THE LOG BOOK PROJECT

Historic Wreck Cargo Classification (HWCC) Framework

Working Paper – v2.0

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A framework for classifying WWII merchant vessel cargoes.

Developed under the Caribbean PPW Project as a case study of WWII shipwrecks within EEZ-defined waters.

This Working Paper is published to invite review and feedback from the PPW and wider maritime community. The framework remains under development and may be revised in response to peer feedback.

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Introduction

The need for a classification framework arose during the Caribbean PPW (Potentially Polluting Wrecks) project, which initially set out to map oil tankers sunk during WWII. Faced with a regional maritime battle zone where in excess of 300 ships were sunk, it became apparent that focusing solely on tankers would overlook potentially relevant cargoes carried by conventional merchant vessels.

The expanded scope therefore required a structured system to consistently categorise each wreck's cargo. What began as a practical solution within our project has evolved into a broader concept — developed as The Log Book Project's **Historic Wreck Cargo Classification (HWCC)**[1] framework.

The HWCC is constructed on the following principles:

1) Clarity for ease of use
2) Flexibility for expansion
3) Transparency designed to capture both detail and uncertainty

In preparing this document we also made use of OpenAI's ChatGPT as a drafting and editorial tool. Its role was limited to language and structure. The underlying framework design, interpretations, and judgments remain entirely those of the project team.

Purpose of the Framework

The HWCC framework provides a consistent way of recording what cargoes were carried on the final voyage of vessels lost during WWII.

It is designed as a technical tool and common reference point for the wider PPW community. This includes researchers, heritage practitioners, policymakers, and those concerned with the environmental and safety impacts of shipwrecks.

By capturing cargoes in a structured way, the HWCC:

- Develops a more complete picture of cargo losses and associated pollutant or hazard characteristics, inclusive of, rather than solely focused on, oil.
- Enables the filtering and comparison of wrecks and cargo types across regions.

[1] The acronym HWCC is also used in other, unrelated contexts (e.g. community centres, clubs, committees). In this document, HWCC refers specifically to **The Log Book Project's Historic Wreck Cargo Classification framework**.

- Provides structured cargo information that can support subsequent pollutant risk assessment, disaster preparedness and heritage work.

The system is designed to be flexible and adaptable across different datasets, regions and research contexts.

Framework design

HWCC employs a four-level classification framework. Levels 1–3 form a hierarchical cargo classification, progressing from broad cargo families to increasingly detailed commodity groupings where records allow. Level 4 serves a different function, providing an associated persistence or hazard alignment for screening purposes rather than a further subdivision of the cargo hierarchy. This approach ensures that wreck cargoes can be recorded consistently whether well documented, vaguely described or unknown, while relevant persistence or hazard characteristics remain visible within the framework.

Level 1 – Cargo Families

At the highest level, the HWCC groups cargoes into six broad families:

- **OIL** – oil cargoes (crude, heavy fuel oils, refined petroleum products)
- **ORE** – ores and bulk minerals (metallic and non-metallic, e.g. bauxite, coal)
- **GEN** – general cargo (manufactured goods, mixed cargo, mail)
- **WAR** – war cargo (explosives, ordnance, and other military stores)
- **BAL** – ballast (water, sand, stone)
- **MSC** – miscellaneous or unspecified cargo

This structure ensures that even when records are vague, the recorded cargo can still be consistently placed within an appropriate family.

Level 2 – Cargo Categories

Within each family, cargoes are divided into more specific categories. This level balances clarity with flexibility, using terminology commonly aligned with WWII records.

- Oil is categorized as **crude oil (CRD)**, **heavy fuel oil (HFO)**, and **refined petroleum products (RPP)**. This distinction is based on refinement level and intended use.

- Ores are separated into **metallic ores (ORM)** such as bauxite or iron ore, and **non-metallic ores (ORN)** such as coal or phosphates.

- General cargo includes **agricultural produce (GEA)**, **manufactured goods (GEM)**, and **mixed cargo (GEX)**. These categories capture the broad types of goods carried by merchant freighters, from grain to machinery to mail.

- War cargo distinguishes **explosive remnants of war (ERW)** from other **war material (WAM)**. ERW covers munitions and ordnance, while WAM covers non-explosive military stores such as vehicles, equipment, or supplies.

