8: PRINT REPRESENTING THE ARMS BAZAAR AT DAMASCUS IN THE 19TH CENTURY.

¹ Based on: Reibold *et al* 2006, p. 286. – see also: Levin et al. 2005, pp. 905-916.

² See among others: Zschokke 1924, pp. 654-669. - Arendt 1931, pp. 296-298. - Panseri 1965, pp. 5-67.

³ The original article published in „Nature“ was available to the present author. However due to staying in Japan this was not the case with the secondary publications. The following links demonstrate the media coverage of the article by the Dresden based research-team:

<http://www.spiegel.de/wissenschaft/m...448539,00.html>.

<http://www.stern.de/wissenschaft/nat...ie/576565.html>.

<http://www.newscientisttech.com/article.ns?id=mg19225780.151>.

<http://news.nationalgeographic.com/news/2006/11/061116-nanotech-swords.html>

<http://www.sciencedaily.com/upi/index.php?feed=Science&article=UPI-1-20061116-11490400-bc-germany-steelstudy.xml>

⁴ <http://www.messerforum.net/showthread.php?t=38344>, see contributions by A. Eckhardt, U. Gerfin and R. Landes. Within this online-forum expert bladesmiths make their knowledge available to the public.

⁵ The present author collects evidence for a more comprehensive study of the term „Damascus Steel“. Several results are rendered in his PhD-thesis completed in 2001.

⁶ E.g. Criado 2000, pp. 370-379.

⁷ See footnote 1, Reibold *et al.* 2006, p. 286.

⁸ To the Holy Land and Egypt: 1096-1254, *i.e.* late 11th to the middle of the 13th century.

⁹ Feuerbach, 2000, pp. 33-42. - Dto. *et al.* 1998, pp. 37-44. – Papachristou *et al.* 1993, pp. 122-131.

¹⁰ Panseri, 1965, pp. 33-34.

¹¹ The present author had the opportunity to visit Abbotsford in 1995.

¹² Sherby/Wadsworth, 1985, p. 94.

¹³ Reibold *e.a.*, 2006, 286.

¹⁴ To sum up the whole range of contradictions and generalizations surrounding the term “Damascus-Steel” would doubtless be a desirable study. However this would be taking things a little too far within the present article.

¹⁵ The research literature on these studies was compiled by the author into a bibliography that will be made available in English also.

¹⁶ Plinius, *Naturalis Historia* XXXIV, 41.

¹⁷ Landes, 2002.

¹⁸ Eckhardt 2007, pp. 44-55.

¹⁹ For the first time: Lorange, 1889.

²⁰ Well explained in: Verhoeven 2001, 62-67.

²¹ Hoyland/Gilmour 2006, pp. 31-33, 35, 39.

²² Juleff, 1998.

²³ Hitti 1987, p. 191.

²⁴ The passage was translated from English into German before. The original publication was not available to me so the given translation is a re-translation from German into English.

²⁵ Kapteyn 1926, Verses 4754-4759.

²⁶ Maryon 1960, pp. 25-37, pp. 52-60.

²⁷ Double-edged Spatha-blades with welded patterns based on twisted thin bars of steel within their fullers. These patterns could evoke the holographic effect of moving snakes/worms in the surface of a polished sword. This phenomenon is treated in detail in the present author’s thesis.

²⁸ Arendt 1931, pp. 296-298.

²⁹ See Maeder, 2001a. – Dto. 2000, pp. 17-27. – Dto., 2001b. - Dto. 2002a, pp. 277-285. - Dto., 2002b, pp. 179-182. - Dto., 2004, pp. 23-31. - Dto. 2005, pp. 49-51. - Dto. 2007, 95-107.

³⁰ These requirements consist of the respective combative system and defensive armament.

³¹ Cited in : Gessler, 1923-25, pp. 186-187.

³² Numerous sources for the history and application of the term “Damask” (German: “Damast”) and for some related terms are included in the Dictionary of Foreign Words published by the Institute for German Language in Mannheim. The online-version was accessible to the author: : <http://www.ids-mannheim.de/II/fremdwort/artikel/Damast.pdf>

³³ Krünitz, J.G.: *Oekonomische Encyklopädie oder allgemeines System der Staats-, Stadt-, Haus- und Landwirthschaft.* 242 Vols., publ. from 1773-1858. Keyword: „Damascener Arbeit“. Available online: <http://www.kruenitz1.uni-trier.de/>

³⁴ Grimm, J.u.W.: Deutsches Wörterbuch, 16 Vols. (Leipzig 1854-1860). Available online: <http://germazope.uni-trier.de/Projects/WBB/woerterbuecher/dwb/wbgui?lemid=GD00268>

³⁵ Schwarzlose, 1886.

³⁶ Alexander 1984, pp. 131-138.

³⁷ The Travels of Bertrandon de la Brocquiere, A.D. 1432 and 1433. In: Wright 1848, 304. Cited as well as other sources of crucial significance by: Alexander, 1984. The passage had to be re-translated from German as the original version was not available to the present author.

³⁸ Reibold, *et al.* 2006, p. 286: „*We suggest therefore that our finding could link the distinctive banding seen in Damascus blades with „impurities“ contained in the steel.*“

³⁹ Dto., 2006, 286: „*Its microstructure has been investigated previously, but the nanotubes only became apparent after dissolution of the sample in hydrochloric acid (for methods see supplementary information on Nature´s website.*“

⁴⁰ Hoyland/Gilmour 2006.