- Ballast remains as a single category **(BAL)**, covering non-cargo weight such as water, sand, or stone used for vessel stability.

- Miscellaneous cargo remains as a single category **(MSC)**, used where items do not fit clearly into the other families or categories.

Together, these categories ensure that even when records are incomplete, the recorded cargo can still be assigned to a meaningful category, while leaving space for greater precision at Level 3.

At the time of sinking, munitions such as shells, mines, torpedoes and ammunition were transported as operational cargo. In the contemporary context, such material may constitute Explosive Remnants of War (ERW). HWCC adopts the recognised ERW terminology for this category while retaining its original function within the framework: the classification of ordnance transported as cargo.

Level 3 – Cargo Details

Where records provide greater precision, cargoes can be described in more detail. This level allows precise descriptions to be captured when available, but also ensures vague records can be handled transparently through the use of “unspecified” codes.

Examples include (full reference list provided in Appendix A):

- **CRD (L2) Crude oil**
  - CRD00 – Crude oil, unspecified
  - CRD01 – Light crude oil
  - CRD02 – Medium crude oil
  - CRD03 – Heavy crude oil
- **HFO (L2) Heavy fuel oil**
  - HFO00 – Heavy fuel oil, unspecified

    - HFO01 – Bunker C
    - HFO02 – Admiralty fuel oil
- **RPP (L2) Refined petroleum products**
    - RPP00 – Refined petroleum products, unspecified
    - RPP01 – Diesel oil / gas oil
    - RPP02 – Kerosene / paraffin
    - RPP03 – Aviation spirit (avgas)
    - RPP04 – Lubricating oils
    - RPP05 – Gasoline (motor spirit / petrol)
- **ORM (L2) Metallic ores**
    - ORM00 – Metallic ore, unspecified
    - ORM01 – Bauxite
    - ORM02 – Iron ore
- **ERW (L2) Explosive remnants of war**
    - ERW00 – Ordnance, unspecified/unknown
    - ERW01 – Ammunition (general)
    - ERW02 – Mines & depth charges
    - ERW03 – Naval shells & projectiles
- **WAM (L2) Other war material**
    - WAM00 – Other war material, unspecified
    - WAM01 – Vehicles (military)
    - WAM02 – Equipment and stores

Level 3 provides the granularity needed to record detailed cargo information without compromising consistency. By pairing every specific example with an “unspecified” option, the framework avoids forcing vague records into misleading categories. At the same time, its expandable coding structure (00–99) ensures that new subcategories can be added in future as research uncovers additional details.

In this way, Level 3 balances precision with flexibility — capturing detail where available, while still preserving transparency and comparability across the wider dataset.

Level 4 – Persistence & Hazard Alignment

Levels 1–3 describe the vessel’s transported cargo, progressing from broad cargo family to specific commodity.

Level 4 serves a different function, recording an applicable persistence or hazard characteristic associated with the documented cargo. It therefore operates as an

alignment and screening layer rather than as a further subdivision of the cargo hierarchy.

For petroleum cargoes, Level 4 retains the **U.S. Coast Guard** oil persistence Groups I–IV used in **NOAA RULET (2013)**[2]:

- **Group I** – Non-persistent oils
- **Group II** – Oils with specific gravity < 0.85
- **Group III** – Oils with specific gravity ≥ 0.85 and < 0.95
- **Group IV** – Highly persistent oils

The detailed definitions and example cargoes associated with these groups are reproduced in Appendix B.

For ordnance cargoes, Level 4 identifies the presence of an explosive hazard separately from the oil persistence groupings. This treatment is informed by the UK Ministry of Defence **Salvage and Marine Operations (SALMO) Wreck Management Programme**. Ordnance carried as cargo is therefore identified as an explosive hazard rather than assigned a USCG oil persistence group.

At Levels 1–3, a single cargo classification is assigned based on the dominant cargo commodity. Level 4 is applied independently of this rule: a relevant persistence or hazard characteristic may be recorded where supported by the documented cargo, even where that cargo is not the dominant commodity. In particular, the documented carriage of explosives or ordnance triggers an explosive-hazard identification irrespective of the vessel's principal cargo classification. This ensures that potentially significant explosive cargoes are not obscured during initial screening by a larger quantity of another commodity.

The ERW category applies only to ordnance transported as cargo. This distinction is particularly important in the context of WWII merchant shipping, where defensive armament was widespread, including through the use of Defensively Equipped Merchant Ships (DEMS)[3]. Fitted weapons and their associated ammunition formed part of the vessel's equipment rather than its transported cargo and are therefore outside the scope of the HWCC. Their presence may nevertheless be relevant to wider wreck assessment and should be recorded separately from the cargo classification.

[2] NOAA (2013). Remediation of Underwater Legacy Environmental Threats (RULET) Database Report. Office of Response and Restoration, National Oceanic and Atmospheric Administration.

[3] "Defensively Equipped Merchant Ships" (DEMS) was the British term for armed merchant vessels. A parallel U.S. programme placed Navy Armed Guard detachments aboard merchant ships to provide similar protection.

Accordingly, a merchant vessel carrying general or other non-ordnance cargo remains classified according to that cargo irrespective of its armed or DEMS status. Conversely, ordnance transported as cargo — including ammunition, mines, naval projectiles or torpedoes — may be classified through the WAR/ERW hierarchy and identified at Level 4 as an explosive hazard.

Level 4 therefore functions as an alignment and screening layer, rather than as a further subdivision of the cargo hierarchy. Petroleum cargoes are aligned directly with USCG Groups I–IV as used in NOAA RULET, while transported ordnance is identified as an explosive hazard. This allows relevant persistence and hazard characteristics to remain visible during screening without assigning or implying an assessment of actual wreck condition or risk.

Foundations and Boundaries

The classification framework was first developed as a practical solution to support the Caribbean PPW project. What began as a simple way of identifying oil tankers quickly had to expand: once the scope widened to include all merchant vessels and their varied cargoes, a more robust system was needed.

We have not identified an existing classification framework designed specifically to record WWII merchant vessel cargoes at this level of historical and cargo-specific detail. What began as a practical project tool is now being developed as The Log Book Project's *Historic Wreck Cargo Classification (HWCC)* framework.

At the same time, the HWCC has been shaped by established practice:

- NOAA's RULET framework (2013) — informed the treatment of oil persistence, with HWCC retaining the U.S. Coast Guard Groups I–IV used in RULET.

- UK MoD's SALMO Wreck Management Programme — informed the treatment of transported ordnance as an explosive hazard.

Levels 1–3 were developed to suit historical merchant shipping records, while Level 4 provides an alignment with established approaches to oil persistence and ordnance hazard identification.

External classification schemes have also been reviewed. The **Cefas Offshore Chemical Notification Scheme (OCNS)**[4] is robust for modern offshore regulation, and **HELCOM's framework for potentially polluting shipwrecks**[5] provides an effective basis for environmental risk management. Both provide useful approaches within their respective environmental and hazard-assessment contexts, but neither is designed to provide the historical, cargo-specific classification required for the HWCC's intended purpose.

[4] Cefas, Hazard Assessment Process: OCNS grouping scheme (Groups A–E based on aquatic and sediment toxicity thresholds, adjusted by biodegradability and bioaccumulation criteria), as applied in operational hazard screening of offshore chemicals. Available at: https://www.cefas.co.uk/data-and-publications/ocns/hazard-assessment-process (accessed 25 Aug 2025).

[5] HELCOM, Thematic Assessment on Hazardous Submerged Objects in the Baltic Sea: Potentially Polluting Shipwrecks (Volume 2, 2025), used to support current-use environmental risk screening of wreck-associated pollutants. Available at: https://www.researchgate.net/publication/393662729_HELCOM_Thematic_assessment_on_Hazardous_submerged_objects_in_the_Baltic_Sea_Potentially_polluting_shipwrecks_in_the_Baltic_Sea (accessed 25 Aug 2025).

The HWCC is

- A purpose-developed framework for classifying WWII merchant vessel cargoes.
- A structured way to record what cargoes were aboard at the time of sinking.
- A transparent method that recognises both detail and uncertainty.
- A flexible and expandable framework designed to accommodate new subcategories as further evidence emerges.
- A practical tool to support consistent recording, filtering and comparison of wreck cargoes across regions.

The HWCC is *not*

- Designed to assign or calculate risk.
- Intended to predict the behaviour of cargoes on the seabed.
- A system for prioritising wrecks for intervention or risk mitigation.
- Designed to replace specialist wreck assessments, including engineering, salvage, environmental or safety studies.

What the HWCC can be

- A potential **shared reference framework**, enabling the PPW community to use consistent terminology when describing wreck cargoes.
- A **foundation for integration** with complementary vessel-based pollutant classification, combining cargo and bunker perspectives into a fuller picture of potential pollutant sources.
- A **tool supporting subsequent risk assessment** — not by assigning risk itself, but by making relevant cargo characteristics visible and comparable.
- A **bridge between disciplines**, allowing environmental agencies, heritage bodies, researchers and operators to work from consistently classified cargo information.
- A **scalable framework** that, if adopted more widely, could support coordinated research and assessment across regions and institutions.

By transparently describing both its scope and its limits, the HWCC provides a solid foundation for shared understanding. It ensures that WWII wreck cargoes can be recorded and compared consistently, while leaving specialist assessments and management decisions to the appropriate domains. At the same time, this foundation opens the door to broader developments — such as vessel-based pollutant classification — that can extend the framework beyond cargo alone.

Future Vision – Beyond Cargo

While the HWCC has been developed to classify cargoes, The Log Book Project is also building a complementary framework to classify vessels themselves from a pollutant perspective. This recognises that potential wreck-associated pollutants are not limited to transported cargo. Propulsion fuels — carried as bunkers — represent a significant and often overlooked pollutant dimension.

Developing this vessel framework is not straightforward. Records from the WWII era rarely state bunker volumes explicitly. In most cases, estimates must be derived from surviving ship drawings, plans, or technical references. Despite this difficulty, it is possible to define a consistent classification structure at least down to a Level 2 (L2) resolution.

At the highest level (L1), vessels can be grouped by broad type: Motor Merchant, Steam Merchant, Motor Tanker, Steam Tanker, and Sailing Ship. Each of these can then be subdivided at L2 according to their propulsion fuel — for example, Motor Merchant (oil), Steam Merchant (coal), Steam Merchant (oil), etc.

This approach would enable vessels with different propulsion-fuel profiles to be distinguished and filtered, complementing the cargo information captured through HWCC.

To illustrate, the tanker *Beth* was lost carrying over 10,000 tons of Admiralty fuel oil as cargo, but also carried approximately 650 tons of bunker fuel. The example demonstrates that cargo classification alone does not capture the complete oil inventory associated with a wreck. Equally, a merchant vessel carrying non-hazardous cargo may still have carried substantial quantities of propulsion fuel.

As seen also in HELCOM's thematic assessment of hazardous submerged objects, bunker fuel has long been recognised as a pollutant concern in its own right—rather than viewing, for example, only oil tankers and their cargoes as the main hazard. One case cited is the *S/S Park Victory*, where significant bunker leakage prompted a dedicated removal operation that recovered hundreds of tons of fuel—underscoring how long-submerged propulsion oil can persist and demand attention. Although outside the WWII Caribbean scope of our framework, this example illustrates the value of acknowledging vessel-borne bunker risks alongside cargo.

By developing a vessel classification system in parallel with the HWCC, TLBP is seeking to capture this fuller pollutant profile: cargo plus bunkers. We are already applying this dual approach within our dataset. It remains to be seen if the wider PPW community

sees value in adopting propulsion fuel classification alongside the HWCC, potentially paving the way for an integrated reference framework that unites both cargo and vessel dimensions.

Next Steps & Call for Feedback

The HWCC is published as a Working Paper to invite review, practical testing and feedback. While developed initially to support the Caribbean PPW project, the underlying aim is broader: to explore the potential for a common reference framework for classifying WWII merchant vessel cargoes.

The HWCC can be seen as a structured attempt to capture, in a consistent way, what was carried on the final voyages of WWII ships. We have not identified an existing framework designed specifically for this form of systematic WWII merchant-vessel cargo classification. If shaped collectively, the HWCC could evolve into a shared reference framework supporting greater consistency in research, heritage and environmental work on potentially polluting wrecks.

We therefore welcome feedback on:

1. **Clarity** – Is the HWCC easy to follow? Are the levels intuitive?
2. **Completeness** – Do the categories sufficiently capture the range of cargoes?
3. **Usability** – Is the system practical for recording and filtering wreck data?
4. **Boundaries** – Are the limits of what is (and isn't) included appropriate?

The hope is that this Working Paper may provide the foundation for something more enduring: a framework that, with input from across the PPW community, could be recognised and adopted as a common reference — the HWCC. As a Working Paper, the framework remains open to constructive challenge, practical testing and continued refinement.

Appendix A – HWCC Classification Master List

This appendix presents the full cargo classification master list used in the Historic Wreck Cargo Classification (HWCC) framework. It sets out all current Level 1 families, Level 2 categories, Level 3 cargo details, and their alignment with Level 4 persistence or hazard designations (where applicable). The list is intended as a practical reference and a living document — open to refinement as further research or community input identifies additional cargoes that should be recorded.

L1 Family	L2 Category	L3 Cargo Detail	L4 Persistence & Hazard Alignment
OIL	CRD – Crude oil	CRD00 – Crude oil (unspecified / unknown)	Unresolved
		CRD01 – Light crude oil	II (USCG/RULET)
		CRD02 – Medium crude oil	III (USCG/RULET)
		CRD03 – Heavy crude oil	IV (USCG/RULET)
	HFO – Heavy fuel oil	HFO00 – Heavy fuel oil (unspecified / unknown)	IV (TBC)
		HFO01 – Bunker C / Residual oil	IV (USCG/RULET)
		HFO02 – Admiralty fuel oil	IV (TBC)
		HFO03 – Navy Special Fuel Oil (NSFO)	IV (TBC)
	RPP – Refined petroleum products	RPP00 – Refined petroleum products (unspecified / unknown)	Unresolved
		RPP01 – Diesel oil / gas oil	II/III (USCG/RULET)
		RPP02 – Kerosene / paraffin	I (USCG/RULET)
		RPP03 – Aviation spirit (avgas)	I (USCG/RULET)
		RPP04 – Lubricating oils	Unresolved
		RPP05 – Gasoline (motor spirit / petrol)	I (USCG/RULET)
GEN	GEA – Agricultural produce	GEA00 – Agricultural produce (unspecified / unknown)	–
		GEA01 – Foodstuffs & perishables	–
	GEM – Manufactured goods	GEM00 – Manufactured goods (unspecified / unknown)	–
		GEM01 – Machinery	–
		GEM02 – Building materials	–
		GEM03 – Textiles & clothing	–
		GEM04 – Vehicles	–

L1 Family	L2 Category	L3 Cargo Detail	L4 Persistence & Hazard Alignment
		GEM05 – Timber / wood products	–
		GEM06 – Chemicals (non-petroleum)	–
	GEX – Mixed cargo (incl. mail)	GEX00 – Mixed cargo (unspecified / unknown)	–
		GEX01 – Mixed general cargo (no dominant commodity)	–
		GEX02 – Mixed cargo including mail	–
ORE	ORM – Metallic ores	ORM00 – Metallic ores (unspecified / unknown)	–
		ORM01 – Iron ore	–
		ORM02 – Bauxite	–
		ORM03 – Copper ore	–
		ORM04 – Manganese ore	–
	ORN – Non-metallic ores	ORN00 – Non-metallic ores (unspecified / unknown)	–
		ORN01 – Phosphates	–
		ORN02 – Coal	–
		ORN03 – Salt	–
WAR	ERW – Explosive Remnants of War	ERW00 – Ordnance (unspecified / unknown)	Explosive Hazard
		ERW01 – Ammunition (general)	Explosive Hazard
		ERW02 – Mines & depth charges	Explosive Hazard
		ERW03 – Naval shells & projectiles	Explosive Hazard
		ERW04 – Torpedoes	Explosive Hazard
	WAM – War Material	WAM00 – War material (unspecified / unknown)	-
		WAM01 – Vehicles (military)	-
		WAM02 – Equipment & supplies (non-explosive)	-
BAL	BAL – Ballast	BAL00 – Ballast (unspecified / unknown)	–
		BAL01 – Water ballast	–
		BAL02 – Sand / stone ballast	–
MSC	MSC – Miscellaneous cargo	MSC00 – Miscellaneous cargo (unspecified / unknown)	–

L1 Family	L2 Category	L3 Cargo Detail	L4 Persistence & Hazard Alignment
		MSC01 – Other cargoes not elsewhere classified	–

Table 1 HWCC Cargo Classification Master List (Levels 1–4) Rev 3.0 September 2026

Level 4 notation:

- ***(USCG/RULET)*** indicates an alignment directly supported by the USCG persistence definitions and/or examples reproduced in NOAA RULET (2013).
- ***(TBC)*** identifies a provisional HWCC persistence alignment requiring further source verification.
- ***Unresolved*** indicates that the available cargo description does not presently support assignment to a specific persistence group.

This master list underpins the HWCC framework and provides the reference point for assigning classifications to individual wrecks. It should be read together with the main text of this paper, which explains the logic behind the four-level structure and the use of persistence and hazard alignments.

Appendix B – USCG / NOAA Persistence Groupings

(Reference table reproduced for completeness)

This appendix reproduces the U.S. Coast Guard oil persistence groupings (Groups I–IV), which form the basis of the persistence classifications adopted in NOAA's RULET (2013) study. These definitions provide the reference basis for the Level 4 oil persistence alignments used in Appendix A.

No modifications have been made for WWII context; the table is presented here as an authoritative reference only. Where WWII-specific fuels (e.g. Admiralty Fuel Oil, Navy Special Fuel Oil) are not explicitly covered in these standards, further source verification or expert interpretation may be required before a definitive alignment is adopted.

USCG Group	Definition (as cited in RULET)	Example Cargoes
Group I – Nonpersistent	Petroleum-based oil that, at time of shipment, consists of hydrocarbon fractions: at least 50% (by volume) distill at ≤ 340 °C (645 °F) and at least 95% (by volume) distill at ≤ 370 °C (700 °F).	Gasoline, Kerosene
Group II	Oils with specific gravity < 0.85 (API° > 35.0).	Diesel, Jet fuel, Light crude oils
Group III	Oils with specific gravity ≥ 0.85 and < 0.95 (API° ≤ 35.0 and > 17.5).	Medium crude oils, Marine diesel blends
Group IV – Highly persistent	Oils with specific gravity ≥ 0.95 and ≤ 1.0 (API° ≤ 17.5 and > 10.0).	Heavy crude oils, Bunker C, No. 6 fuel oil

Table 2 USCG oil persistence groupings (as cited in NOAA RULET, 2013)

Source: NOAA, Risk Assessment for Potentially Polluting Wrecks (RULET), 2013. Definitions cited from U.S. Coast Guard oil persistence groupings. These groupings are presented here for reference only. Conversely, many WWII-era fuel designations (e.g. "Admiralty Fuel Oil", "Navy Special Fuel Oil") are not explicitly covered. Where a provisional HWCC alignment has been made, this is identified as TBC pending further source verification before a definitive assignment is adopted.

Changelog

Date	Version	Changes
2025-08-22	v1.0	First draft of the HWCC Working Paper.
2025-08-23	v1.1	Minor editorial updates.
2025-08-25	v1.2	Minor editorial updates, clarifications and added reference to *HELCOM's thematic assessment of hazardous submerged objects*
2026-05-04	v1.3	a) Corrected misalignment in Level 3 (RPP) cargo detail examples within main text; entries realigned to match Appendix A master classification. b) Added RPP05 – Gasoline (motor spirit / petrol) as a Level 3 category under refined petroleum products (RPP) to improve representation of commonly recorded WWII cargoes.
2026-09-22	v2.0	a) Revised Level 4 as a Persistence & Hazard Alignment layer, retaining USCG Groups I–IV used in NOAA RULET in place of the previous HWCC A–D translation, and identifying transported ordnance separately as an explosive hazard. b) Revised Level 4 to operate independently of the dominant-cargo principle applied at Levels 1–3, allowing relevant persistence or hazard characteristics to remain visible where supported by documented cargo. c) Clarified the treatment of transported ordnance, defensive armament and Defensively Equipped Merchant Ships (DEMS), limiting HWCC ERW classification to ordnance transported as cargo. d) Refined oil persistence alignments to distinguish direct USCG/RULET classifications, provisional assignments requiring verification (TBC), and Unresolved classifications. Associated editorial, scope and publication-status revisions made for public release as a Working Paper.

Lars McKie Digitally signed by Lars McKie Date: 2026.09.22 14:56:48 +02'00'